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The 2013 International Joint Conference on Neural Networks

Final Program

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The 2013 International Joint Conference on Neural Networks

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Welcome from the General Chairs

 

On behalf of the Organizing Committee, we would like to warmly welcome you to the 2013 International Joint Conference on Neural Networks (IJCNN 2013) in Dallas, Texas, USA.

This conference continues the tradition of joint sponsorship of IJCNN by the International Neural Network Society (INNS) and the IEEE Computational Intelligence Society (IEEE-CIS). This collaboration has produced many successful meetings in past years, and this year's meeting is no exception. We would like to thank the leadership of both organizations, and particularly the Presidents, Danil Prokhorov and Marios Polycarpou, for making this possible.

This year's venue, Texas, is well known for hosting high tech giants like Texas Instruments, Johnson Space Centre in Houston and leading Universities. The synergy between advanced information processing, notably neural networks and dedicated hardware, led to many applications ranging from space to health and robotics with truly groundbreaking results. These include but are not limited to brain-inspired techniques to address the 'Big Data' challenge, to understand deeper the intricate details of brain functioning and assist in neuro-degenerative disease, to emulate and complement the brain, to advance human-computer interaction and develop systems with a higher level of autonomy, to understand and efficiently process social and bio-signals, to enhance man-made vision systems, to emulate and benefit from evolution and to adequately address the dynamic evolution of the environment and or representation and measurements of it.

This also has led to brain-line computer systems and neural implants. IJCNN 2013 continues and takes further the tradition of a confluence and mutual complementarity of neuroscience and engineering applications which is typical for the INNS organised events. This is evident in many aspects of the conference, but perhaps it is most notable in the National Science Foundation sponsored Workshop on Cognitive Science which will feature some leading researchers in the area working on better understanding of the way the human brain is capable of cognition elements that scientists in various application areas attempt to emulate. The Workshop is organised by the Program Chair, Péter Érdi.

In addition to this NSF sponsored Workshop there will be workshops on Autonomous Learning co-organised by Asim Roy and Plamen Angelov and on Brain and Language organised by Colleen Crangle.

The plenary talks by Stephen Grossberg, Lydia Kavraki, Frank Lewis and Olaf Sporns also reflect the broad themes of neuroscience and engineering applications, and go beyond traditional neural networks into areas like behavioural economics, bio-molecules, robotics, control, culminating in the talk about President Obama's initiative on the brain presented by Terry Sejnowski.

This year's edition will feature over a dozen tutorials as well as over two dozen special sessions covering a broad range of themes and topics. A special – if sober – event at IJCNN 2013 is the dedicated special session convened to remember one of the pioneers in the field of neural networks, John Taylor, who passed away in 2012. The session will include remembrances by colleagues and friends of Dr. Taylor including Walter Freeman, Stephen Grossberg, Robert Kozma, Amir Hussein, Vassilis Cutsuridis, Vishwanthan Mohan, Thomas Trappenberg, Oury Monchi, and Daniel Levine.

In this year's edition of IJCNN we continue with the neuroscience and neurocognition abstracts – an initiative introduced in IJCNN 2011 which was taken well also in IJCNN 2012 within WCCI. The goal was to attract research communities which were not traditionally submitting to IJCNN and similar conferences and are not accustomed to writing full-length papers for conferences that they usually attend. This experiment has been successful in that about 10% of all papers were abstracts.

For IJCNN we received over 600 (605) submissions, some of which were later withdrawn. We accepted in the final programme 477 papers (79%) including 33 abstracts. Out of these 261 are oral presentations, 206 are posters and 10 are plenary or invited presentations. The programme also features 13 tutorials, and three post-conference workshops plus an NSF sponsored workshop.

To organise such a forum was very demanding in terms of organization, efforts, coordination and positive spirit. We would like to thank most of all our colleagues on the Conference Organising Committee, Péter Érdi, the Program Chair, including for his efforts to secure NSF funding for the Workshop on Cognitive Science, and the two Program Co-Chairs, Marley Vellasco and Emilio Del Moral Hernandez whose dedication made the organization of the conference possible. Special thanks are due to Bruno Apolloni, the Publication Chair. We would also like to thank our Special Session Chair, Radu-Emil Precup, Awards Chair, Mike Watts, Tutorials Chairs, Leonid Perlovsky and Suresh Sundaram, Competitions Chairs, Sven Crone, Workshops Chair, Simona Doboli, and Panels Chair, Juyang Weng. We also thank all other members of the Organizing Committee for their great help, all of whom put in a special effort towards the meeting's success.

We are particularly grateful to all members of the Program Committee and all reviewers who deserve great appreciation for providing discerning and timely reviews of over 600 submissions. We are also very grateful for the support we have received from many members of the INNS Board of Governors, and especially for sage advice from the Vice-President for Conferences, Ali Minai as well as the President, Danil Prokhorov (previously Vice President for Conferences himself).

Finally, we would like to thank the organizational team at The Rees Group led by Jane Shepard and Linda Potchoiba, without whose work the meeting would have been infinitely harder to organize.

As in past years, INNS and IEEE-CIS have provided support for many students to attend the conference. This year, the support has been supplemented by a grant from NSF to encourage more students – especially women, under-represented minorities, and students from undergraduate institutions. We hope that IJCNN will continue to serve as a place where young researchers can find both knowledge and inspiration.

We wish you a wonderful, productive, and pleasant IJCNN 2013.

Plamen Angelov and Daniel Levine
General Co-Chairs IJCNN 2013

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Conference Topics

1 NEURAL NETWORK MODELS
- 1a Feedforward neural networks
- 1b Recurrent neural networks
- 1c, 1d Self-organizing maps
- 1e Attractor neural networks
- 1f, 1i Special neural networks (fuzzy, modular, reservoir, large-scale)
- 1g Fuzzy neural networks
- 1h Spiking neural networks
- 1j Large-scale neural networks
- 1k Mixed topics in neural networks

2 MACHINE LEARNING
- 2a Supervised learning
- 2b Unsupervised learning and clustering, (including PCA and ICA)
- 2c Reinforcement learning
- 2d, 2h Probabilistic, Bayesian, and semantic networks
- 2e, 2f Support vector machines and EM algorithms
- 2i Pattern recognition and feature selection
- 2o Other topics in learning machines

3 NEURODYNAMICS
- 3a Dynamical models of spiking neurons
- 3b, 3c, 3d Dynamic neural networks and oscillatory and chaotic neural networks

4 COMPUTATIONAL NEUROSCIENCE
- 4c Synaptic transmission, learning, and neuromodulation
- 4g Cognitive neuroscience
- 4j Neuroscience and neuroinformatics
- 4k Computational neuroscience

5 NEURAL MODELS OF PERCEPTION, COGNITION, AND ACTION
- 5b, 5c Cognitive architectures, cognitive modeling
- 5i, 5j, 5k, 5l Visual, auditory, and other sensory systems

6 NEUROENGINEERING
- 6a Brain-machine interface and neural engineering

7 BIO-INSPIRED AND BIOMORPHIC SYSTEMS
- 7a Cognitive robots and brain-inspired cognitive systems

8 APPLICATIONS
- 8a Bioinformatics
- 8e Robotics
- 8h Financial forecasting
- 8j Temporal data analysis, prediction, and forecasting; time series analysis

9 CROSS-DISCIPLINARY TOPICS

C COMPETITIONS
- C02 German Traffic Sign Detection

S SPECIAL SESSIONS
- S01 Mind, Brain, and Cognitive Algorithms
- S04 In Memory of John Taylor
- S05, S08 Computational Intelligence Applied to Vision and Robotics
- S06, S07 Active Learning and Experimental Design
- S09 Complex-Valued Neural Networks
- S12, S24 Unsupervised Model-Based Learning: Bayesian Regularization and Sparsity
- S13 Incremental Machine Learning Methods and Applications
- S16 Intelligent Embedded Systems
- S17 From Machine Sensing to Sensorimotor Intelligence
- S18 Hybrid Neural Intelligent Systems
- S19 Advances and Applications in Forecasting
- S20, S22 Neuromorphic Science Technology for Cybersecurity
- S21 Computational Intelligence Based Ensemble Classifiers
- S23 Neural Computing for Human Friendly Robotic Applications
- S25 Neurocomputational Models of Thought and Creativity

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Welcome Message from the President of INNS

Dear Attendee of IJCNN 2013:

Welcome to the International Joint Conference on Neural Networks 2013! IJCNN is the main conference of the International Neural Network Society (INNS), and it is one of the key meetings for our colleagues from the IEEE. IJCNN welcomes neural network research contributions, while embracing the proliferation of related fields. Among many IJCNN research topics are neuroscience, connectionism, cognitive science, brain-inspired computing, neuroinformatics, brain informatics, and all kinds of neural network applications. The IJCNN also welcomes those who study emerging research topics, for example, bio-inspired robotics, autonomous learning and mental development. Neural networks continue to be successfully deployed in applications, many of which were first presented at one of the IJCNN sessions or workshops. It is clear to me that IJCNN is your premier venue to stay current in this important field.

It takes many volunteers and tons of time to organize an event as large as IJCNN. We all should bow deeply to the following people:

- General Co-Chairs, Daniel Levine and Plamen Angelov.
- Program Chair, Péter Érdi.
- Program Co-Chairs, Marley Vellasco and Emilio del Moral Hernandez.
- The rest of the Organizing and Program Committee members, and a dedicated army of IJCNN reviewers.

They all worked hard to ensure that myriads of large and small issues in the IJCNN organization process got resolved successfully.

I would also like to thank the INNS Board of Governors and our colleagues – leaders of the IEEE Computational Intelligence Society (CIS). For many years we have enjoyed a mutually beneficial relationship with the IEEE – enhancing value for members of both societies. Members of both societies are privileged to benefit from the wisdom of this outstanding group of leaders. I am confident that the productive relationship between both societies will continue for years to come.

On behalf of the INNS, let me welcome you to the IJCNN and to our society in which we are trying to bridge the gap between natural and artificial intelligence through studies of neural networks. Our studies are published in the INNS flagship journal *Neural Networks*, and the INNS magazine *Natural Intelligence*. The INNS also presents prestigious awards of our society to outstanding researchers who made significant, ground-breaking contributions to the science and technology in our fields, including the Hebb Award, the Helmholtz Award, and the Gabor Award, as well as the Young Investigator Award. Our members can progress from regular or student status to Senior Members and members of the College of Fellows. Be sure to visit www.inns.org to learn more, and to join or renew your membership to help us improve our understanding of the human brain/mind and create more powerful intelligent machines for addressing complex problems of the world.

Last but not least, a heartfelt thanks to YOU. IJCNN does not have a meaning without active participation of motivated people such as yourself. Whether you attend this meeting in person, or are just reading these proceedings to enhance your knowledge in the field, IJCNN is for you. We encourage you to read and refer to IJCNN papers frequently in your work, and hope to see you at future IJCNN's.

Enjoy IJCNN 2013!

Sincerely,

Danil Prokhorov
INNS President
Toyota Research Institute North America
Ann Arbor, MI, USA

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Welcome Message from the President of the IEEE Computational Intelligence Society

On behalf of IEEE Computational Intelligence Society (IEEE CIS), it is my pleasure and honor to welcome all the participants to the *2013 International Joint Conference on Neural Network* (IJCNN 2013). This is an exciting scientific gathering attracting researchers from diverse fields such as computational neuroscience, neural network theory and models, cognitive models, brain-machine interfaces, evolving neural systems, neurodynamics, neuroinformatics, pattern recognition, machine vision, neural network applications, and many other areas.

IJCNN has a long history of providing a forum for researchers from around the world to share common interests and to rekindle lifetime friendships. Active participation from the members of IEEE CIS and International Neural Network Society (INNS) plays a key role to sustain the continuing growth of this technical event for many years to come.

I would like to thank the organizing committee of IJCNN 2013 for their wonderful work in putting together a memorable conference. In particular, I would like to thank the General Co-Chairs Plamen Angelov and Daniel Levine, and the Program Chair Peter Erdi, for their leadership and hard work required to organize a conference of this stature. Congratulations!

IEEE CIS's current activities are well represented by its publications and conferences. The *IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Fuzzy Systems*, and *IEEE Transactions on Evolutionary Computation* routinely rate high in their respective categories at ISI (Institute for Scientific Information). The *IEEE Computational Intelligence Magazine*, *IEEE Transactions on Computational Intelligence and AI in Games*, and *IEEE Transactions on Autonomous Mental Development*, as newer additions, have paved paths to greater successes in the years to come. Our main conferences in addition to IJCNN, the *IEEE International Conference on Fuzzy Systems* (FUZZ-IEEE), and the IEEE Congress on Evolutionary Computation (IEEE CEC) each continue to showcase well-regarded peer-reviewed technical contributions and attract growing participation from around the world. These three meetings join forces every two years in the IEEE World Congress on Computational Intelligence (IEEE WCCI). Additionally, the IEEE Symposium Series on Computational Intelligence (IEEE SSCI) has witnessed overwhelming success, featuring a large number of concurrent symposia in specialized topics.

Our technical activities are catered by eleven technical committees and many task forces that comprise of over 1,000 active volunteers. Leading researchers are encouraged to participate in these working groups to help shape the strategic and tactical advances that are required for our research community to flourish. It is through the concerted efforts of motivated individuals and these grass-root organizations that novel ideas are born, new symposia are initiated, and special issues of our transactions are proposed.

In conclusion, I personally send my best wishes to all IJCNN 2013 participants, who collectively define the quality of this technical event.

Marios Polycarpou, President
IEEE Computational Intelligence Society (2012-2013)

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Conference Information

Registration

Registration for the conference will be open at the following times in the Regency Ballroom Foyer at the Fairmont Dallas:

Sunday, August 4	7:30 a.m.–5:00 p.m.
Monday, August 5	7:30 a.m.–5:00 p.m.
Tuesday, August 6	7:30 a.m.–5:00 p.m.
Wednesday, August 7	8:00 a.m.–5:00 p.m.
Thursday, August 8	8:00 a.m.–1:00 p.m.

Internet Access

Free Wi-Fi Internet access is complimentary in your sleeping room if you signed up to be a member of the Fairmont President's Club in advance (complimentary membership) of your arrival. Please be sure the front desk has made a note of your Fairmont President's Club membership number in your reservation record. Once this number is in your record, wireless internet service is complimentary in the lobby and the restaurant as well as your guest room.

Otherwise, there is complimentary wireless internet service in the Starbucks on property.

Speaker Ready Room

The Speaker Ready Room is located in the Executive Room on the lobby level of the hotel. Please stop by prior to your presentation to preview your slides and review your presentation. The Speaker Ready Room will be open at the following times:

Sunday, August 4	1:00 p.m.–5:00 p.m.
Monday, August 5	7:00 a.m.–5:00 p.m.
Tuesday, August 6	7:00 a.m.–5:00 p.m.
Wednesday, August 7	7:00 a.m.–5:00 p.m.
Thursday, August 8	7:00 a.m.–11:00 a.m.

Conference Badges

Please wear your badge to all IJCNN 2013 functions. It will admit you to the sessions and the exhibit area.

Poster Sessions

If you are presenting a poster at the IJCNN meeting, please review the schedule carefully and be sure to assemble and tear down your poster when indicated:

General Poster Session A
Monday, August 5 – Regency Ballroom
Setup Posters: 1:00 p.m.–3:10 p.m.
Match the poster number from the program book to the number in the upper corner of the poster board.
Poster Viewing: 3:10 p.m.–6:30 p.m.
Posters available for attendees to visit.
Poster Authors Present: 6:30 p.m.–8:00 p.m.
Presenters available at their poster for presentation and discussion with attendees.

Tuesday, August 6 – Regency Ballroom
Poster Viewing: 8:00 a.m.–10:00 a.m.
Remove Posters: 10:00 a.m.–11:00 a.m

General Poster Session B
Tuesday, August 6 – Regency Ballroom
Setup Posters: 1:00 p.m.–3:10 p.m.
Match the poster number from the program book to the number in the upper corner of the poster board.
Poster Viewing: 3:10 p.m.–6:30 p.m.
Poster presentations available for attendees to visit.
Poster Authors Present: 6:30 p.m.–8:00 p.m.
Presenters available at their poster for presentation and discussion with attendees.

Wednesday, August 7 – Regency Ballroom
Poster Viewing: 8:00 a.m.–10:00 a.m.
Remove Posters: 10:00 a.m.–11:00 a.m.

Exhibits

Plan to spend time in the Regency Ballroom Foyer visiting with exhibitors at IJCNN 2013. Refreshment breaks and poster sessions will be located adjacent in the Regency Ballroom area. The exposition will be open at the following times:

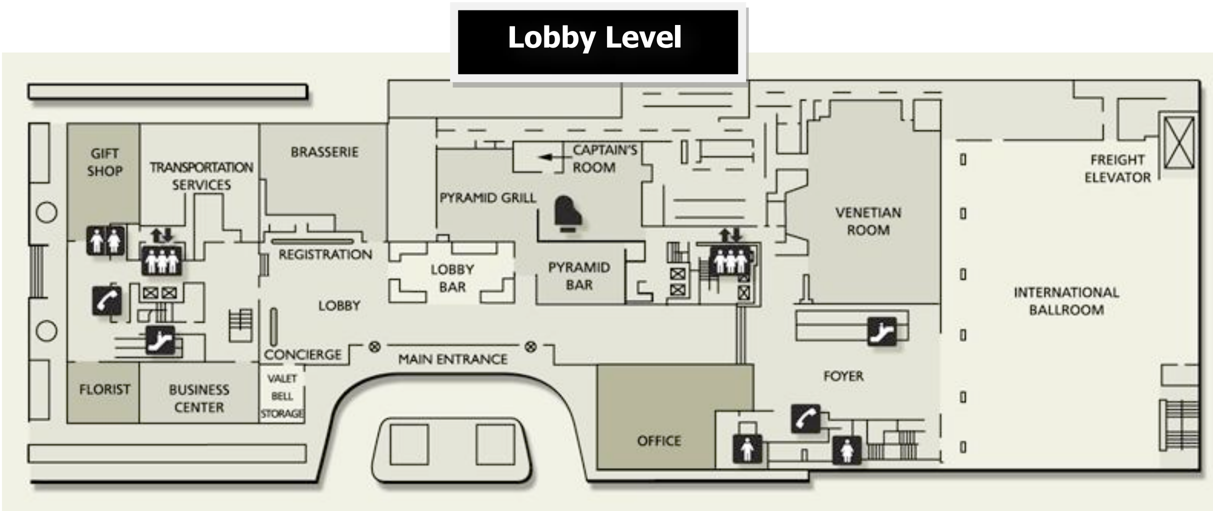
Monday, August 5	2:40 p.m.–8:00 p.m.
Tuesday, August 6	9:00 a.m.–8:00 p.m.
Wednesday, August 7	9:00 a.m.–3:10 p.m.

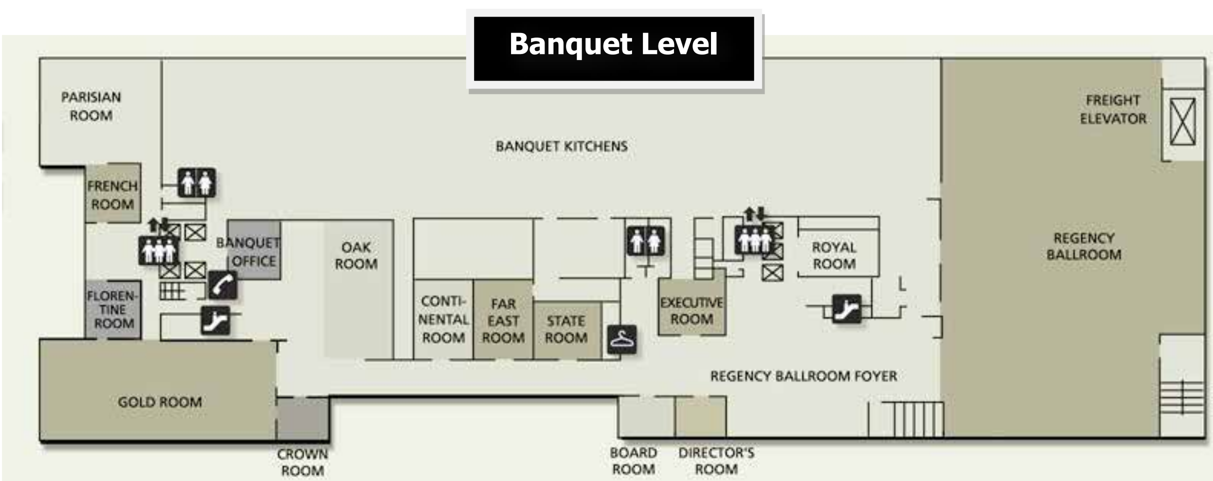
Conference Exhibitors

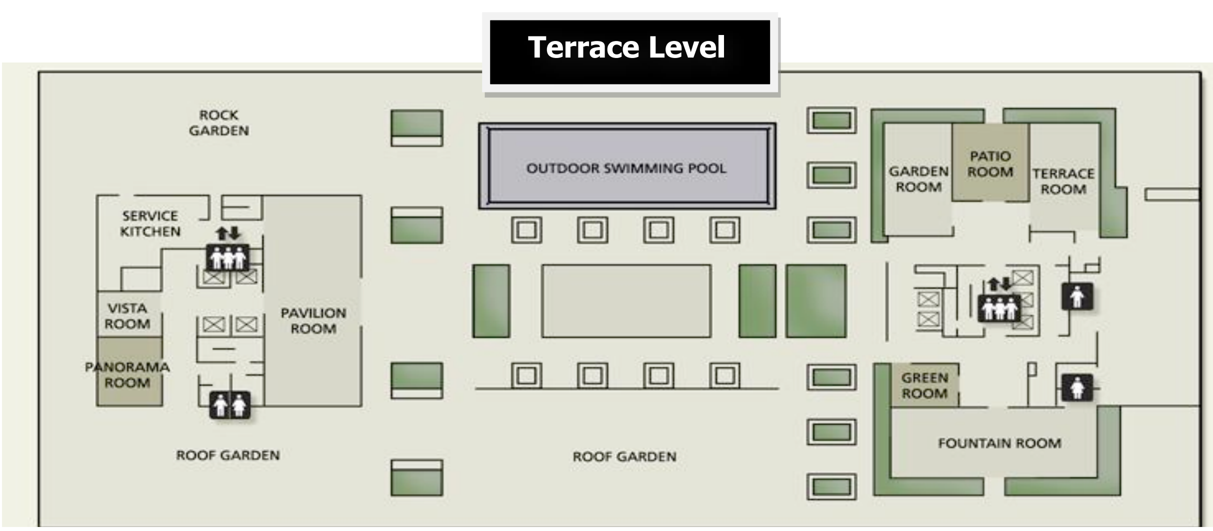
- Springer
- University of Milan
- WCCI 2014

Hotel Maps

Fairmont Hotel, Dallas, Texas







IJCNN 2013 Schedule-at-a-Glance

Sunday, August 4, 2013

TIME	SESSION	ROOM
7:30 a.m.-5:00 p.m.	Registration	Regency Ballroom Foyer
8:00 a.m.-9:45 a.m.	Tutorial T1: Natural and Artificial Intelligence: Introduction to Computational Brain-Mind	Oak
8:00 a.m.-9:45 a.m.	Tutorial T2: Complex-Valued Neural Networks With Multi-Valued Neurons	Far East
8:00 a.m.-9:45 a.m.	Tutorial T3: Super-Turing and Adaptive Processes	Continental
8:00 a.m.-9:45 a.m.	Tutorial T4: Brain Connectivity Mapping	Parisian
9:45 a.m.-10:00 a.m.	Refreshment Break	Regency Ballroom Foyer
10:00 a.m.-11:45 a.m.	Tutorial T5: Cognitive Computational Intelligence: Language-Cognition Interaction, Data Mining, Financial Prediction, Cognitive Functions of Music and Beautiful, Cultural Evolution	Oak
10:00 a.m.-11:45 a.m.	Tutorial T6: Stochastic Artificial Neurons and Neural Networks	Far East
10:00 a.m.-11:45 a.m.	Tutorial T7: Meta-Cognition in Neural Networks	Continental
10:00 a.m.-11:45 a.m.	Tutorial T8: Intelligent Energy Control and Management in Hybrid Electric Vehicles (HEV)	Parisian
11:45 a.m.-1:30 p.m.	Lunch Break (on your own)	
1:00 p.m.-5:00 p.m.	Speaker Ready Room	Executive
1:00 p.m.-6:00 p.m.	Board of Governors Meeting	Terrace
1:30 p.m.-3:15 p.m.	Tutorial T9: Cortical Networks	Oak
1:30 p.m.-3:15 p.m.	Tutorial T10: Recurrent Neural Networks in System Identification, Forecasting and Control	Far East
1:30 p.m.-3:15 p.m.	Tutorial T11: Autonomous Learning and Evolving Neural Networks	Continental
1:30 p.m.-3:15 p.m.	Tutorial T12: Evolving Neural Networks	Parisian
3:15 p.m.-3:30 p.m.	Refreshment Break	Regency Ballroom Foyer
3:30 p.m.-5:15 p.m.	Tutorial T13: Autonomous Machine Learning	Oak
3:30 p.m.-5:15 p.m.	Tutorial T14: Random Neural Network and Applications in Engineering and Biology	Far East
3:30 p.m.-5:15 p.m.	Tutorial T15: Protein Prediction Based on Machine Learning Techniques	Continental
3:30 p.m.-5:15 p.m.	Tutorial T16: Online Learning for Big Data	Parisian
6:30 p.m.-8:00 p.m.	Opening Reception	Gold

IJCNN 2013 Schedule-at-a-Glance

Monday, August 5, 2013

TIME	SESSION	ROOM
7:00 a.m.-5:00 p.m.	Speaker Ready Room	Executive
7:30 a.m.-5:00 p.m.	Registration	Regency Foyer
8:00 a.m.-9:10 a.m.	Plenary Mo-Plen1: Neural Network Reinforcement Learning Structures for Real-Time Optimal Feedback Control and Games *Frank Lewis*	International Ballroom
9:10 a.m.-9:30 a.m.	Refreshment Break	Regency Ballroom Foyer
9:30 a.m.-11:30 a.m.	Session Mo1-1: In Memory of John Taylor I	Gold
9:30 a.m.-11:30 a.m.	Session Mo1-2: Computational Intelligence Applied to Vision and Robotics	Parisian
9:30 a.m.-11:30 a.m.	Session Mo1-3: Self-Organizing Maps I	Continental
9:30 a.m.-11:30 a.m.	Session Mo1-4: Hybrid Neural Intelligent Systems	Oak
11:30 a.m.-11:40 a.m.	Break	
11:40 a.m.-12:40 p.m.	Session Mo2-1: In Memory of John Taylor II	Gold
11:40 a.m.-12:40 p.m.	Session Mo2-2: Advances and Applications in Forecasting I	Parisian
11:40 a.m.-12:40 p.m.	Session Mo2-3: Mixed Topics in Neural Networks I	Continental
11:40 a.m.-12:40 p.m.	Session Mo2-4: Reinforcement Learning	Oak
12:40 p.m.-1:40 p.m.	Lunch Break (on your own)	
1:40 p.m.-2:40 p.m.	Session Mo3-1: In Memory of John Taylor III	Gold
1:40 p.m.-2:40 p.m.	Session Mo3-2: Advances and Applications in Forecasting II	Parisian
1:40 p.m.-2:40 p.m.	Session Mo3-3: Unsupervised Model-Based Learning: Bayesian Regularization and Sparsity	Continental
1:40 p.m.-2:40 p.m.	Session Mo3-4: Intelligent Embedded Systems I	Oak
2:40 p.m.-3:10 p.m.	Refreshment Break	Regency Ballroom Foyer
2:40 p.m.-8:00 p.m.	Exhibits	Regency Ballroom Foyer
3:10 p.m.-5:10 p.m.	Session Mo4-1: In Memory of John Taylor IV	Gold
3:10 p.m.-5:10 p.m.	Session Mo4-2: Neuromorphic Science Technology for Cybersecurity	Parisian
3:10 p.m.-5:10 p.m.	Session Mo4-3: Incremental Machine Learning: Methods and Applications	Continental
3:10 p.m.-5:10 p.m.	Session Mo4-4: Intelligent Embedded Systems II	Oak
5:10 p.m.-5:20 p.m.	Break	
5:20 p.m.-6:20 p.m.	Session Mo5-1: Synaptic Transmission, Learning, and Neuromodulation	Gold
5:20 p.m.-6:20 p.m.	Session Mo5-2: Robotics I	Parisian
5:20 p.m.-6:20 p.m.	Session Mo5-3: Visual, Auditory, and Other Sensory Systems I	Continental
5:20 p.m.-6:20 p.m.	Session Mo5-4: Neuroscience and Neuroinformatics	Oak
6:20 p.m.-6:30 p.m.	Break	
6:30 p.m.-8:00 p.m.	Poster Session A	Regency Ballroom
8:00 p.m.-9:30 p.m.	Panel on Higher Human Emotions	Gold

IJCNN 2013 Schedule-at-a-Glance

Tuesday, August 6, 2013

TIME	SESSION	ROOM
7:00 a.m.-5:00 p.m.	Speaker Ready Room	Executive
7:30 a.m.-5:00 p.m.	Registration	Regency Foyer
8:00 a.m.-9:10 a.m.	Plenary Tu-Plen2: Network Models of the Human Brain *Olaf Sporns*	International Ballroom
9:10 a.m.-9:30 a.m.	Refreshment Break and Exhibits	Regency Ballroom Foyer
9:00 a.m.-8:00 p.m.	Exhibits	Regency Ballroom Foyer
9:20 a.m.-11:30 a.m.	Session Tu1-1: NSF Workshop on Cognitive Science	Gold
9:30 a.m.-11:30 a.m.	Session Tu1-2: Supervised Learning I	Parisian
9:30 a.m.-11:30 a.m.	Session Tu1-3: German Traffic Sign Detection Competition	Continental
9:30 a.m.-11:30 a.m.	Session Tu1-4: Probabilistic, Bayesian, and Semantic Networks	Oak
9:30 a.m.-11:30 a.m.	Session Tu1-5: Feedforward Neural Networks I	International Ballroom
11:30 a.m.-11:40 a.m.	Break	
11:40 a.m.-1:00 p.m.	Session Tu2-1: NSF Workshop on Cognitive Science (contd.)	Gold
11:40 a.m.-12:40 p.m.	Session Tu2-2: Robotics II	Parisian
11:40 a.m.-12:40 p.m.	Session Tu2-3: From Machine Sensing to Sensorimotor Intelligence	Continental
11:40 a.m.-12:40 p.m.	Session Tu2-4: Computational Intelligence Based Ensemble Classifiers	Oak
12:40 p.m.-1:40 p.m.	Lunch Break (on your own)	
1:40 p.m.-3:00 p.m.	Session Tu3-1: NSF Workshop on Cognitive Science (contd.)	Gold
1:40 p.m.-2:40 p.m.	Session Tu3-2: Attractor Neural Networks	Parisian
1:40 p.m.-2:40 p.m.	Session Tu3-3: Neural Computing for Human Friendly Robot Applications	Continental
1:40 p.m.-2:40 p.m.	Session Tu3-4: Attention, Learning, and Memory	Oak
2:40 p.m.-3:10 p.m.	Refreshment Break	Regency Foyer
3:00 p.m.-5:10 p.m.	Session Tu4-1: NSF Workshop on Cognitive Science (contd.)	Gold
3:10 p.m.-5:10 p.m.	Session Tu4-2: Supervised Learning II	Parisian
3:10 p.m.-5:10 p.m.	Session Tu4-3: Recurrent Neural Networks	Continental
3:10 p.m.-5:10 p.m.	Session Tu4-4: Temporal Data Analysis, Prediction, and Forecasting; Time Series Analysis	Oak
3:10 p.m.-5:10 p.m.	Session Tu4-5: Feedforward Neural Networks II	International Ballroom
5:10 p.m.-6:00 p.m.	Session Tu5-1: NSF Workshop on Cognitive Science (contd.)	Gold
5:10 p.m.-5:20 p.m.	Break	
5:20 p.m.-6:20 p.m.	Session Tu5-2: Self-Organizing Maps II	Parisian
5:20 p.m.-6:20 p.m.	Session Tu5-3: Complex-Valued Neural Networks	Continental
5:20 p.m.-6:20 p.m.	Session Tu5-4: Dynamic Neural Networks and Oscillatory and Chaotic Neural Networks	Oak
6:20 p.m.-6:30 p.m.	Break	
6:30 p.m.-8:00 p.m.	Poster Session B	Regency Ballroom
8:00 p.m.-9:30 p.m.	Panel on Teaching Cognitive Science and Computational Intelligence	Gold

IJCNN 2013 Schedule-at-a-Glance

Wednesday, August 7, 2013

TIME	SESSION	ROOM
7:00 a.m.-5:00 p.m.	Speaker Ready Room	Executive
8:00 a.m.-5:00 p.m.	Registration	Regency Ballroom Foyer
8:00 a.m.-9:10 a.m.	Plenary We-Plen3: Behavioral Economics and Neuroeconomics: Cooperation, Competition, Preference, and Risky Decision Making *Stephen Grossberg*	International Ballroom
9:10 a.m.-9:30 a.m.	Refreshment Break and Exhibits	Regency Ballroom Foyer
9:00 a.m.-3:10 p.m.	Exhibits	Regency Ballroom Foyer
9:30 a.m.-11:30 a.m.	Session We1-1: Unsupervised Learning and Clustering, (including PCA and ICA)	Gold
9:30 a.m.-11:30 a.m.	Session We1-2: Pattern Recognition and Feature Selection	Parisian
9:30 a.m.-11:30 a.m.	Session We1-3: Active Learning and Experimental Design (ALED)	Continental
9:30 a.m.-11:30 a.m.	Session We1-4: Support Vector Machines and EM Algorithms I	Oak
11:30 a.m.-11:40 a.m.	Break	
11:40 a.m.-12:40 p.m.	Session We2-1: Neurocomputational Models of Thought and Creativity I	Gold
11:40 a.m.-12:40 p.m.	Session We2-2: Crossdisciplinary Topics I	Parisian
11:40 a.m.-12:40 p.m.	Session We2-3: Financial Forecasting	Continental
11:40 a.m.-12:40 p.m.	Session We2-4: Special Neural Networks (Fuzzy, Modular, Reservoir, Large-Scale)	Oak
12:40 p.m.-1:40 p.m.	Lunch Break (on your own)	
1:40 p.m.-2:40 p.m.	Session We3-1: Neurocomputational Models of Thought and Creativity II	Gold
1:40 p.m.-2:40 p.m.	Session We3-2: Other Topics in Learning Machines I	Parisian
1:40 p.m.-2:40 p.m.	Session We3-3: Spiking Neural Networks I	Continental
1:40 p.m.-2:40 p.m.	Session We3-4: Visual, Auditory, and Other Sensory Systems II	Oak
2:40 p.m.-3:10 p.m.	Refreshment Break	Regency Ballroom Foyer
3:10 p.m.-5:10 p.m.	Session We4-1: Unsupervised Learning and Clustering, (including PCA and ICA) II	Gold
3:10 p.m.-5:10 p.m.	Session We4-2: Other Topics in Learning Machines II	Parisian
3:10 p.m.-5:10 p.m.	Session We4-3: Spiking Neural Networks II	Continental
3:10 p.m.-5:10 p.m.	Session We4-4: Support Vector Machines and EM Algorithms II	Oak
5:10 p.m.-5:20 p.m.	Break	
5:20 p.m.-6:20 p.m.	Session We5-1: Dynamical Models of Spiking Neurons	Gold
5:20 p.m.-6:20 p.m.	Session We5-2: Bioinformatics	Parisian
5:20 p.m.-6:20 p.m.	Session We5-3: Mind, Brain, and Cognitive Algorithms	Continental
5:20 p.m.-6:20 p.m.	Session We5-4: President Obama's Brain Mapping Initiative	Oak
7:00 p.m.-10:00 p.m.	Banquet	International Ballroom

IJCNN 2013 Schedule-at-a-Glance

Thursday, August 8, 2013

TIME	SESSION	ROOM
7:00 a.m.-11:00 a.m.	Speaker Ready Room	Executive
8:00 a.m.-1:00 p.m.	Registration	Regency Foyer
8:00 a.m.-9:10 a.m.	Plenary Th-Plen4: From Robots to Biomolecules: Computing for the Physical World *Lydia Kavraki*	International Ballroom
9:10 a.m.-9:30 a.m.	Refreshment Break	Regency Foyer
9:30 a.m.-11:30 a.m.	Session Th1-1: Cognitive Neuroscience	Gold
9:30 a.m.-11:30 a.m.	Session Th1-2: Crossdisciplinary Topics II	Parisian
9:30 a.m.-11:30 a.m.	Session Th1-3: Mixed Topics in Neural Networks II	Continental
9:30 a.m.-11:30 a.m.	Session Th1-4: Cognitive Robots and Brain-Inspired Cognitive Systems	Oak
9:30 a.m.-11:30 a.m.	Session Th1-5: Panel on Adaptive Computing for 21st Century Applications	International Ballroom
11:30 a.m.-11:40 a.m.	Break	
11:40 a.m.-12:40 p.m.	Session Th2-1: Brain-Machine Interface and Neural Engineering	Gold
11:40 a.m.-12:40 p.m.	Session Th2-2: Cognitive Architectures, Cognitive Modeling	Parisian
11:40 a.m.-12:40 p.m.	Session Th2-3: Special Neural Networks (Fuzzy, Modular, Reservoir, Large-Scale) II	Continental
11:40 a.m.-12:40 p.m.	Session Th2-4: Computational Neuroscience	Oak
12:40 p.m.-2:00 p.m.	Break	
2:00 p.m.-5:00 p.m.	Workshop W-1: Autonomous Learning Systems	Executive
2:00 p.m.-5:00 p.m.	Workshop W-2: What Language and Emotion Can Tell Us About the Brain: New Methods of Analysis	Royal

Friday, August 9, 2013

TIME	SESSION	ROOM
9:00 a.m.-12:00 noon	Workshop W-3: Perception and Cognition in the Brain: Integrating Single Cell Recordings, Spiking Neurons, and a Brain Theory	Executive

IJCNN 2013 Schedule

Sunday, August 4, 2013: Tutorials

	Oak	Far East	Continental	Parisian
8:00 a.m.–9:45 a.m.	**T1:** Natural and Artificial Intelligence: Introduction to Computational Brain-Mind	**T2:** Complex-Valued Neural Networks With Multi-Valued Neurons	**T3:** Super-Turing and Adaptive Processes	**T4:** Brain Connectivity Mapping
9:45a.m.–10:00 a.m.	**Break**			
10:00 a.m.–11:45 a.m.	**T5:** Cognitive Computational Intelligence: Language-Cognition Interaction, Data Mining, Financial Prediction, Cognitive Functions of Music and Beautiful, Cultural Evolution	**T6:** Stochastic Artificial Neurons and Neural Networks	**T7:** Meta-Cognition in Neural Networks	**T8:** Intelligent Energy Control and Management in Hybrid Electric Vehicles (HEV)
11:45 a.m.–1:30 p.m.	**Lunch Break (on your own)**			
1:30 p.m.–3:15 p.m.	**T9:** Cortical Networks	**T10:** Recurrent Neural Networks in System Identification, Forecasting and Control	**T11:** Autonomous Learning and Evolving Neural Networks	**T12:** Evolving Neural Networks
3:15 p.m.–3:30 p.m.	**Break**			
3:30 p.m.–5:15 p.m.	**T13:** Autonomous Machine Learning	**T14:** Random Neural Network and Applications in Engineering and Biology	**T15:** Protein Prediction Based on Machine Learning Techniques	**T16:** Online Learning for Big Data
5:15 p.m.–6:30 p.m.	**Break**			
6:30 p.m.–8:00 p.m.	**Opening Reception (Gold Room)**			

IJCNN 2013 Schedule

Monday, August 5, 2013

	Gold	Parisian	Continental	Oak
8:00 a.m.–9:10 a.m.	**Plenary Talk Mo-Plen1, International Ballroom: Neural Network Reinforcement Learning Structures for Real-Time Optimal Feedback Control and Games** *Frank Lewis, University of Texas at Arlington*			
9:10 a.m.–9:30 a.m.	**Coffee Break**			
9:30 a.m.–11:30 a.m.	**Session Mo1-1:** In Memory of John Taylor I	**Session Mo1-2:** Computational Intelligence Applied to Vision and Robotics	**Session Mo1-3:** Self-Organizing Maps I	**Session Mo1-4:** Hybrid Neural Intelligent Systems
11:30 a.m.–11:40 a.m.	**Break**			
11:40 a.m.–12:40 p.m.	**Session Mo2-1:** In Memory of John Taylor II	**Session Mo2-2:** Advances and Applications in Forecasting I	**Session Mo2-3:** Mixed Topics in Neural Networks I	**Session Mo2-4:** Reinforcement Learning
12:40 p.m.–1:40 p.m.	**Lunch Break (on your own)**			
1:40 p.m.–2:40 p.m.	**Session Mo3-1:** In Memory of John Taylor III	**Session Mo3-2:** Advances and Applications in Forecasting II	**Session Mo3-3:** Unsupervised Model-Based Learning: Bayesian Regularization and Sparsity	**Session Mo3-4:** Intelligent Embedded Systems I
2:40 p.m.–3:10 p.m.	**Coffee Break**			
3:10 p.m.–5:10 p.m.	**Session Mo4-1:** In Memory of John Taylor IV	**Session Mo4-2:** Neuromorphic Science Technology for Cybersecurity	**Session Mo4-3:** Incremental Machine Learning: Methods and Applications	**Session Mo4-4:** Intelligent Embedded Systems II
5:10 p.m.–5:20 p.m.	**Break**			
5:20 p.m.–6:20 p.m.	**Session Mo5-1:** Synaptic Transmission, Learning, and Neuromodulation	**Session Mo5-2:** Robotics I	**Session Mo5-3:** Visual, Auditory, and Other Sensory Systems I	**Session Mo5-4:** Neuroscience and Neuroinformatics
6:20 p.m.–6:30 p.m.	**Break**			
6:30 p.m.–8:00 p.m.	**Poster Session A (Regency Ballroom)**			
8:00 p.m.–9:30 p.m.	Panel on Higher Human Emotions			

IJCNN 2013 Schedule

Tuesday, August 6, 2013

	Gold	Parisian	Continental	Oak	International Ballroom
8:00 a.m.–9:10 a.m.	**Plenary Talk Tu-Plen2, International Ballroom: Network Models of the Human Brain** *Olaf Sporns, Indiana University*				
9:10 a.m.–9:30 a.m.	**Coffee Break**				
9:30 a.m.–11:30 a.m.	**Session Tu1-1:** NSF Workshop on Cognitive Science (starts at 9:20 a.m.)	**Session Tu1-2:** Supervised Learning I	**Session Tu1-3:** German Traffic Sign Detection Competition	**Session Tu1-4:** Probabilistic, Bayesian, and Semantic Networks	**Session Tu1-5:** Feedforward Neural Networks I
11:30 a.m.–11:40 a.m.	**Break**				
11:40 a.m.–12:40 p.m.	**Session Tu2-1:** NSF Workshop on Cognitive Science (through 1:00 p.m.)	**Session Tu2-2:** Robotics II	**Session Tu2-3:** From Machine Sensing to Sensorimotor Intelligence	**Session Tu2-4:** Computational Intelligence Based Ensemble Classifiers	
12:40 p.m.–1:40 p.m.	**Lunch Break (on your own)**				
1:40 p.m.–2:40 p.m.	**Session Tu3-1:** NSF Workshop on Cognitive Science (through 3:00 p.m.)	**Session Tu3-2:** Attractor Neural Networks	**Session Tu3-3:** Neural Computing for Human Friendly Robot Applications	**Session Tu3-4:** Attention, Learning, and Memory	
2:40 p.m.–3:10 p.m.	**Coffee Break**				
3:10 p.m.–5:10 p.m.	**Session Tu4-1:** NSF Workshop on Cognitive Science (starts at 3:00 p.m.)	**Session Tu4-2:** Supervised Learning II	**Session Tu4-3:** Recurrent Neural Networks	**Session Tu4-4:** Temporal Data Analysis, Prediction, and Forecasting; Time Series Analysis	**Session Tu4-5:** Feedforward Neural Networks II
5:10 p.m.–5:20 p.m.	**Break**				
5:20 p.m.–6:20 p.m.	**Session Tu5-1:** NSF Workshop on Cognitive Science (5:10 p.m. through 6:00 p.m.)	**Session Tu5-2:** Self-Organizing Maps II	**Session Tu5-3:** Complex-Valued Neural Networks	**Session Tu5-4:** Dynamic Neural Networks and Oscillatory and Chaotic Neural Networks	
6:20 p.m.–6:30 p.m.	**Break**				
6:30 p.m.–8:00 p.m.	**Poster Session B (Regency Ballroom)**				
8:00 p.m.–9:30 p.m.	Panel on Teaching Cognitive Science and Computational Intelligence				

IJCNN 2013 Schedule

Wednesday, August 7, 2013

	Gold	Parisian	Continental	Oak
8:00 a.m.–9:10 a.m.	**Plenary Talk We-Plen3, International Ballroom: Behavioral Economics and Neuroeconomics: Cooperation, Competition, Preference, and Risky Decision Making** *Stephen Grossberg, Boston University*			
9:10 a.m.–9:30 a.m.	**Coffee Break**			
9:30 a.m.–11:30 a.m.	**Session We1-1:** Unsupervised Learning and Clustering, (including PCA and ICA) I	**Session We1-2:** Pattern Recognition and Feature Selection	**Session We1-3:** Active Learning and Experimental Design (ALED)	**Session We1-4:** Support Vector Machines and EM Algorithms I
11:30 a.m.–11:40 a.m.	**Break**			
11:40 a.m.–12:40 p.m.	**Session We2-1:** Neurocomputational Models of Thought and Creativity	**Session We2-2:** Crossdisciplinary Topics I	**Session We2-3:** Financial Forecasting	**Session We2-4:** Special Neural Networks (Fuzzy, Modular, Reservoir, Large-Scale) I
12:40 p.m.–1:40 p.m.	**Lunch Break (on your own)**			
1:40 p.m.–2:40 p.m.	**Session We3-1:** Neurocomputational Models of Thought and Creativity II	**Session We3-2:** Other Topics in Learning Machines I	**Session We3-3:** Spiking Neural NetworksI	**Session We3-4:** Visual, Auditory, and Other Sensory Systems
2:40 p.m.–3:10 p.m.	**Coffee Break**			
3:10 p.m.–5:10 p.m.	**Session We4-1:** Unsupervised Learning and Clustering, (including PCA and ICA) II	**Session We4-2:** Other Topics in Learning Machines II	**Session We4-3:** Spiking Neural Networks II	**Session We4-4:** Support Vector Machines and EM Algorithms II
5:10 p.m.–5:20 p.m.	**Break**			
5:20 p.m–6:20 p.m.	**Session We5-1:** Dynamical Models of Spiking Neurons	**Session We5-2:** Bioinformatics	**Session We5-3:** Mind, Brain, and Cognitive Algorithms	**Session We5-4:** President Obama's Brain Mapping Initiative
6:20 p.m.–7:00 p.m.	**Break**			
7:00 p.m.–10:00 p.m.	**Banquet (International Ballroom)**			

IJCNN 2013 Schedule

Thursday, August 8, 2013

	Gold	Parisian	Continental	Oak	International Ballroom
8:00 a.m.–9:10 a.m.	**Plenary Talk Th-Plen4, International Ballroom: From Robots to Biomolecules: Computing for the Physical World** *Lydia Kavraki, Rice University*				
9:10 a.m.–9:30 a.m.	**Coffee Break**				
9:30 a.m.–11:30 a.m.	**Session Th1-1:** Cognitive Neuroscience	**Session Th1-2:** Crossdisciplinary Topics II	**Session Th1-3:** Mixed Topics in Neural Networks II	**Session Th1-4:** Cognitive Robots and Brain Inspired Cognitive Systems	**Session Th1-5:** Panel on Adaptive Computing for 21st Century Applications
11:30 a.m.–11:40 a.m.	**Break**				
11:40 a.m.–12:40 p.m.	**Session Th2-1:** Brain-Machine Interface and Neural Engineering	**Session Th2-2:** Cognitive Architectures, Cognitive Modeling	**Session Th2-3:** Special Neural Networks (Fuzzy, Modular, Reservoir, Large-Scale) II	**Session Th2-4:** Computational Neuroscience	
12:40 p.m.–2:00 p.m.	**Break**				
2:00 p.m.–5:00 p.m.	**Workshops**				

IJCNN 2013 Schedule

Thursday, August 8, 2013: Workshops

	Executive	**Royal**	**Continental**	**Oak**
8:00 a.m.–12:40 p.m.	**Regular Sessions**			
12:40 p.m.–2:00 p.m.	**Break**			
2:00 p.m.–5:00 p.m.	**Workshop W-1:** Autonomous Learning Systems	**Workshop W-2:** What Language and Emotion Can Tell Us About the Brain: New Methods of Analysis		

Friday, August 9, 2013: Workshops

	Executive	**Royal**	**Continental**	**Oak**
9:00 a.m.–12:00 noon	**Workshop W-3:** Perception and Cognition in the Brain: Integrating Single Cell Recordings, Spiking Neurons, and a Brain Theory			

WCCI 2014

2014 IEEE World Congress on Computational Intelligence

July 6 – 11, 2014, Beijing, China

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The IEEE World Congress on Computational Intelligence (IEEE WCCI) is the largest technical event in the field of computational intelligence. IEEE WCCI 2014 will host three conferences: The 2014 International Joint Conference on Neural Networks (IJCNN 2014), the 2014 IEEE International Conference on Fuzzy Systems (FUZZ-IEEE 2014), and the 2014 IEEE Congress on Evolutionary Computation (IEEE CEC 2014). IEEE WCCI 2014 will engage in cross-fertilization among the three big areas and provide a forum for scientists, engineers, educators, and students from all over the world to discuss and present their research findings on computational intelligence.

IEEE WCCI 2014 will be held in Beijing, the capital of the People's Republic of China. Beijing is the nation's political, economic, and cultural center as well as China's most important center for international trade and communications. With the biggest central square in the world - Tiananmen Square, the Forbidden City - the largest and best-preserved imperial palace complex, a superbly preserved section of the Great Wall, as well as the largest sacrificial complex in the world - the Temple of Heaven, Beijing attracts both domestic and foreign visitors who all come to wonder at its long history and unique cultural relics.

Call for Papers

IJCNN 2014 The annual International Joint Conference on Neural Networks (IJCNN) is the flagship conference of the IEEE Computational Intelligence Society and the International Neural Network Society. It covers all topics in the field of neural networks from biological neural network modeling to artificial neural computation.

FUZZ-IEEE 2014 The annual IEEE International Conference on Fuzzy Systems (FUZZ-IEEE) is the foremost conference in the field of fuzzy systems. It covers all topics in fuzzy systems from theory to applications.

IEEE CEC 2014 The annual IEEE Congress on Evolutionary Computation (IEEE CEC) is one of the leading events in the field of evolutionary computation. It covers all topics in evolutionary computation from theory to applications.

All papers should be submitted electronically through the Congress website. Contributed papers will be refereed by experts in the fields based on the criteria of originality, significance, quality and clarity.

Call for Tutorials

IEEE WCCI 2014 will feature pre-Congress tutorials, covering fundamental and advanced topics in computational intelligence. A tutorial proposal should include title, outline, expected enrolment, and presenter/organizer biography. Inquiries regarding the tutorials should be addressed to Tutorials Chairs.

Call for Special Session Proposals

IEEE WCCI 2014 solicits proposals for special sessions within the technical scope of the three conferences. Special sessions, to be organized by internationally recognized experts, aim to bring together researchers in special focused topics. Cross-fertilization of the three technical disciplines and newly emerging research areas are strongly encouraged. Papers submitted for special sessions are to be peer-reviewed with the same criteria used for the contributed papers.

Call for Competition Proposals

IEEE WCCI 2014 will host competitions to stimulate research in computational intelligence, promote fair evaluations, and attract students. The proposals should include descriptions of the problems addressed, motivations and expected impact on computational intelligence, data description, evaluation procedures and established baselines, schedules, anticipated number of participants, and a biography of the main team members.

Important Dates

Special session proposals deadline.......November 15, 2013
Competition proposals submission deadline.......November 15, 2013
Tutorial proposals deadline.......December 20, 2013
Paper submission deadline.......December 20, 2013
Paper acceptance notification date.......March 15, 2014
Final paper submission deadline.......April 15, 2014
Early registration.......April 15, 2014

IEEE Computational Intelligence Society

For more information, please visit http://www.ieee-wcci2014.org

2014 IEEE Symposium Series on Computational Intelligence

IEEE SSCI 2014

December 9 to 12, 2014, Orlando, Florida, U.S.A.

Important dates:

Paper submission:	**June 15, 2014**
Notification to authors:	**September 5, 2014**
Final submission:	**October 5, 2014**
Early registration:	**October 5, 2014**
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Welcome to the sunshine of Orlando, Florida for the IEEE SSCI 2014, a flagship international conference sponsored by the IEEE Computational Intelligence Society (CIS) promoting all aspects of Computational Intelligence (CI). The IEEE SSCI 2014 co-locates multiple symposiums at one single location, providing a unique opportunity to encourage cross-fertilization and collaborations in all areas of CI. The IEEE SSCI 2014 features a large number of keynotes, tutorials, and special sessions. The IEEE SSCI 2014 will also offer a number of travel grants as well as an exciting Doctoral Consortium. We hope you will join us at this exciting event, and look forward to seeing you in Orlando in December 2014!

IEEE SSCI 2014 Symposia

ADPRL'14, IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning, Huaguang Zhang, China, Jagannathan Sarangapani, USA, Lucian Busoniu, France.

CCMB'14, IEEE Symposium on Computational Intelligence, Cognitive Algorithms, Mind, and Brain, Robert Kozma, USA, Leonid Pervlovsky, USA, Damien Coyle, UK.

CIASG'14, IEEE Symposium on Computational Intelligence Applications in Smart Grid, G. Kumar Venayagamoorthy, USA, Jung-Wook Park, Korea.

CIBD'14, IEEE Symposium on Computational Intelligence in Big Data, Yaochu Jin, UK, Yonghong Peng, UK, and Nitesh Chawla, USA.

CIBIM'14, IEEE Symposium on Computational Intelligence in Biometrics and Identity Management, Qinghan Xiao, Canada, David Zhang, China, Fabio Scotti, Italy

CICA'14, IEEE Symposium on Computational Intelligence in Control and Automation, Xiao-Jun Zeng, UK.

CICARE'14, IEEE Symposium on Computational Intelligence in healthcare and e-health, Amir Hussain, UK.

CIComms'14, IEEE Symposium on Computational Intelligence for Communication Systems and Networks, Sergey Andreev, Finland, Raymond Carroll, Ireland, Maode Ma, Singapore, Paolo Rocca, Italy.

CICS'14, IEEE Symposium on Computational Intelligence in Cyber Security, Dipankar Dasgupta, USA

CIDM'14, IEEE Symposium on Computational Intelligence and Data Mining, Zhi-Hua Zhou, China, Barbara Hammer, Germany, Carlotta Domeniconi, USA.

CIDUE'14, IEEE Symposium on Computational Intelligence in Dynamic and Uncertain Environments, Yaochu Jin, UK, Robi Polikar, USA, Shengxiang Yang, UK

CIEL'14, IEEE Symposium on Computational Intelligence in Ensemble Learning, Nikhil R. Pal, India, P. N. Suganthan, Singapore, Xin Yao, UK

CIES'14, IEEE Symposium on Computational Intelligence for Engineering Solutions, Michael Beer, UK, Rudolf Kruse, Germany, Vladik Kreinovich, USA.

CIHLI'14, IEEE Symposium on Computational Intelligence for Human-like Intelligence, Jacek Mandziuk, Poland, Wlodzislaw Duch, Poland.

CIMSIVP'14, IEEE Symposium on Computational Intelligence for Multimedia, Signal and Vision Processing, Khan M Iftekharuddin, USA, Salim Bouzerdoum, Australia.

EALS'14, IEEE Symposium on Evolving and Autonomous Learning Systems, Plamen Angelov, U.K., Dimitar Filev, USA, Nikola Kasabov, New Zealand.

FOCI'14, IEEE Symposium on Foundations of Computational Intelligence, Manuel Ojeda-Aciego, Spain.

IA'14, IEEE Symposium on Intelligent Agents, Hani Hagras, UK, Vincenzo Loia, Italy.

ICES'14, IEEE International Conference on Evolvable Systems, Andrew Tyrrell, UK, Pauline Haddow, Norway

CIR2AT'14, IEEE Symposium on Computational Intelligence in Robotic Rehabilitation and Assistive Technologies, Gui DeSouza, USA, James Patton, USA, Georgios Kouroupetroglou, Greece

MC'14, IEEE Workshop on Memetic Computing, Giovanni Iacca, Netherlands, Fabio Caraffini, UK, Ferrante Neri, UK

MCDM'14, IEEE Symposium on Computational Intelligence in Multicriteria Decision-Making, Yaochu Jin, UK, Piero Bonissone, USA, Juergen Branke, UK

RiiSS'14, IEEE Workshop on Robotic Intelligence in Informationally Structured Space, Janos Botzheim, Japan, Chu Kiong Loo, Malaysia.

SDE'14, IEEE Symposium on Differential Evolution, Janez Brest, Slovenia, Swagatam Das, India, Ferrante Neri, UK

SIS'14, IEEE Symposium on Swarm Intelligence, Yuhui Shi, China, P. N. Suganthan, Singapore.

PROGRAM

TUTORIALS

Sunday, August 4, 8:00AM–9:45AM

Tutorial T1: Natural and Artificial Intelligence: Introduction to Computational Brain-Mind, Instructor: Juyang Weng, Room: Oak
Tutorial T2: Complex-Valued Neural Networks With Multi-Valued Neurons, Instructor: Igor Aizenberg, Room: Far East
Tutorial T3: Super-Turing and Adaptive Processes, Instructor: Hava Siegelmann, Room: Continental
Tutorial T4: Brain Connectivity Mapping, Instructor: Yoonsuck Choe, Room: Parisian

Sunday, August 4, 10:00AM–11:45AM

Tutorial T5: Cognitive Computational Intelligence: Language-Cognition Interaction, Data Mining, Financial Prediction, Cognitive Functions of Music and Beautiful, Cultural Evolution, Instructor: Leonid Perlovsky, Room: Oak
Tutorial T6: Stochastic Artificial Neurons and Neural Networks, Instructor, Richard C. Windecker, Room: Far East
Tutorial T7: Meta-Cognition in Neural Networks, Instructors: Narasimhan Sundararajan and Savitha Ramasamy, Room: Continental
Tutorial T8: Intelligent Energy Control and Management in Hybrid Electric Vehicles (HEV), Instructor: Yi-Lu Murphey, Room: Parisian

Sunday, August 4, 1:30PM–3:15PM

Tutorial T9: Cortical Networks, Instructors: A. Ravishankar Rao & Guillermo Cecchi, Room: Oak
Tutorial T10: Recurrent Neural Networks in System Identification, Forecasting and Control, Instructor: Georg Zimmermann, Room: Far East
Tutorial T11: Autonomous Learning and Evolving Neural Networks, Instructors: Plamen Angelov & Nikola Kasabov, Room: Continental
Tutorial T12: Evolving Neural Networks, Instructor: Risto Miikkulainen, Room: Parisian

Sunday, August 4, 3:30PM–5:15PM

Tutorial T13: Autonomous Machine Learning, Instructor: Asim Roy, Room Oak
Tutorial T14: Random Neural Network and Applications in Engineering and Biology, Instructor: Erol Gelenbe, Room: Far East
Tutorial T15: Protein Prediction Based on Machine Learning Techniques, Instructor: De-Shuang Huang, Room: Continental
Tutorial T16: Online Learning for Big Data, Instructor: Irwin King, Room: Parisian

RESEARCH PRESENTATIONS

Monday, August 5, 8:00AM–9:10AM

Plenary Talk Mo-Plen1: Plenary Session Chair: Plamen Angelov, Room: International Ballroom
8:00AM *Neural Network Reinforcement Learning Structures for Real-Time Optimal Feedback Control and Games*
Frank Lewis (University of Texas at Arlington)

Monday, August 5, 9:30AM–11:30AM

Special Session Mo1-1: In Memory of John Taylor I, Chair: Daniel Levine, Room: Gold

9:30AM	*John Gerald Taylor: Comrade, Polymath, and Consummate Neuroscientist* [no. 1519] Walter Freeman
10:10AM	*John Taylor, Learning, Attention, and Consciousness* [no. 1207] Stephen Grossberg
10:50AM	*The Race to New Mathematics of Brains and Consciousness: A Tribute to John G. Taylor* [no. 1544] Robert Kozma

Special Session Mo1-2: Computational Intelligence Applied to Vision and Robotics, Chair: José García-Rodríguez and Khan Iftekharuddin, Room: Parisian

9:30AM	*Point Cloud Data Filtering and Downsampling Using Growing Neural Gas* [no. 1168] Sergio Orts-Escolano, Vicente Morell, José García-Rodríguez and Miguel Cazorla
9:50AM	*A Semi-Parametric Approach for Football Video Annotation* [no. 1417] Markos Mentzelopoulos, Alexandra Psarrou, Anastassia Angelopoulou and José García-Rodríguez
10:10AM	*Alignment-Based Transfer Learning for Robot Models* [no. 1106] Botond Bocsi, Lehel Csato and Jan Peters
10:30AM	*Novelty Estimation in Developmental Networks: Acetylcholine and Norepinenephrine* [no. 1445] Jordan Fish, Lisa Ossian and Juyang Weng
10:50AM	*Learning Topological Image Transforms Using Cellular Simultaneous Recurrent Networks* [no. 1463] Keith Anderson and Khan Iftekharuddin
11:10AM	*Human Behaviour Recognition Based on Trajectory Analysis Using Neural Networks* [no. 1411] Jorge Azorin-Lopez, Marcelo Saval-Calvo, Andres Fuster-Guillo and José García-Rodríguez

Session Mo1-3: Self-Organizing Maps I, Chair: Risto Miikkulainen, Room: Continental

9:30AM	*An Incremental Self-Organizing Neural Network Based on Enhanced Competitive Hebbian Learning* [no. 1162] Hao Liu, Masahito Kurihara, Satoshi Oyama and Haruhiko Sato
9:50AM	*Clustering the Self-Organizing Map Through the Identification of Core Neuron Regions* [no. 1565] Leonardo Enzo Brito da Silva and Jose Alfredo Ferreira Costa
10:10AM	*Hierarchical SOM-Based Detection of Novel Behavior for 3D Human Tracking* [no. 1380] German Parisi and Stefan Wermter
10:30AM	*Clustering iOS Executable Using Self-Organizing Maps* [no. 1469] Fang Yu, Shin-Yin Huang, Li-Ching Chiou and Rua-Huan Tsaih
10:50AM	*Batch Self-Organizing Maps for Mixed Feature-Type Symbolic Data* [no. 1355] Francisco De Carvalho and Gibson Barbosa
11:10AM	*Modified Self-Organizing Mixture Network for Probability Density Estimation and Classification* [no. 1009] Chang Lin and Chong-xiu Yu

Special Session Mo1-4: Hybrid Neural Intelligent Systems, Chair: Patricia Melin, Room: Oak

9:30AM	*Improvement of a Neural-Fuzzy Motion Detection Vision Model for Complex Scenario Conditions* [no. 1033] Mario Chacon-Murguia, Graciela Ramirez-Alonso and Sergio Gonzalez-Duarte
9:50AM	*Neuro-Fuzzy Control Strategy for Methane Production in an Anaerobic Process* [no. 1421] Kelly J. Gurubel, Edgar N. Sanchez and Salvador Carlos-Hernandez
10:10AM	*Time Series Prediction Using Ensembles of Neuro-Fuzzy Models With Interval Type-2 and Type-1 Fuzzy Integrators* [no. 1258] Jesus Soto, Patricia Melin and Oscar Castillo
10:30AM	*Self-Organizing Retinotopic Maps Applied to Background Modeling for Dynamic Object Segmentation in Video Sequences* [no. 1034] Juan A. Ramirez-Quintana and Mario I. Chacon-Murguia

10:50AM *A Class of Interval Type-2 Fuzzy Neural Networks Illustrated With Application to Non-Linear Identification* [no. 1031]
Juan Castro and Oscar Castillo

11:10AM *Neuro-Fuzzy Fitness in a Genetic Algorithm for Optimal Fuzzy Controller Design* [no. 1560]
Abraham Melendez, Oscar Castillo, Patricia Melin and Leslie Astudillo

Monday, August 5, 11:40AM–12:40PM

Special Session Mo2-1: In Memory of John Taylor II, Chair: Bruno Apolloni, Room: Gold

11:40AM *Cognitive Models of the Perception-Action Cycle: A View From the Brain* [no. 1128]
Vassilis Cutsuridis

12:20PM *In Search of the Brain's Executive* [no. 1067]
Daniel Levine

Special Session Mo2-2: Advances and Applications in Forecasting, Chair: Gustavo Juarez, Room: Parisian

11:40AM *Crogging (Cross-Validation Aggregation) for Forecasting—A Novel Algorithm of Neural Network Ensembles on Time Series Subsamples* [no. 1548]
Devon K. Barrow and Sven F. Crone

12:00PM *Analysis of a Gaussian Process and Feed-Forward Neural Networks Based Filter for Forecasting Short Rainfall Time Series* [no. 1036]
Cristian Rodriguez Rivero, Julian Pucheta, Sergio Laboret, Victor Sauchelli, Josef Baumgartner and Daniel Patino

12:20PM *Multivariate k-Nearest Neighbour Regression for Time Series Data—A Novel Algorithm for Forecasting UK Electricity Demand* [no. 1559]
Fahad H. Al-Qhatani and Sven F. Crone

Session Mo2-3: Mixed Topics in Neural Networks, Chair: Jürgen Schmidhuber, Room: Continental

11:40AM *Hierarchical Encoding of Human Working Memory* [no. 1290]
Guoqi Li

12:00PM *Cognitive Computing Systems: Algorithms and Applications for Networks of Neurosynaptic Cores* [no. 1392]
Steve Esser, Alexander Andreopoulos, Rathinakumar Appuswamy, Pallab Datta, Davis Barch, Arnon Amir, John Arthur, Andrew Cassidy, Myron Flickner, Paul Merolla, Shyamal Chandra, Nicola Basilico, Stefano Carpin, Tom Zimmerman, Frank Zee, Rodrigo Alvarez-Icaza, Jeffrey Kusnitz, Theodore Wong, William Risk, Emmett McQuinn, Tapan Nayak, Raghavendra Singh and Dharmendra Modha

12:20PM *Computer-Aided Music Composition With LSTM Neural Network and Chaotic Inspiration* [no. 1459]
Andres Eduardo Coca Salazar, Debora Cristina Correa and Zhao Liang

Session Mo2-4: Reinforcement Learning, Chair: Donald C. Wunsch, Room: Oak

11:40AM *Neural Network Based Finite Horizon Stochastic Optimal Controller Design for Nonlinear Networked Control Systems* [no. 1052]
Xu Hao and Sarangapani Jagannathan

12:00PM *Solutions to Finite Horizon Cost Problems Using Actor-Critic Reinforcement Learning* [no. 1147]
Ivo Grondman, Hao Xu, Sarangapani Jagannathan and Robert Babuska

12:20PM *Learning Population of Spiking Neural Networks With Perturbation of Conductances* [no. 1289]
Piotr Suszynski and Pawel Wawrzynski

Monday, August 5, 1:40PM–2:40PM

Special Session Mo3-1: In Memory of John Taylor III, Chair: Daniel Levine, Room: Gold

1:40PM	*Studying Fronto-Striatal Function and Dysfunction Before 'Pubmed': Remembering the Legacy of Prof. John G. Taylor* [no. 1606] Oury Monchi
2:00PM	*Toward a Cooperative Brain: Continuing the Work With John Taylor* [no. 1505] Bruno Apolloni

Special Session Mo3-2: Advances and Applications in Forecasting, Chair: Gustavo Juarez, Room: Parisian

1:40PM	*An SVM-Based Approach for Stock Market Trend Prediction* [no. 1165] Yuling Lin, Haixiang Guo and Jinglu Hu
2:00PM	*Volatility Analysis via Coupled Wishart Process* [no. 1204] Zhong She and Can Wang
2:20PM	*Credit Risk Evaluation Using a Multilayered Feedforward Neural Network With Backpropagation Learning Rule* [no. 1496] Sizo Duma and Bhekisipho Twala

Special Session Mo3-3: Unsupervised Model-Based Learning: Bayesian Regularization and Sparsity, Chair: Faicel Chamroukhi, Room: Continental

1:40PM	*Unsupervised Feature Selection for Proportional Data Clustering via Expectation Propagation* [no. 1237] Wentao Fan and Nizar Bouguila
2:00PM	*Robust EM Algorithm for Model-Based Curve Clustering* [no. 1338] Faicel Chamroukhi
2:20PM	*Autonomous Reinforcement Learning With Hierarchical REPS* [no. 1081] Christian Daniel, Gerhard Neumann and Jan Peters

Special Session Mo3-4: Intelligent Embedded Systems I, Chair: Manuel Roveri, Room: Oak

1:40PM	*Multilevel Adaptive Neural Network Architecture for Implementing Single-Chip Intelligent Agents on FPGAs* [no. 1101] Raul Finker, Ines del Campo, Javier Echanobe and Faiyaz Doctor
2:00PM	*Model Ensemble for an Effective On-Line Reconstruction of Missing Data in Sensor Networks* [no. 1342] Cesare Alippi, Stavros Ntalampiras and Manuel Roveri
2:20PM	*Application of Dynamic Neural Networks With Exogenous Input to an Industrial Remote Conditional Monitoring Test-Bed via Embedded via TCP/IP Bridging* [no. 1389] Syed Yusuf, David Brown, Alan Mackinnon and Richard Papanicolaou

Monday, August 5, 3:10PM–5:10PM

Special Session Mo4-1: In Memory of John Taylor IV, Chair: Bruno Apolloni, Room: Gold

3:10PM	*Cognitive Computation: A Case Study in Cognitive Control of Autonomous Systems and Some Future Directions* [no. 1589] Amir Hussain
3:50PM	*On the Interplay Between "Learning, Memory, Prospection and Abstraction" in Cumulatively Learning Baby Humanoids* [no. 1580] Vishwanathan Mohan, Giulio Sandini and Pietro Morasso
4:30PM	*Bubbles in the Robot* [no. 1231] Thomas Trappenberg

Special Session Mo4-2: Neuromorphic Science Technology for Cybersecurity, Chair: Robinson E. Pino, Room: Parisian

3:10PM	*Periodic Activation Functions in Memristor-Based Analog Neural Networks* [no. 1340] Cory Merkel, Dhireesha Kudithipudi and Nick Sereni
3:30PM	*Memristor SPICE Model and Crossbar Simulation Based on Devices With Nanosecond Switching Time* [no. 1407] Chris Yakopcic, Tarek Taha, Guru Subramanyam and Robinson Pino
3:50PM	*Cognitive Clustering Algorithm for Efficient Cybersecurity Applications* [no. 1405] Robert Kozma, Joao Luis Rosa and Denis Piazentin
4:10PM	*Routing Bandwidth Model for Feed Forward Neural Networks on Multicore Neuromorphic Architectures* [no. 1351] Raqibul Hasan and Tarek Taha
4:30PM	*Memristor-Based Synapse Design and a Case Study in Reconfigurable Systems* [no. 1029] Feng Ji, Hai Li, Bryant Wysocki, Clare Thiem and Nathan McDonald
4:50PM	*Autism Spectrum Disorder Detection Using Projection Based Learning Meta-Cognitive RBF Network* [no. 1399] Vigneshwaran Subbaraju, Mahanand B. Suresh, Suresh Sundaram and Savitha Ramasamy

Special Session Mo4-3: Incremental Machine Learning: Methods and Applications, Chair: Shogo Okada, Room: Continental

3:10PM	*Scalable, Incremental Learning With MapReduce Parallelization for Cell Detection in High-Resolution 3D Microscopy Data* [no. 1471] Chul Sung, Jongwook Woo, Matthew Goodman, Todd Huffman and Yoonsuck Choe
3:30PM	*Incremental Learning of New Classes From Unbalanced Data* [no. 1457] Gregory Ditzler, Gail Rosen and Robi Polikar
3:50PM	*A Robust Incremental Principal Component Analysis for Feature Extraction from Stream Data With Missing Values* [no. 1416] Daijiro Aoki, Toshiaki Omori and Seiichi Ozawa
4:10PM	*Incremental Learning Using Self-Organizing Neural Grove* [no. 1378] Hirotaka Inoue and Yudai Umemoto
4:30PM	*An Importance Weighted Projection Method for Incremental Learning Under Unstationary Environments* [no. 1333] Yamauchi Koichiro
4:50PM	*Incremental Learning From Several Different Microarrays* [no. 1317] Vladimir Nikulin, Nicoleta Rogovschi and Nistor Grozavu

Special Session Mo4-4: Intelligent Embedded Systems II, Chair: Manuel Roveri, Room: Oak

3:10PM	*Aircraft Sensor Estimation for Fault Tolerant Flight Control System Using Fully Connected Cascade Neural Network* [no. 1039] Saed Hussain, Maizura Mokhtar and Joe M. Howe
3:30PM	*WSN-ANN: Parallel and Distributed Neurocomputing With Wireless Sensor Networks* [no. 1010] Gursel Serpen, Jiakai Li, Linqian Liu and Zhenning Gao
3:50PM	*Biologically Inspired Distributed Sensor Networks: Collective Signal Amplification via Ultra-Low Bandwidth Spike-Based Communication* [no. 1516] Sheng Lundquist, Dylan Paiton, Brennan Nowers, Peter Schultz, Steven Brumby, Anders Jorgensen and Garrett Kenyon
4:10PM	*Self-Learning and Neural Network Adaptation by Embedded Collaborative Learning Engine (eCLE)—an Overview* [no. 1371] Francisco J. Maldonado and Stephen Oonk
4:30PM	*Multi-Pattern Cross Training: An ANN Model Training Method Using WSN Sensor Data* [no. 1424] Zhao Yi, Valentin Gies, Felipe Teles Ademir and Jean Marc Ginoux
4:50PM	*Concept Drift Detection for Online Class Imbalance Learning* [no. 1103] Shuo Wang, Leandro L. Minku, Davide Ghezzi, Daniele Caltabiano, Peter Tino and Xin Yao

Monday, August 5, 5:20PM–6:20PM

Session Mo5-1: Synaptic Transmission, Learning, and Neuromodulation, Chair: Sergio Davies, Room: Gold

5:20PM	*Shaping Synaptic Learning by the Duration of the Postsynaptic Action Potentia*l [no. 1579] Youwei Zheng and Lars Schwabe
5:40PM	*Biologically Plausible Models of Homeostasis and STDP: Stability and Learning in Spiking Neural Networks* [no. 1425] Kristofor Carlson, Micah Richert, Nikil Dutt and Jeffrey Krichmar
6:00PM	*Spike-Based Learning of Transfer Functions With the SpiNNaker Neuromimetic Simulator* [no. 1089] Sergio Davies, Terry Stewart, Chris Eliasmith and Steve Furber

Session Mo5-2: Robotics I, Chair: Chu-Kiong Loo, Room: Parisian

5:20PM	*Quantum Neural Network Based Surface EMG Signal Filtering for Control of Robotic Hand* [no. 1079] Vaibhav Gandhi and Martin McGinnity
5:40PM	*IC Chip of Pulse-Type Hardware Neural Networks for Hexapod Walking MEMS Micro Robot* [no. 1280] Ken Saito, Shiho Takahama, Shinpei Yamasaki, Minami Takato, Yoshifumi Sekine and Fumio Uchikoba
6:00PM	*How Can a Robot Evaluate its Own Behaviour? A Generic Model for Self-Assessment* [no. 1410] Adrien Jauffret, Caroline Grand, Nicolas Cuperlier, Philippe Gaussier and Philippe Tarroux

Session Mo5-3: Visual, Auditory, and Other Sensory Systems I, Chair: Deliang Wang, Room: Continental

5:20PM	*Unified Losses for Multi-Modal Pose Coding and Regression* [no. 1414] Leif Johnson, Joseph Cooper and Dana Ballard
5:40PM	*A Neurocomputing Model for Ganglion Cell's Color Opponency Mechanism and its Application in Image Analysis* [no. 1063] Hui Wei and Heng Wu
6:00PM	*Audio-Visual Fuzzy Fusion for Robust Speech Recognition* [no. 1016] Mario Malcangi, Ouazzane Karim and Premit Patel

Session Mo5-4: Neuroscience and Neuroinformatics, Chair: Paul Verschure, Room: Oak

5:20PM	*Information Theoretic Analysis of Energy Efficient Neurons With Biologically Plausible Constraints* [no. 1584] Siavash Ghavami, Farshad Lahouti and Lars Schwabe
5:40PM	*Integrated Information for Large Complex Networks* [no. 1490] Xerxes Arsiwalla and Paul Verschure
6:00PM	*Creation of Spiking Neuron Models Applied in Pattern Recognition Problems* [no. 1450] Josafath I. Espinosa-Ramos, Nareli Cruz-Cortes and Roberto A. Vazquez

Monday, August 5, 6:30PM–8:00PM

Poster Session Mo-PA: Poster Session A, Chair: Simona Doboli, Room: Regency Ballroom

P101	*Biologically Inspired Intensity and Range Image Feature Extraction* [no. 1069] Dermot Kerr, Sonya Coleman, Martin McGinnity and Marine Clogenson
P102	*Learning Convolutional Neural Networks From Few Samples* [no. 1108] Raimar Wagner, Markus Thom, Roland Schweiger, Guenther Palm and Albrecht Rothermel
P103	*Adaptive Linear Learning for On-Line Harmonic Identification: An Overview With Study Cases* [no. 1221] Patrice Wira and Thien Minh Nguyen
P104	*FEBAMSOM-BAM*: Neural Network Model of Human Categorization of the N-Bits Parity Problem* [no. 1382] Laurence Morissette and Sylvain Chartier
P105	*Fine-Tuning of the SOMkNN Classifier* [no. 1522] Leandro Augusto Silva, Edson Kitani and Emilio Del-Moral-Hernandez
P106	*A First Analysis of the Effect of Local and Global Optimization Weights Methods in the Cooperative-Competitive Design of RBFN for Imbalanced Environments* [no. 1193] Maria Dolores Perez-Godoy, Antonio Jesus Rivera Rivas, Maria Jose Del Jesus Diaz and Francisco Martinez del Rio
P107	*Spreading Activation and Sparseness in a Bidirectional Associative Memory* [no. 1408] Christophe Tremblay, Maxime Dorville, Kaia Myers-Stewart and Sylvain Chartier
P108	*Stimulus Discrimination in Networks of Spiking Neurons* [no. 1259] Eric Kuebler, Elise Bonnema, James McCorriston and Jean-Philippe Thivierge
P109	*Dynamic Sample Size Selection Based Quasi-Newton Training for Highly Nonlinear Function Approximation Using Multilayer Neural Networks* [no. 1552] Hiroshi Ninomiya
P110	*Unsupervised Feature Learning Classification Using an Extreme Learning Machine* [no. 1223] Dao Lam and Donald C. Wunsch
P111	*Classifier Comparison for MSER-Based Text Classification in Scene Images* [no. 1060] Khalid Iqbal, Xu-Cheng Yin, Xuwang Yin, Hazrat Ali and Hong-Wei Hao
P112	*Measure Optimized Wrapper Framework for Multi-Class Imbalanced Data Learning: An Empirical Study* [no. 1091] Peng Cao, Dazhe Zhao and Osmar Zaiane
P113	*A Novel Cost Sensitive Neural Network Ensemble for Multiclass Imbalance Data Learning* [no. 1092] Peng Cao, Bo Li, Dazhe Zhao and Osmar Zaiane
P114	*ColorPCA: Color Principal Feature Extraction Technique for Color Image Reconstruction and Recognition* [no. 1071] Zhao Zhang, Mingbo Zhao, Bing Li and Peng Tang
P115	*On the Convergence of Techniques That Improve Value Iteration* [no. 1449] Marek Grzes and Jesse Hoey
P116	*An Interval Nonparametric Regression Method* [no. 1093] Roberta Fagundes, Renata Souza, Ricardo Queiroz and Francisco Cysneiros
P117	*EMG Signal Classification Using Relevance Vector Machines and Fractal Dimension* [no. 1386] Clodoaldo Lima, Andre Coelho, Renata Madeo and Sarajane Peres
P118	*Diversity in Task Decomposition: A Strategy for Combining Mixtures of Experts* [no. 1306] Everson Verissimo, Diogo Severo, George Cavalcanti and Tsang Ing Ren
P119	*Locally Linear Representation Fisher Criterion* [no. 1154] Bo Li, Jin Liu, Zhong-Qiu Zhao and Wen-Sheng Zhang
P120	*Impact of Variability in Data on Accuracy and Diversity of Neural Network Based Ensemble Classifiers* [no. 1330] Chien-Yuan Chiu, Brijesh Verma and Michael Li
P121	*Neuronal Mechanisms Underlying Exploration-Exploitation Strategies in Operant Learning* [no. 1403] Sergio Lew, Hernan Rey and Silvano Zanutto

P122 *Correctness and Performance of the SpiNNaker Architecture* [no. 1132]
Thomas Sharp and Steve Furber

P123 *A Highly Accurate, Optical Flow-Based Algorithm for Nonlinear Spatial Normalization of Diffusion Tensor Images* [no. 1331]
Wen Ying, Bradley S. Peterson and Dongrong Xu

P124 *About Analysis and Robust Classification of Searchlight fMRI-Data Using Machine Learning Classifiers* [no. 1509]
Mandy Lange, Marika Kaestner and Thomas Villmann

P125 *Designing Partially Connected, Multilayer Perceptron Neural Nets Through Information Gain* [no. 1242]
Dalia Rodriguez-Salas, Pilar Gomez-Gil and Arturo Olvera-Lopez

P126 *Evolving Flexible Beta Basis Function Neural Tree for Nonlinear Systems* [no. 1575]
Souhir Bouaziz, Adel M. Alimi and Ajith Abraham

P127 *Recurrent Neural Networks Inspired by Artificial Immune Algorithm for Time Series Prediction* [no. 1368]
Dhiya Al-Jumeily, Abir Hussain and Heya Alaskar

P128 *A Procedure for Training Recurrent Networks* [no. 1420]
Manh Phan, Mark Beale and Martin Hagan

P129 *Adaptive Control of Discrete-Time Nonlinear Systems by Recurrent Neural Networks in a Quasi Sliding Mode Regime* [no. 1441]
Ivan Salgado, Cornelio Yanez, Oscar Camacho and Isaac Chairez

P130 *Robust Neural Predictor for Noisy Chaotic Time Series Prediction* [no. 1061]
Min Han and Xinying Wang

P131 *Adaptive Problem Decomposition in Cooperative Coevolution of Elman Recurrent Networks for Time Series Prediction* [no. 1006]
Rohitash Chandra

P132 *Electrical Load Forecasting Using Fast Learning Recurrent Neural Networks* [no. 1569]
Gul Muhammad Khan, Atif Rasheed Khattak, Sahibzada Ali Mahmud and Faheem Khan

P133 *Contradiction Resolution With Explicit and Limited Evaluation and its Application to SOM* [no. 1179]
Ryotaro Kamimura

P134 *Speaker Identification Model for Assamese Language Using a Neural Framework* [no. 1219]
Mousmita Sarma and Kandarpa Kumar Sarma

P135 *Self-Organizing Trees for Visualizing Protein Dataset* [no. 1324]
Nhat-Quang Doan, Hanane Azzag, Mustapha Lebbah and Guillaume Santini

P136 *Neurocomputing and Associative Memories Based on Ovenized Aluminum Nitride Resonators* [no. 1012]
Vehbi Calayir, Tom Jackson, Augusto Tazzoli, Gianluca Piazza and Larry Pileggi

P137 *Detection and Diagnosis of Broken Rotor Bars and Eccentricity Faults in Induction Motors Using the Fuzzy Min-Max Neural Network* [no. 1305]
Harapajan Singh, Manjeevan Seera and Mohd Zaki Abdullah

P138 *Levenberg-Marquardt and Conjugate Gradient Methods Applied to a High Order Neural Network* [no. 1488]
Islam El-Nabarawy, Ashraf Abdelbar and Donald C. Wunsch

P139 *Neural Network Ensemble: Evaluation of Aggregation Algorithms for Electricity Demand Forecasting* [no. 1072]
Saima Hassan, Abbas Khosravi and Jafreezal Jaafar

P140 *A New Fast Learning Algorithm With Promising Global Convergence Capability for Feed-Forward Neural Networks* [no. 1137]
Chi-Chung Cheung, Sin-Chun Ng, Andrew K. Lui and Sean Shensheng Xu

P141 *A Robot On-Line Area Coverage Approach Based on the Probabilistic Lloyd Method* [no. 1446]
Muriilo Batista, Rodrigo Calvo and Roseli Romero

P142 *A Computational Model of Selecting Visual Attention Based on Bottom-Up and Top-Down Feature Combination* [no. 1567]
Wenyong Chen, Furao Shen and Jinxi Zhao

P143 *Recent Advances in Algorithmic Learning Theory of Kanban Cell Neuron Networks* [no. 1535]
Colin James III

P144 *Modeling Disinhibition Within a Layered Structure of the LGMD Neuron* [no. 1419]
Ana Silva and Cristina Santos

P145 *Dysfunctional Neural Activity and Connection Patterns in Attention Deficit Hyperactivity Disorder: A Resting State fMRI Study* [no. 1002]
Wei Wang, Bin Hu, Zhijun Yao, Mike Jackson, Liu Ruiyue and Chuanjiang Liang

P146 *STDP Produces Robust Oscillatory Architectures That Exhibit Precise Collective Synchronization* [no. 1296]
David Bhowmik and Murray Shanahan

P147 *Ensemble of Heterogeneous Classifiers Applied to Lithofacies Classification Using Logs From Different Wells* [no. 1263]
Joacir Oliveira Junior, Eulanda Santos, Reginaldo Carvalho and Leyne Marques

P148 *Impute vs. Ignore: Missing Values for Prediction* [no. 1155]
Qianyu Zhang, Ashfaqur Rahman and Claire D'Este

P149 *CRNN: Integrating Classification Rule Into Neural Network* [no. 1139]
Wei Li, Longbing Cao, Dazhe Zhao, Xia Cui and Jinzhu Yang

P150 *Characterization Measures of Ensemble Systems Using a Meta-Learning Approach* [no. 1224]
Regina Parente, Anne Canuto and Joao C. Xavier-Junior

P151 *A Hybrid Optimization Method for Acceleration of Building Linear Classification Models* [no. 1157]
Junchao Lv, Qiang Wang and Joshua Huang

P152 *Chunk Incremental IDR/QR LDA Learning* [no. 1170]
Yiming Peng, Shaoning Pang, Gang Chen, Hossein Sarrafzadeh, Tao Ban and Daisuke Inoue

P153 *A Soft Label Based Linear Discriminant Analysis for Semi-Supervised Dimensionality Reduction* [no. 1041]
Mingbo Zhao, Zhao Zhang and Haijun Zhang

P154 *Feature Construction Approach for Email Categorization Based on Term Space Partition* [no. 1023]
Guyue Mi, Pengtao Zhang and Ying Tan

P155 *A Parameter-Free Kernel Design Based on Cumulative Distribution Function for Correntropy* [no. 1334]
Jongmin Lee, Pingping Zhu and Jose Principe

P156 *Noise Benefits in Backpropagation and Bidirectional Pre-Training* [no. 1520]
Bart Kosko, Kartik Audhkhasi and Osonde Osoba

P157 *Using Neural Networks Committee Machines to Improve Outcome Prediction Assessment in Nonlinear Regression* [no. 1524]
Elia Matsumoto and Emilio Del-Moral-Hernandez

P158 *Using Genetic Algorithms and Ensemble Systems in Online Cancellable Signature Recognition* [no. 1418]
Fernando Pintro, Anne Canuto and Michael Fairhurst

P159 *Variational Learning of Finite Beta-Liouville Mixture Models Using Component Splitting* [no. 1015]
Wentao Fan and Nizar Bouguila

P160 *Random Brains* [no. 1141]
Ulf Johansson, Tuve Lofstrom and Henrik Bostrom

P161 *Online News Topic Detection and Tracking via Localized Feature Selection* [no. 1050]
Ola Amayri and Nizar Bouguila

P162 *Analysis of the Statistical Texture Features Based on Histogram Quantization Bins for the Image Retrieval in the DCT Domain* [no. 1151]
Fazal Malik and Baharum Baharudin

P163 *Self-Adaptive Probability Estimation for Naive Bayes Classification* [no. 1117]
Jia Wu, Zhihua Cai and Xingquan Zhu

P164 *Non-Parallel Semi-Supervised Classification Based on Kernel Spectral Clustering* [no. 1349]
Siamak Mehrkanoon and Johan Suykens

P165 *MinSVM for Linearly Separable and Imbalanced Datasets* [no. 1603]
Nizar Ajeeb, Ammar Nayal and Mariette Awad

P166 *Incremental Anomaly Identification by Adapted SVM Method* [no. 1225]
Mikhail Suvorov, Sergey Ivliev, Garegin Markarian, Denis Kolev, Dmitry Zvikhachevskiy and Plamen Angelov

P167 *A Local Mixture Based SVM for an Efficient Supervised Binary Classification* [no. 1604]
Yara Rizk, Nicolas Mitri and Mariette Awad

P168 *Fuzzy Entropy Semi-Supervised Support Vector Data Description* [no. 1526]
Trung Le, Dat Tran, Tien Tran, Khanh Nguyen and Wanli Ma

P169 *The Convergence Rate of Linearly Separable SMO* [no. 1369]
Jorge Lopez and Jose Dorronsoro

P170 *A Quasi-Linear SVM Combined With Assembled SMOTE for Imbalanced Data Classification* [no. 1053]
Bo Zhou, Cheng Yang, Haixiang Guo and Jinglu Hu

P171 *Designing Multi-Objective Multi-Armed Bandits Algorithms: A Study* [no. 1547]
Madalina Drugan and Ann Nowe

P172 *Collaborative Multi-View Clustering* [no. 1096]
Mohamad Ghassany, Nistor Grozavu and Younes Bennani

P173 *Discriminative k-Means Clustering* [no. 1066]
Ognjen Arandjelovic

P174 *A Comparative Analysis of Dissimilarity Measures for Clustering Categorical Data* [no. 1365]
Joao C. Xavier-Junior, Anne M.P. Canuto, Noriedson D. Almeida and Luiz M.G. Goncalves

P175 *Learning Vector Quantization With Local Adaptive Weighting for Relevance Determination in Genome-Wide Association Studies* [no. 1553]
Flavia Araujo, Hansenclever Bassani and Aluizio Araujo

P176 *A Dissimilarity-Based Classifier for Generalized Sequences by a Granular Computing Approach* [no. 1391]
Antonello Rizzi, Francesca Possemato, Lorenzo Livi, Azzurra Sebastiani, Alessandro Giuliani and Fabio Massimo Frattale Mascioli

P177 *High-Level Data Classification Based on Network Entropy* [no. 1180]
Filipe Alves Neto and Liang Zhao

P178 *Application of String Kernel Based Support Vector Machine for Malware Packer Identification* [no. 1551]
Tao Ban, Ryouichi Isawa, Shanqing Guo, Daisuke Inoue and Koji Nakao

P179 *Dealing With Highly Imbalanced Textual Data Gathered Into Similar Classes* [no. 1468]
Jean-Charles Lamirel

P180 *Kernel Adaptive Filtering With Confidence Intervals* [no. 1174]
Kan Li, Badong Chen and Jose Principe

P181 *Non-Preemptive Multi-Constrain Scheduling for Multi-Processor With Hopfield Neural Network* [no. 1181]
Abdellatief Ali

P182 *Mitigation of Catastrophic Forgetting in Recurrent Neural Networks Using a Fixed Expansion Layer* [no. 1343]
Robert Coop and Itamar Arel

P183 *Epidemiological Dynamics Modeling by Fusion of Soft Computing Techniques* [no. 1261]
Thi Nguyen, Abbas Khosravi, Douglas Creighton and Saeid Nahavandi

P184 *First Original (1980) Siegel-Rosen-Feynman-Marinov-Smith-Young-Wunderman "Quantum-Computing" in Artificial/Biological Neural-Networks as WRONG-Sign Sigmoid-Function Quantum-Statistical-Mechanics Bose-Einstein Condensation (BEC) "Machine" Forcing "Optimizing"* [no. 1234]
Edward Siegel

Monday, August 5, 8:00PM–9:30PM

Panel Session: Panel on Higher Human Emotions, Chair: Leonid Perlovsky, Room Gold
Organizers: Fernando Fontanari, Stephen Grossberg, Daniel Levine and Leonid Perlovsky
Panelists: Fernando Fontanari, Stephen Grossberg, Daniel Levine, Paul Werbos and Juyang Weng

Tuesday, August 6, 8:00AM–9:10AM

Plenary Talk Tu-Plen2: Plenary Session Chair: Péter Érdi, Room: International Ballroom
8:00AM *Network Models of the Human Brain*
Olaf Sporns (Indiana University)

Tuesday, August 6, 9:30AM–11:30AM

Session Tu1-1: NSF Workshop on Cognitive Science I, Chair: Péter Érdi, Room: Gold

9:20AM	*Introduction* Péter Érdi
9:30AM	*Synthesizing Symbolic and Connectionist Approaches to Cognitive Science* Paul Thagard
10:10AM	*Cognitive Computation* Amir Hussain
10:50AM	*Cognitive Informatics* Vassilis Cutsuridis

Session Tu1-2: Supervised Learning I, Chair: Ricardo Prudêncio, Room: Parisian

9:30AM	*Overcoming the Local-Minimum Problem in Training Multilayer Perceptrons by Gradual Deconvexification* [no. 1150] James Lo, Yichuan Gui and Yun Peng
9:50AM	*Agree to Disagree: Learning Objective Aesthetics Assessment From Subjective Opinions* [no. 1323] Han Xiao
10:10AM	*Robust Human Action Recognition via Long Short-Term Memory* [no. 1182] Alexander Grushin, Derek Monner, James Reggia and Ajay Mishra
10:30AM	*Active Selection of Training Instances for a Random Forest Meta-Learner* [no. 1347] Arthur Sousa, Ricardo Prudencio, Carlos Soares and Teresa Ludermir
10:50AM	*Ordinal-Based Metric Learning for Learning Using Privileged Information* [no. 1532] Shereen Fouad and Peter Tino
11:10AM	*A Pixel-Level, Intensity-Based Nonlinear Autoregressive Classifier (NARX) With Chromatic Exogenous Input for Efficient Image Background Subtraction* [no. 1591] Syed Yusuf, David Brown, Alan Mackinnon and Richard Papanicolaou

Session Tu1-3: German Traffic Sign Detection Competition, Chairs: Sebastian Houben and Johannes Stallkamp, Room: Continental

9:30AM	*Detection of Traffic Signs in Real-World Images: The German Traffic Sign Detection Benchmark* [no. 1288] Sebastian Houben, Johannes Stallkamp, Jan Salmen, Marc Schlipsing and Christian Igel
9:50AM	*A Traffic Sign Detection Pipeline Based on Interest Regions Extraction* [no. 1413] Samuele Salti, Alioscia Petrelli, Federico Tombari, Nicola Fioraio and Luigi Di Stefano
10:10AM	*Traffic Sign Recognition: How Far are We From the Solution?* [no. 1462] Markus Mathias, Radu Timofte, Rodrigo Benenson and Luc Van Gool
10:30AM	*Traffic Sign Detection by ROI Extraction and Histogram Features-Based Recognition* [no. 1483] Ming Liang, Mingyi Yuan, Xiaolin Hu, Jianmin Li and Huaping Liu
10:50AM	*Traffic Sign Detection Based on Convolutional Neural Networks* [no. 1484] Yihui Wu, Yulong Liu, Jianmin Li, Huaping Liu and Xiaolin Hu
11:10AM	*A Robust, Coarse-to-Fine Traffic Sign Detection Method* [no. 1499] Gangyi Wang, Guanghui Ren, Zhilu Wu, Yaqin Zhao and Lihui Jiang

Session Tu1-4: Probabilistic, Bayesian, and Semantic Networks, Chair: José García-Rodríguez, Room: Oak

9:30AM	*Biologically Plausible Feature Reduction Through Relative Correlation* [no. 1447] Patrick Connor and Thomas Trappenberg
9:50AM	*Massively Parallel Learning of Bayesian Networks With MapReduce for Factor Relationship Analysis* [no. 1536] Wei Chen, Tengjiao Wang, Dongqing Yang, Kai Lei and Yueqin Liu

10:10AM	*Active Learning of Causal Bayesian Networks Using Ontologies: A Case Study* [no. 1111] Montassar Ben Messaoud, Philippe Leray and Nahla Ben Amor
10:30AM	*SAXO: An Optimized Data-Driven Symbolic Representation of Time Series* [no. 1051] Alexis Bondu, Marc Boulle and Benoit Grossin
10:50AM	*Effective Utilization of Data in Inductive Conformal Prediction Using Ensembles of Neural Networks* [no. 1328] Tuve Lofstrom, Ulf Johansson and Henrik Bostrom
11:10AM	*Artificial Immune System for Attribute Weighted Naive Bayes Classification* [no. 1116] Jia Wu, Zhihua Cai, Sanyou Zeng and Xingquan Zhu

Session Tu1-5: Feedforward Neural Networks I, Chair: Anne Canuto, Room: International Ballroom

9:30AM	*On the Role of Shape Prototypes in Hierarchical Models of Vision* [no. 1478] Michael Thomure, Melanie Mitchell and Garrett Kenyon
9:50AM	*Solving the Local Minimum and Flat-Spot Problem by Modifying Wrong Outputs for Feed-Forward Neural Networks* [no. 1138] Chi-Chung Cheung, Sin-Chun Ng, Andrew K. Lui and Sean Shensheng Xu
10:10AM	*Partially Affine Invariant Training Using Dense Transform Matrices* [no. 1329] Melvin Robinson and Michael Manry
10:30AM	*Neural Decision Directed Segmentation of Silicon Defects* [no. 1456] Aditi Godbole, Kanishka Tyagi and Michael Manry
10:50AM	*Deja-Vu Object Localization Using IRF Neural Networks Properties* [no. 1217] Philippe Smagghe, Jean-Luc Buessler and Jean-Philippe Urban
11:10AM	*Continuous Neural Identifier for Uncertain Nonlinear Systems With Time Delays in the Input Signal* [no. 1230] Alfaro Mariel, Arguelles Amadeo and Isaac Chairez

Tuesday, August 6, 11:40AM–12:40PM

Session Tu2-1: NSF Workshop on Cognitive Science II (through 1:00PM), Chair: Péter Érdi, Room: Gold

11:40AM	*Cognitive Science and Idea Generation* Simona Doboli
12:20PM	*Cognitive Robotics* Juyang (John) Weng

Session Tu2-2: Robotics II, Chair: Michael E. Lopez-Franco, Room: Parisian

11:40AM	*Robot Coverage Control by Evolved Neuromodulation* [no. 1573] Kyle Harrington, Emmanuel Awa, Sylvain Cussat-Blanc and Jordan Pollack
12:00PM	*Real-Time Decentralized Inverse Optimal Neural Control for a Shrimp Robot* [no. 1434] Michel E. Lopez-Franco, Edgar N. Sanchez, Alma Y. Alanis and Nancy G. Arana-Daniel
12:20PM	*Discrete Time Neural Control of a Nonholonomic Mobile Robot Integrating Stereo Vision Feedback* [no. 1437] Michel E. Lopez-Franco, Edgar N. Sanchez, Alma Y. Alanis and Carlos A. Lopez-Franco

Special Session Tu2-3: From Machine Sensing to Sensorimotor Intelligence, Chair: Agostino Gibaldi, Room: Continental

11:40AM	*Artificial Neural Networks for Spatial Perception: Towards Visual Object Localisation in Humanoid Robots* [no. 1232] Jürgen Leitner, Simon Harding, Mikhail Frank, Alexander Foerster and Jürgen Schmidhuber
12:00PM	*Application of the Visuo-Oculomotor Transformation to Ballistic and Visually Guided Eye Movements* [no. 1396] Marco Antonelli, Angel J. Duran and Angel P. Del Pobil
12:20PM	*Population Coding for a Reward-Modulated Hebbian Learning of Vergence Control* [no. 1372] Agostino Gibaldi, Andrea Canessa, Manuela Chessa, Fabio Solari and Silvio P. Sabatini

Special Session Tu2-4: Computational Intelligence Based Ensemble Classifiers, Chair: Brijesh Verma, Room: Oak

11:40AM	*Cluster Oriented Ensemble Classifiers Using Multi-Objective Evolutionary Algorithm* [no. 1136] Ashfaqur Rahman and Brijesh Verma
12:00PM	*A New Approach to Three Ensemble Neural Network Rule Extraction Using Recursive-Rule eXtraction Algorithm* [no. 1556] Yoichi Hayashi, Ryusuke Sato and Sushmita Mitra
12:20PM	*Using Ensembles for Adaptive Learning: A Comparative Approach* [no. 1422] Tatiana Escovedo, Andre Cruz, Marley Vellasco and Adriano Koshiyama

Tuesday, August 6, 1:40PM–2:40PM

Session Tu3-1: NSF Workshop on Cognitive Science III (through 3:00PM), Chair: Péter Érdi, Room: Gold

1:40PM	*Neurally Inspired Modeling of Cognitive Architectures* Christian Lebiere
2:20 PM	*Cognitive Science and Soft Computation* Barbara Knowlton

Session Tu3-2: Attractor Neural Networks, Chair: Suresh Sundaram, Room: Parisian

1:40PM	*A Computationally Efficient Associative Memory Model of Hippocampus CA3 by Spiking Neurons* [no. 1161] Huajin Tang, Chin Hiong Tan, Eng Yeow Cheu and Jun Hu
2:00PM	*Strong Attractors of Hopfield Neural Networks to Model Attachment Types and Behavioural Patterns* [no. 1394] Abbas Edalat and Federico Mancinelli
2:20PM	*Fully Digital Oscillatory Associative Memories Enabled by Non-Volatile Logic* [no. 1011] Vehbi Calayir and Larry Pileggi

Special Session Tu3-3: Neural Computing for Human Friendly Robot Applications, Chair: Chu Kiong Loo, Room: Continental

1:40PM	*Feature Extraction Based on Hierarchical Growing Neural Gas for Informationally Structured Space* [no. 1467] Yuichiro Toda and Kubota Naoyuki
2:00PM	*Incremental On-line Learning of Human Motion Using Gaussian Adaptive Resonance Hidden Markov Model* [no. 1167] Farhan Davood, Chu Kiong Loo and Wei Hong Chin
2:20PM	*Assistance of Knee Movements Using an Actuated Orthosis Through Subject's Intention Based on MLPNN Approximators* [no. 1431] Saber Mefoued

Session Tu3-4: Attention, Learning, and Memory, Chair: Robert Kozma, Room: Oak

1:40PM	*Neuromorphic Learning Towards Nano Second Precision* [no. 1252] Thomas Pfeil, Anne-Christine Scherzer, Johannes Schemmel and Karlheinz Meier
2:00PM	*Analogical Mapping and Inference With Binary Spatter Codes and Sparse Distributed Memory* [no. 1285] Blerim Emruli, Ross W. Gayler and Fredrik Sandin
2:20PM	*Dynamics of Cortical Neuropil is Gas-Like in Sensation, Liquid-Like in Perception* [no. 1160] Walter J. Freeman, Robert Kozma, Roman Ormandy and Giuseppe Vitiello

Tuesday, August 6, 3:10PM–5:10PM

Session Tu4-1: NSF Workshop on Cognitive Science IV, Chair: Péter Érdi, Room: Gold

3:00PM *Bayesian (Not Necessarily Network) Model of Cognition and Perception*
Gergő Orbán

3:50PM *Cognitive Neurodynamics*
Steven Bressler

4:30PM *Integrating Cognition and Emotion*
Luiz Pessoa

Session Tu4-2: Supervised Learning II, Chair: Anne Canuto, Room: Parisian

3:10PM *Iterative Learning of Fisher Linear Discriminants for Handwritten Digit Recognition* [no. 1281]
Feng Qin and Daqi Gao

3:30PM *Function Learning With Local Linear Regression Models: An Analysis Based on Discrepancy* [no. 1078]
Cristiano Cervellera, Danilo Macciò and Roberto Marcialis

3:50PM *A Hierarchical Method for Traffic Sign Classification With Support Vector Machines* [no. 1056]
Gangyi Wang, Guanghui Ren, Zhilu Wu, Yaqin Zhao and Lihui Jiang

4:10PM *Heteroscedastic Gaussian Based Correction Term for Fisher Discriminant Analysis and Its Kernel Extension* [no. 1188]
Tatsuya Yokota, Toru Wakahara and Yukihiko Yamashita

4:30PM *Training the Feedforward Neural Network Using Unconscious Search* [no. 1043]
Mohammadreza Amin-Naseri, Ehsan Ardjmand and Gary Weckman

4:50PM *Using Confidence Values in Multi-Label Classification Problems With Semi-Supervised Learning* [no. 1300]
Fillipe Rodrigues, Araken Santos and Anne Canuto

Session Tu4-3: Recurrent Neural Networks, Chair: Edgar Sanchez, Room: Continental

3:10PM *A Fast Analogue K-Winners-Take-All Neural Circuit* [no. 1131]
Pavlo Tymoshchuk

3:30PM *Gaussian-Bernoulli Deep Boltzmann Machine* [no. 1046]
Kyunghyun Cho, Tapani Raiko and Alexander Ilin

3:50PM *Convergence of a Neural Network for Sparse Approximation Using the Nonsmooth Lojasiewicz Inequality* [no. 1134]
Aurele Balavoine, Christopher Rozell and Justin Romberg

4:10PM *The Simultaneous Coding of Heading and Path in Primate MSTd* [no. 1019]
Oliver Layton and Andrew Browning

4:30PM *Neurodynamic Optimization Approaches to Robust Pole Assignment Based on Alternative Robustness Measures* [no. 1118]
Xinyi Le and Jun Wang

4:50PM *Recurrent Neural Networks With Fixed Time Convergence for Linear and Quadratic Programming* [no. 1474]
Juan Diego Sanchez-Torres, Edgar Sanchez and Alexander Loukianov

Session Tu4-4: Temporal Data Analysis, Prediction, and Forecasting; Time Series Analysis, Chair: Teresa Ludermir, Room: Oak

3:10PM *A Prior-Free Encode-Decode Change Detection Test to Inspect Datastreams for Concept Drift* [no. 1313]
Cesare Alippi, Li Bu and Dongbin Zhao

3:30PM *Extracting Discriminative Features for Identifying Abnormal Sequences in One-Class Mode* [no. 1084]
Yin Song, Longbing Cao, Junfu Yin and Cheng Wang

3:50PM *Combining Pattern Sequence Similarity With Neural Networks for Forecasting Electricity Demand Time Series* [no. 1276]
Irena Koprinska, Mashud Rana, Alicia Troncoso and Francisco Martinez-Alvarez

4:10PM	*Prediction Intervals for Electricity Load Forecasting Using Neural Networks* [no. 1062] Mashud Rana, Irena Koprinska, Abbas Khosravi and Vassilios Agelidis	
4:30PM	*Forecasting Models of Wind Power in Northeastern Brazil* [no. 1487] Ronaldo Aquino, Teresa Ludermir, Otoni Nobrega Neto, Aida Ferreira, Milde Lira and Manoel Carvalho Jr.	
4:50PM	*Hidden Markov Models With Graph Densities for Action Recognition* [no. 1507] Michael Glodek, Edmondo Trentin, Friedhelm Schwenker and Guenther Palm	

Session Tu4-5: Feedforward Neural Networks II, Chair: Chrisina Jayne, Room: International Ballroom

3:10PM	*Extending Generalized Delta Rules for Efficient Approximate Hessian Evaluations Through Stagewise Backpropagation* [no. 1336] Eiji Mizutani and Stuart Dreyfus
3:30PM	*Restricted Boltzmann Machines for Pre-Training Deep Gaussian Networks* [no. 1387] Mark Eastwood and Chrisina Jayne
3:50PM	*Minimizing Validation Error With Respect to Network Size and Number of Training Epochs* [no. 1385] Rohit Rawat, Jignesh Patel and Michael Manry
4:10PM	*Multi-Scale Pyramidal Pooling Network for Generic Steel Defect Classification* [no. 1191] Jonathan Masci, Ueli Meier, Gabriel Fricout and Jürgen Schmidhuber
4:30PM	*Investigation of Four-Layer Multi-Layer Perceptron With Glia Connections of Hidden-Layer Neurons* [no. 1293] Chihiro Ikuta, Yoko Uwate and Yoshifumi Nishio
4:50PM	*Fast Parking Control of Mobile Robot Based on Multi-Layer Neural Network on Homogeneous Architecture* [no. 1227] Hanen Chenini

Tuesday, August 6, 5:20PM–6:20PM

Session Tu5-1: NSF Workshop on Cognitive Science V (through 6:00 p.m.), Chair: Péter Érdi, Room: Gold

5:10PM	*Cognitive Modeling* Frank Ritter
5:50PM	*Wrap Up* Péter Érdi

Session Tu5-2: Self-Organizing Maps, Chair: Mustapha Lebbah, Room: Parisian

5:20PM	*Meta-Cognitive q-Gaussian RBF Network for Binary Classification: Application to Mild Cognitive Impairment (MCI)* [no. 1282] Sateesh Babu Giduthuri, Suresh Sundaram and Mahanand Belathur Suresh
5:40PM	*Classificability-Regulated Self-Organizing Map Using Restricted RBF* [no. 1189] Pitoyo Hartono and Thomas Trappenberg
6:00PM	*A Scalable and Dynamic Self-Organizing Map for Clustering Large Volumes of Text Data* [no. 1265] Hiran Ganegedara, Sumith Matharage and Damminda Alahakoon

Special Session Tu5-3: Complex-Valued Neural Networks, Chair: Igor Aizenberg, Room: Continental

5:20PM	*A Modified Error-Correction Learning Rule for Multilayer Neural Network With Multi-Valued Neurons* [no. 1098] Igor Aizenberg
5:40PM	*Self-Organizing Maps With a Single Neuron* [no. 1572] George Georgiou and Kerstin Voigt
6:00PM	*Complex-Valued Bidirectional Auto-Associative Memory* [no. 1113] Yozo Suzuki and Masaki Kobayashi

Session Tu5-4: Dynamic Neural Networks & Oscillatory And Chaotic Neural Networks, Chair: Ganesh Kumar Venayagamoorthy, Room: Oak

5:20PM	*Chaotic Complex-Valued Multidirectional Associative Memory With Adaptive Scaling Factor* [no. 1295] Takuya Chino and Yuko Osana
5:40PM	*Investigation of Complex Dynamic in a Recurrent Neural Network With Network Community Structure and Asymmetric Weight Matrix* [no. 1055] Fabiano de Sousa and Liang Zhao
6:00PM	*Capacity Limits in Oscillatory Networks: Implications for Sensory Coding* [no. 1109] A. Ravishankar Rao and Guillermo Cecchi

Tuesday, August 6, 6:30PM–8:00PM

Poster Session Tu-PB: Poster Session B, Chair: Emilio Del Moral Hernandez, Room: Regency Ballroom

P301	*Traffic Sign Detection With VG-RAM Weightless Neural Networks* [no. 1423] Alberto F. De Souza, Cayo Fontana, Filipe Mutz, Tiago Alves de Oliveira, Mariella Berger, Avelino Forechi, Jorcy de Oliveira Neto, Edilson de Aguiar and Claudine Badue
P302	*Handwriting Representation and Recognition Through a Sparse Projection and Low-Rank Recovery Framework* [no. 1166] Zhao Zhang, Cheng-Lin Liu and Mingbo Zhao
P303	*Robust Image Representation and Decomposition by Laplacian Regularized Latent Low-Rank Representation* [no. 1571] Zhao Zhang, Shuicheng Yan and Mingbo Zhao
P304	*The Adaptive Suffix Tree: A Space Efficient Sequence Learning Algorithm* [no. 1184] Upuli Gunasinghe and Damminda Alahakoon
P305	*Acquiring Visual Servoing Reaching and Grasping Skills Using Neural Reinforcement Learning* [no. 1192] Thomas Lampe and Martin Riedmiller
P306	*Stability of Direct Heuristic Dynamic Programming for Nonlinear Tracking Control Using PID Neural Network* [no. 1246] Xiong Luo and Jennie Si
P307	*Neural Network Based Finite Horizon Optimal Control for a Class of Nonlinear Systems With State Delay and Control Constraints* [no. 1563] Xiaofeng Lin, Nuyun Cao and Yuzhang Lin
P308	*Metaclasses and Zoning for Handwritten Document Recognition* [no. 1540] Valmir Macario, Gabriel F.P. Silva, Milena R.P Souza, Cleber Zanchettin and George D.C. Cavalcanti
P309	*Learning Bayesian Network Leveled-Structure from Support Based XML Frequent Itemsets* [no. 1003] Khalid Iqbal, Xu-Cheng Yin, Hong-Wei Hao and Qazi Mudassar Ilyas
P310	*Machine Learning to Predict Extubation Outcome in Premature Infants* [no. 1144] Martina Mueller, Carol Wagner, Romesh Stanislaus and Jonas Almeida
P311	*Extended Scaled Neural Predictor for Improved Branch Prediction* [no. 1125] Zihao Zhou, Mayank Kejriwal and Risto Miikkulainen
P312	*Image Sequence Recognition With Active Learning Using Uncertainty Sampling* [no. 1494] Masatoshi Minakawa, Bisser Raytchev, Toru Tamaki and Kazufumi Kaneda
P313	*Domain Adaptation for Cross-Lingual Query Annotation Using Search Query Logs and Document Classification* [no. 1452] Mohamed Abdel Hady, Rania Ibrahim and Ahmed Ashour
P314	*Finite-Horizon Neural Network-Based Optimal Control Design for Affine Nonlinear Continuous-Time Systems* [no. 1057] Qiming Zhao, Hao Xu, Travis Dierks and Jagannathan Sarangapani
P315	*Sparse Similarity Matrix Learning for Visual Object Retrieval* [no. 1122] Zhicheng Yan and Yizhou Yu
P316	*A Shape Descriptor Based on Symbolic Data Analysis* [no. 1017] Carlos de Almeida, Renata Souza and Ana Candeias

P317 *Quasi-Random Sampling for Approximate Dynamic Programming* [no. 1102]
Cristiano Cervellera, Mauro Gaggero, Danilo Macciò and Roberto Marcialis

P318 *Real-Time Road Surface Mapping Using Stereo Matching, V-Disparity and Machine Learning* [no. 1495]
Vitor Azevedo, Alberto Souza, Lucas Veronese, Claudine Badue and Mariella Berger

P319 *Neuromorphic Adaptations of Restricted Boltzmann Machines and Deep Belief Networks* [no. 1541]
Bruno Umbria Pedroni, Srinjoy Das, Emre Neftci, Kenneth Kreutz-Delgado and Gert Cauwenberghs

P320 *Bio-Inspired Orientation Analysis for Seismic Image* [no. 1018]
Yingwei Yu, Clifford Kelley and Irina Mardanova

P321 *Incorporating Approximate Dynamic Programming-Based Parameter Tuning into PD-type Virtual Inertia Control of DFIGs* [no. 1260]
Wentao Guo, Feng Liu, Jennie Si and Shengwei Mei

P322 *Learning from Local and Global Discriminative Information for Semi-Supervised Dimensionality Reduction* [no. 1107]
Mingbo Zhao, Zhao Zhang and Haijun Zhang

P323 *Design Study of Efficient Digital Order-Based STDP Neuron Implementations for Extracting Temporal Features* [no. 1196]
David Roclin, Olivier Bichler, Christian Gamrat, Simon J. Thorpe and Jacques-Olivier Klein

P324 *Extension of Neuron Machine Neurocomputing Architecture for Spiking Neural Networks* [no. 1381]
Jerry B. Ahn

P325 *Energy Efficient Perceptron Pattern Recognition Using Segmented Memristor Crossbar Arrays* [no. 1383]
Chris Yakopcic and Tarek Taha

P326 *Exploring the Design Space of Specialized Multicore Neural Processors* [no. 1353]
Tarek Taha, Raqibul Hasan, Chris Yakopcic and Mark McLean

P327 *DPLL Based Hardware SOM With A New Winner-Take-All Circuit* [no. 1477]
Hiroomi Hikawa

P328 *A CMOS Neuromorphic Approach to Emulate Neuro-Astrocyte Interactions* [no. 1504]
Yilda Irizarry-Valle, Alice C. Parker and Jonathan Joshi

P329 *Cognitive Computing Building Block: A Versatile and Efficient Digital Neuron Model for Neurosynaptic Cores* [no. 1156]
Andrew Cassidy, Paul Merolla, John Arthur, Steve Esser, Bryan Jackson, Rodrigo Alvarez-Icaza, Pallab Datta, Jun Sawada, Theodore Wong, Vitaly Feldman, Arnon Amir, Daniel Ben-Dayan Rubin, Filipp Akopyan, Emmett McQuinn, William Risk and Dharmendra Modha

P330 *Cognitive Computing Programming Paradigm: A Corelet Language for Composing Networks of Neurosynaptic Cores* [no. 1438]
Arnon Amir, Pallab Datta, William Risk, Andrew Cassidy, Jeffrey Kusnitz, Steve Esser, Alexander Andreopoulos, Theodore Wong, Myron Flickner, Rodrigo Alvarez-Icaza, Emmett McQuinn, Ben Shaw, Norm Pass and Dharmendra Modha

P331 *Development of an Efficient Parameter Estimation Method for the Inference of Vohradsky's Neural Network Models of Genetic Networks* [no. 1059]
Shuhei Kimura, Masanao Sato and Mariko Okada-Hatakeyama

P332 *Early Diagnosis of Heart Disease Using Classification and Regression Trees* [no. 1593]
Amiri Amir Mohammad and Armano Giuliano

P333 *An Incremental Learning Face Recognition System for Single Sample Per Person* [no. 1198]
Tao Zhu, Furao Shen and Jinxi Zhao

P334 *Automatic Text Categorization by a Granular Computing Approach: Facing Unbalanced Data Sets* [no. 1406]
Francesca Possemato and Antonello Rizzi

P335 *Towards Predicting Persistent Activity of Neurons by Statistical and Fractal Dimension-Based Features* [no. 1203]
Panagiotis Petrantonakis, Athanasia Papoutsi and Panayiota Poirazi

P336 *Visual Classification of Marine Organisms in Underwater Images Using CQ-HMAX Biologically Inspired Color Approach* [no. 1530]
Sepehr Jalali, Paul Seekings, Cheston Tan, Hazel Tan, Joo-Hwee Lim and Elizabeth Taylor

P337 *Geometrical Facial Modeling for Emotion Recognition* [no. 1401]
Giampaolo L. Libralon and Roseli A.F. Romero

P338 *Genetic Algorithm for Seismic Velocity Picking* [no. 1346]
Kou-Yuan Huang, Kai-Ju Chen and Jia-Rong Yang

P339 *Exploring Mineral Domains With Genetic Algorithm* [no. 1044]
Ashfaqur Rahman, Ritaban Dutta and Daniel Smith

P340 *Noisy Hidden Markov Models for Speech Recognition* [no. 1470]
Bart Kosko, Kartik Audhkhasi and Osonde Osoba

P341 *Robust Feedback Passivity via Dynamic Neural Networks* [no. 1354]
Panuncio Cruz Francisco, Wen Yu and Xiaoou Li

P342 *Subcutaneous Neural Inverse Optimal Control for an Artificial Pancreas* [no. 1373]
Blanca S. Leon, Alma Y. Alanis, Edgar N. Sanchez, Fernando Ornelas-Tellez and Eduardo Ruiz-Velasquez

P343 *Deep Searching for Parameter Estimation of the Linear Time Invariant (LTI) System by Using Quasi-ARX Neural Network* [no. 1124]
Mohammad Abu Jami'in, Imam Sutrisno and Jinglu Hu

P344 *Neural Inverse Optimal Control for a Linear Induction Motor* [no. 1364]
Victor G. Lopez, Edgar N. Sanchez and Alma Y. Alanis

P345 *Face Recognition Improvement With Distortions of Images in Training Set* [no. 1249]
Ernst Kussul, Tatiana Baidyk, Cristina Conde, Isaac Martin de Diego and Enrique Cabello

P346 *Face Recognition Using Voting Technique for the Gabor and LDP Features* [no. 1032]
Issam Dagher, Jamal Hassanieh and Ahmad Younes

P347 *Illumination-Invariant Face Recognition From a Single Image Across Extreme Pose Using a Dual Dimension AAM Ensemble in the Thermal Infrared Spectrum* [no. 1038]
Reza Shoja Ghiass, Ognjen Arandjelovic, Abdelhakim Bendada and Xavier Maldague

P348 *Infrared Face Recognition: A Literature Review* [no. 1001]
Reza Shoja Ghiass, Ognjen Arandjelovic, Abdelhakim Bendada and Xavier Maldague

P349 *NeuroEvolutionary Meta-Optimization* [no. 1149]
Andreas Lang and Kenneth Stanley

P350 *Robust Controller Design of Continuous-Time Nonlinear System Using Neural Network* [no. 1375]
Xiangnan Zhong, Haibo He and Danil Prokhorov

P351 *Object Recognition in a Context-Aware Application* [no. 1309]
Tan Vo, Dat Tran and Wanli Ma

P352 *HMeanMax: Placing HMAX and HoG Into a Unified Framework* [no. 1047]
Yan Zhang, Qixia Jiang and Maosong Sun

P353 *Can N-Dimensional Convolutional Neural Networks Distinguish Men And Women Better Than Humans Do?* [no. 1379]
Iveta Mrazova, Josef Pihera and Jana Veleminska

P354 *A Telecommunications Call Volume Forecasting System Based on a Recurrent Fuzzy Neural Network* [no. 1026]
Paris Mastorocostas, Costas Hilas, Dimitris Varsamis and Stergiani Dova

P355 *A Neural Network Model of the Impact of Political Instability on Tourism* [no. 1240]
Christo Panchev and Antonis Theocharous

P356 *Neural Equalizer Trained by the Artificial Immune System Learning Algorithm* [no. 1537]
Pedro Gouvea Coelho and Luiz Biondi Neto

P357 *Optimizing F-Measure With Non-Convex Loss and Sparse Linear Classifiers* [no. 1120]
Punya Murthy Chinta, Balamurugan Palaniappan, Shirish Shevade and M. Narasimha Murty

P358 *A Framework for Content-Based Retrieval of EEG With Applications to Neuroscience and Beyond* [no. 1233]
Kyungmin Su and Kay Robbins

P359 *Extreme Learning Machine Combining Matrix Factorization for Collaborative Filtering* [no. 1345]
Tianfeng Shang, Qing He, Fuzhen Zhuang and Zhongzhi Shi

P360 *Cellular Neural Network Based Situational Awareness System for Power Grids* [no. 1525]
Karthikeyan Balasubramaniam, Ganesh Kumar Venayagamoorthy and Neville Watson

P361 *Phase Response Curves Explain How Multiplicative Feedback on Neural Phase Elements Differs From Adaptive Physical Feedback in Robotic Motion Controls* [no. 1493]
Kazuki Nakada, Keiji Miura and Hiroaki Wagatsuma

P362 *Object Recognition and Tracking in a Context-Aware Application* [no. 1068]
Tan Vo and Dat Tran

P363 *Learning to Discriminate With Generative Features* [no. 1209]
Bonny Banerjee, Jayanta Dutta and Juan Gu

P364 *Using Random Index Vectors for Semantic Equivalence of Text Using WordNet* [no. 1185]
Rosemary D. Paradis, John Moulton, Jinhong Katherine Guo and Pentti Kanerva

P365 *Simple Dynamic Binary Neural Networks With Sparse Connection* [no. 1194]
Jungo Moriyasu, Ryota Kouzuki and Toshimichi Saito

P366 *Estimation the Next Period of Super Atlantic Hurricanes Using Neural Network* [no. 1326]
Victor Manuel Velasco Herrera

P367 *Improved Separability in Motor Cortical Neural Representation Through Learning of a Directional Control Task* [no. 1492]
Hongwei Mao and Jennie Si

P368 *Learning Complex Cell Receptive Field Properties by Explaining Simple Cell Responses Over Time* [no. 1211]
Jayanta Dutta and Bonny Banerjee

P369 *Mining Transformation-Invariances of Deep Belief Networks by Transformed Weights Training* [no. 1212]
Zheng Shou, Hengjin Cai and Yuhao Zhang

P371 *Ensemble Rainfall-Recharge Model With a Recurrent Neural Network to Improve the Rainfall Recharge Estimation in the Canterbury Plains, New Zealand* [no. 1064]
Kun Guo, Yoon-Seok Hong, Rao Bhamidimarri and Daqing Chen

P372 *A Novel Supervised Feature Extraction and Classification Framework for Land Cover Recognition of the Off-Land Scenario* [no. 1251]
Yan Cui

P373 *Volumetric Visualization Technique for Brain Imaging Data* [no. 1409]
James Ryland

P374 *Stego-Cryptography Using Chaotic Neural Network* [no. 1320]
Haripriya Rout and Nilamadhab Dash

P375 *Seam Carved Image Detection by Hopfield Networks* [no. 1274]
Jyh-Da Wei, Che-Wen Chang and Hui-Jun Cheng

P376 *Data Mining by Hybridation Genetic Algorithms-Neural Networks* [no. 1426]
Djamila Benhaddouche and Radia Benhaddouche

P377 *What a Dynamical Connectome Informs Us About Large-Scale Neural Circuits and Whole-Brain Activity* [no. 1366]
Xerxes Arsiwalla, Alberto Betella, Enrique Martinez, Pedro Omedas, Ricardo Zucca and Paul Verschure

P378 *Energy Normalization in Population Coding: From Theory to Practice* [no. 1362]
Agostino Gibaldi, Andrea Canessa, Manuela Chessa, Fabio Solari and Silvio P. Sabatini

P379 *V'Ger: Virtual Generalizing Random Access Memory Weightless Neural Network Computer* [no. 1464]
Alberto De Souza

P380 *Neuromorphic Adaptations of Restricted Boltzmann Machines (RBMs) and Deep Belief Networks (DBNs)* [no. 1432]
Srinjoy Das, Emre Neftci, Bruno Umbria Pedroni, Kenneth Kreutz-Delgado and Gert Cauwenberghs

P381 *Resting State and Task-Related Network Analysis Using Multi-Channel EEG to Assess Brain Functional Connectivity in Chronic Stroke Patients* [no. 1266]
Ozell Sanders, Ron Goodman, Brian Jung, Jeremy Rietschel and Jason Diaz

P382 *Nested Mutualism of Brain Information Processing Networks* [no. 1359]
Derek Harter

P383 *Object Selection and Search via a Brain Machine Interface in a Co-Robotic Assistant* [no. 1489]
Varsha Shankar, Lena Sherbakov, Byron Galbraith, Aisha Sohail, Gennady Livitz, Anatoli Gorchetchnikov, Heather Ames, Frank Guenther and Massimiliano Versace

P384 *Audio Features as Marker of Autism Spectrum Disorders in Children* [no. 1206]
Bonny Banerjee, Andrew Papanicolaou, Shanshan Gao and Frances Tylavsky

P385 *A Temporal Reinforcement Framework for Classical Direct/Indirect Pathway Basal Ganglia Models* [no. 1178]
Kyle Donowho and Richard Golden

P386 *Radial Wavelet Neural Network for Heart Murmur Classifying* [no. 1267]
Juan Guillermo Castro, Edgar Sanchez Camperos and Luis Ricalde Castellanos

P387 *Model of Cortical Cell Processing to Estimate Binocular Disparity* [no. 1322]
Christophe Maggia, Nathalie Guyader and Anne Guerin-Dugue

P388 *Real-Time Discrete Neural Identifier for a Linear Induction Motor Using a dSPACE DS1104 Board* [no. 1119]
Jorge D. Rios, Alma Y. Alanis, Jorge Rivera and Miguel Hernandez-Gonzalez

P389 *Dam Seepage Analysis Based on Artificial Neural Networks: The Hysteresis Phenomenon* [no. 1568]
David Santillan Sanchez, Jesus Fraile Ardanuy and Miguel Angel Toledo Municio

P390 *Empirical Modeling of Vehicle Fuel Economy Based on Historical Data* [no. 1238]
Dimitry Slavin, Mahmoud Abou-Nasr, Dimitar Filev and Ilya Kolmanovsky

P391 *Constructing Mobile-Oriented Catalog in m-Commerce Using LDA-Based Self-Adaptive Genetic Algorithm* [no. 1315]
Hung-Min Hsu, Ray-I Chang and Jan-Ming Ho

P392 *N2Sky - Neural Networks as Services in the Clouds* [no. 1173]
Erich Schikuta and Erwin Mann

P393 *Intelligent Determination for Readmission of Postoperative Patients in Ambulatory Surgery* [no. 1245]
Jilliam Maria Diaz Barros and Jairo Alberto Cardona Pena

P394 *A Novel Method For Training and Classification of Ballistic and Quasi-Ballistic Missiles in Real-Time* [no. 1546]
Upendra Kumar Singh, Vineet Padmanabhan and Arun Agarwal

P395 *Fast Diagnosing of Pediatric Respiratory Diseases by Using High Speed Neural Networks* [no. 1239]
Hazem El-Bakry and Mohamed Hamada

P396 *Detection and Identification of Seismic P-Waves Using Artificial Neural Networks* [no. 1448]
Komalpreet Kaur, Manish Wadhwa and Eun Park

P397 *A Two-Step Convolutional Neural Network Approach for Semantic Role Labeling* [no. 1159]
Erick Fonseca and Joao Luis Rosa

P398 *Intelligent Speed Profile Prediction on Urban Traffic Networks With Machine Learning* [no. 1558]
Jungme Park, Yi L. Murphey, Johannes Kristinsson, Ryan McGee, Ming Kuang and Tony Phillips

P399 *Multi-Circle Detection for Bladder Cancer Diagnosis Based on Artificial Immune System*s [no. 1480]
Dingran Lu and Xiao-Hua Yu

P400 *Parallel Incremental SVM for Classifying Million Images With Very High-Dimensional Signatures Into Thousand Classes* [no. 1152]
Doan Thanh-Nghi, Do Thanh-Nghi and Francois Poulet

P401 *Real-Time Detection of Young Spruce Using Color and Texture Features on an Autonomous Forest Machine* [no. 1400]
Heikki Hyyti, Jouko Kalmari and Arto Visala

P402 *Off-Line Bangla Signature Verification: An Empirical Study* [no. 1527]
Pal Srikanta, Alaei Alireza, Pal Umapada and Michael Blumenstein

P403 *Nested-Loop Neural Network Vector Control of Permanent Magnet Synchronous Motors* [no. 1097]
Shuhui Li, Michael Fairbank, Xingang Fu, Donald C. Wunsch and Eduardo Alonso

P404 *Applying a Neural Network for Robust Fault Location in a Distribution System With Distributed Generation* [no. 1004]
Oureste Batista, Rogerio Flauzino, Lucas de Moraes, Marcel de Araujo and Ivan da Silva

P405 *Authenticated Key Exchange Protocol Using Neural Cryptography With Secret Boundaries* [no. 1014]
Ahmed Allam, Hazem Abbas and Watheq Elkharashi

P406 *Protein Secondary Structure Prediction Using a Fully Complex-Valued Relaxation Network* [no. 1312]
Shamima Banu, Savitha Ramasamy, Suresh Sundaram and Saraswathi Saras

P407	*On Processing Three Dimensional Data by Quaternionic Neural Networks* [no. 1275] Noriyuki Muramoto, Teijiro Isokawa, Haruhiko Nishimura and Nobuyuki Matsui
P408	*Modified Learning for Discrete Multi-Valued Neuron* [no. 1286] Jin-Ping Chen, Shin-Fu Wu and Shie-Jue Lee
P409	*3D Gesture Recognition With Growing Neural Gas* [no. 1104] Jose Antonio Serra-Perez, José García-Rodríguez, Sergio Orts-Escolano, Juan Manuel Garcia-Chamizo, Anastassia Angelopoulou, Alexandra Psarrou, Markos Mentzelopoulos, Javier Montoyo-Bojo and Andrew Lewis
P410	*Variational Bayesian Tracking: Whole Track Convergence for Large Scale Ecological Video Monitoring* [no. 1430] Jacqueline Christmas, Richard Everson, Rolando Rodriguez-Munoz and Tom Tregenza
P411	*A Management Framework for Device-Free Localization* [no. 1327] Huseyin Yigitler, Ossi Kaltiokallio and Riku Jantti
P412	*Multi-Valued Neuron With New Learning Schemes* [no. 1273] Shin-Fu Wu and Shie-Jue Lee
P413	*Neural-PSO Second Order Sliding Mode Controller for Unknown Discrete-Time Nonlinear Systems* [no. 1404] Alma Y. Alanis, Nancy Arana-Daniel and Carlos Lopez-Franco
P414	*Backpropagation Learning Method With Interval Type-2 Fuzzy Weights in Neural Networks* [no. 1402] Fernando Gaxiola, Patricia Melin, Fevrier Valdez and Oscar Castillo
P415	*Adaptive Learning in Motion Analysis With Self-Organising Maps* [no. 1248] Anastassia Angelopoulou, José García-Rodríguez, Alexandra Psarrou, Gaurav Gupta and Markos Mentzelopoulos
P416	*Analog System Modeling Based on a Double Modified Complex Valued Neural Network* [no. 1121] Antonio Luchetta, Stefano Manetti and Maria Cristina Piccirilli
P417	*A Lyapunov Based Stable Online Learning Algorithm For Nonlinear Dynamical Systems Using Extreme Learning Machines* [no. 1443] Vijay Manikandan Janakiraman, XuanLong Nguyen and Dennis Assanis
P418	*Structural Information Processing in Early Vision Using Hebbian-Based Mean Shift* [no. 1523] Jiqian Liu, Caixia Zhang and Yunde Jia
P419	*Pose Estimation for Vertebral Mobility Analysis Using eXclusive-ICA Based Boosting (XICABoost) Algorithm* [no. 1199] Chao-Hui Huang
P420	*A Spiking Neural Network for Financial Prediction* [no. 1243] David Reid, Abir Hussain and Hissam Tawfik
P421	*Diffusion Least-Mean Squares Over Adaptive Networks With Dynamic Topologies* [no. 1451] Bilal Fadlallah and Jose Principe
P422	*Adaptive Controller for PMSG Wind Turbine Systems With Back-To-Back PWM Converters* [no. 1533] Omar Aguilar, Ruben Tapia, Juan M. Ramirez and Antonio Valderrabano

Tuesday, August 6, 8:00PM–9:30PM

Panel Session: Panel on Teaching Cognitive Science and Computational Intelligence, Chairs: Péter Érdi & Robert Kozma, Room Gold

Panelists: Cesare Alippi, Simona Doboli, Péter Érdi, Haibo He, Robert Kozma, Marios Polycarpou, Frank Ritter, Paul Thagard and Juyang (John) Weng

Wednesday, August 7, 8:00AM–9:10AM

Plenary Talk We-Plen3: Plenary Session Chair: Daniel Levine, Room: International Ballroom

8:00AM	*Behavioral Economics and Neuroeconomics: Cooperation, Competition, Preference, and Risky Decision Making* Stephen Grossberg, Boston University

Wednesday, August 7, 9:30AM–11:30AM

Session We1-1: Unsupervised Learning and Clustering (Including PCA and ICA) I, Chair: Chao-Hui Huang, Room: Gold

9:30AM	*Stereo Where-What Networks: Unsupervised Binocular Feature Learning* [no. 1440] Mojtaba Solgi and Juyang Weng
9:50AM	*A Topographical Nonnegative Matrix Factorization Algorithm* [no. 1244] Nicoleta Rogovschi, Lazhar Labiod and Mohamed Nadif
10:10AM	*Soft Kernel Spectral Clustering* [no. 1319] Rocco Langone, Raghvendra Mall and Johan Suykens
10:30AM	*Brain-Inspired Self-Organizing Model for Incremental Learning* [no. 1042] Kasun Gunawardana, Jayantha Rajapakse and Damminda Alahakoon
10:50AM	*Interval Data Clustering Using Self-Organizing Maps Based on Adaptive Mahalanobis Distances* [no. 1222] Chantal Hajjar and Hani Hamdan
11:10AM	*Coupled Term-Term Relation Analysis for Document Clustering* [no. 1040] Xin Cheng, Duoqian Miao, Can Wang and Longbing Cao

Session We1-2: Pattern Recognition and Feature Selection, Chair: Dave Casasent, Room: Parisian

9:30AM	*Dissimilarity Space Embedding of Labeled Graphs by a Clustering-Based Compression Procedure* [no. 1216] Lorenzo Livi, Filippo Maria Bianchi, Antonello Rizzi and Alireza Sadeghian
9:50AM	*Generic Object Recognition With Local Features: From Bags to Subspaces* [no. 1127] Bisser Raytchev, Yuta Kikutsugi, Ryosuke Shigenaka, Toru Tamaki and Kazufumi Kaneda
10:10AM	*Matching of Time-Varying Labeled Graph*s [no. 1175] Filippo Maria Bianchi, Lorenzo Livi and Antonello Rizzi
10:30AM	*Maximal Margin Learning Vector Quantisation* [no. 1297] Trung Le, Dat Tran, Van Nguyen and Wanli Ma
10:50AM	*Toward a Causal Topic Model for Video Scene Analysis* [no. 1115] John McCaffery and Anthony Maida
11:10AM	*Extraction of 2D-Pattern Signatures for Protein Folds* [no. 1479] Suvarna Vani Koneru and Durga Bhavani Surampudi

Special Session We1-3: Active Learning and Experimental Design (ALED), Chair: Vincent Lemaire, Room: Continental

9:30AM	*Active Learning in Nonstationary Environments* [no. 1482] Robert Capo, Karl Dyer and Robi Polikar
9:50AM	*Incremental Decision Tree Based on Order Statistics* [no. 1027] Christophe Salperwyck and Vincent Lemaire
10:10AM	*Active Learning in the Real-World: Design and Analysis of the Nomao Challenge* [no. 1028] Laurent Candillier and Vincent Lemaire
10:30AM	*Improving Drug Discovery Using a Neural Networks Based Parallel Scoring Functions* [no. 1307] Horacio Perez-Sanchez, Gines D. Guerrero, Jose M. Garcia, Jorge Pena, Jose M. Cecilia, Gaspar Cano, Sergio Orts-Escolano and José García-Rodríguez
10:50AM	*Active Testing for SVM Parameter Selection* [no. 1145] Péricles Miranda and Ricardo Prudencio
11:10AM	*Unsupervised Collaborative Boosting of Clustering: A Unifying Framework for Multi-View Clustering, Multiple Consensus Clusterings and Alternative Clustering* [no. 1302] Jacques-Henri Sublemontier

Session We1-4: Support Vector Machines and EM Algorithms I, Chair: Jose Principe, Room: Oak

9:30AM	*Multidimensional Splines With Infinite Number of Knots as SVM Kernels* [no. 1444] Rauf Izmailov, Vapnik Vladimir and Vashist Akshay

9:50AM	*Improving Multi-Label Classification Performance by Label Constraints* [no. 1075] Benhui Chen, Xuefen Hong, Lihua Duan and Jinglu Hu
10:10AM	*Kernel-Based Distance Metric Learning in the Output Space* [no. 1176] Cong Li, Michael Georgiopoulos and Georgios Anagnostopoulos
10:30AM	*Speaker Recognition Based on SOINN and Incremental Learning Gaussian Mixture Model* [no. 1590] Tang Zelin, Shen Furao and Zhao Jinxi
10:50AM	*Fixed-Size Pegasos for Hinge and Pinball Loss SVM* [no. 1148] Jumutc Vilen, Huang Xiaolin and Johan Suykens
11:10AM	*Analysis on Extended Kernel Recursive Least Squares Algorithm* [no. 1158] Pingping Zhu and Jose Principe

Wednesday, August 7, 11:40AM–12:40PM

Special Session We2-1: Neurocomputational Models of Thought and Creativity, Chair: Ali Minai, Room: Gold

11:40AM	*Thinking in Prose and Poetry: A Semantic Neural Model* [no. 1557] Sarjoun Doumit, Nagendra Marupaka and Ali Minai
12:00PM	*Toward a Neural Network Theory of Emotional Influences on Creativity* [no. 1491] Daniel Levine and Mihai Nadin
12:20PM	*Towards a Unified Neurobiological Theory of Creative Problem Solving* [no. 1094] Sebastien Helie

Session We2-2: Crossdisciplinary Topics I, Chair: Danil Prokhorov, Room: Parisian

11:40AM	*Optimized Neuro Genetic Fast Estimator (ONGFE) for Efficient Distributed Intelligence Instantiation Within Embedded Systems* [no. 1257] Francisco J. Maldonado, Stephen Oonk and Tasso Politopoulos
12:00PM	*A Fuzzy Technique to Control Congestion in WSN* [no. 1595] Sara Ghanavati, Jemal Abawajy and Davood Izadi
12:20PM	*SOMMA: Cortically Inspired Paradigms for Multimodal Processing* [no. 1358] Mathieu Lefort, Yann Boniface and Bernard Girau

Special Session We2-3: Financial Forecasting, Chair: Sven F. Crone, Room: Continental

11:40AM	*A Hybrid Forecasting Approach Using ARIMA Models and Self-Organising Fuzzy Neural Networks for Capital Markets* [no. 1318] Scott McDonald, Sonya Coleman, T.M. McGinnity and Yuhua Li
12:00PM	*Coupled Market Behavior Based Financial Crisis Detection* [no. 1085] Wei Cao, Longbing Cao and Yin Song
12:20PM	*A Comparative Study on Forecasting Polyester Chips Prices for 15 Days, Using Different Hybrid Intelligent System* [no. 1241] Mojtaba Sedigh Fazli and Jean-Fabrice Lebraty

Session We2-4: Special Neural Networks (Fuzzy, Modular, Reservoir, Large-Scale), Chair: Edgar Sanchez, Room: Oak

11:40AM	*Neural Hopfield-Ensemble for Multi-Class Head Pose Detection* [no. 1361] Nils Meins, Sven Magg and Stefan Wermter
12:00PM	*The Added Value of Gating in Evolved Neurocontrollers* [no. 1054] Timur Chabuk and James Reggia
12:20PM	*Dynamic Learning Algorithm of Multi-Layer Perceptron for Letter Recognition* [no. 1076] Feng Qin and Daqi Gao

Wednesday, August 7, 1:40PM–2:40PM

Special Session We3-1: Neurocomputational Models of Thought and Creativity II, Chair: Ali Minai, Room: Gold

1:40PM	*Modeling the Effect of Hint Timing on the Idea Generation Process* [no. 1549] Simona Doboli, Matthew Jacques, Ali Minai, Paul Paulus, Runa Korde and Alex Doboli
2:00PM	*Dual-Process Architecture for Reasoning in Design Innovation Problems* [no. 1508] Alex Doboli and Simona Doboli
2:20PM	*Panel Discussion of Models of Thought and Creativity* [no. 1607] Ali Minai and Simona Doboli

Session We3-2: Other Topics in Learning Machines I, Chair: Cristiano Cervellera, Room: Parisian

1:40PM	*DNA—A Differential Nonlinear Approach* [no. 1588] Dino Raymundo Enriquez Fuentes
2:00PM	*Some Results About the Vapnik-Chervonenkis Entropy and the Rademacher Complexity* [no. 1283] Davide Anguita, Alessandro Ghio, Luca Oneto and Sandro Ridella
2:20PM	*A Dynamical Model for Community Detection in Complex Networks* [no. 1427] Marcos Quiles, Ezequiel Zorzal and Elbert Macau

Session We3-3: Spiking Neural Networks I, Chair: Sebastien Helie, Room: Continental

1:40PM	*Emergent Properties of Divergent and Convergent Harmonic Connectivity in the Auditory System* [no. 1086] Marcos Cantu
2:00PM	*GPU Facilitated Unsupervised Visual Feature Acquisition in Spiking Neural Networks* [no. 1083] Blake Lemoine and Anthony Maida
2:20PM	*A Basis Coupled Evolving Spiking Neural Network With Afferent Input Neurons* [no. 1278] Shirin Dora, Savitha Ramasamy and Suresh Sundaram

Session We3-4: Visual, Auditory, and Other Sensory Systems II, Chair: Igor Aizenberg, Room: Oak

1:40PM	*A Spiking Thalamus Model for Form and Motion Processing of Images* [no. 1253] Suhas Chelian and Narayan Srinivasa
2:00PM	*A Biologically Inspired Recurrent Neural Network for Sound Source Recognition Incorporating Auditory Attention* [no. 1301] Michiel Boes, Damiano Oldoni, Bert De Coensel and Dick Botteldooren
2:20PM	*Multi-Sensory Integration Using Sparse Spatio-Temporal Encoding* [no. 1110] A. Ravishankar Rao and Guillermo Cecchi

Wednesday, August 7, 3:10PM–5:10PM

Session We4-1: Unsupervised Learning and Clustering (Including PCA and ICA) II, Chair: Donald C. Wunsch, Room: Gold

3:10PM	*A Fast Proximal Method for Convolutional Sparse Coding* [no. 1415] Rakesh Chalasani, Jose Principe and Naveen Ramakrishnan
3:30PM	*A New Bi-Clustering Approach Using Topological Maps* [no. 1077] Amine Chaibi, Mustapha Lebbah and Hanane Azzag
3:50PM	*Non-Negative Sparse Coding for Motion Extraction* [no. 1291] Thomas Guthier, Volker Willert, Andrea Schnall, Karel Kreuter and Julian Eggert
4:10PM	*Vigilance Adaptation in Adaptive Resonance Theory* [no. 1439] Lei Meng, Ah-Hwee Tan and Donald C. Wunsch
4:30PM	*Spectral Clustering for Dynamic Data Using Multiple Kernel Learning* [no. 1476] Diego Peluffo-Ordonez, Sergio Garcia-Vega, Rocco Langone, Johan Suykens and German Castellanos-Dominguez

4:50PM	*Robust Non-Negative Matrix Factorization via Joint Sparse and Graph Regularization* [no. 1270] Shizhun Yang, Chenping Hou, Changshui Zhang, Yi Wu and Shifeng Weng

Session We4-2: Other Topics in Learning Machines II, Chair: Cristiano Cervellera, Room: Parisian

3:10PM	*Learning in Deep Architectures With Folding Transformations* [no. 1095] Lech Szymanski and Brendan McCane
3:30PM	*Transfer Learning Based Compressive Tracking* [no. 1171] Shu Tian, Xu-Cheng Yin, Xi Xu and Hong-Wei Hao
3:50PM	*Preprocessing Unbalanced Data Using Weighted Support Vector Machines for Prediction of Heart Disease in Children* [no. 1442] Thiago Tavares, Adriano Oliveira, George Cabral, Sandra Mattos and Renata Grigorio
4:10PM	*Detecting and Labeling Representative Nodes for Network-Based Semi-Supervised Learning* [no. 1350] Bilza Araujo and Liang Zhao
4:30PM	*Active Semi-Supervised Learning Using Particle Competition and Cooperation in Networks* [no. 1262] Fabricio Breve
4:50PM	*A Root Location Training Method for Polynomial Cellular Neural Networks that Implements Totalistic Cellular Automata* [no. 1562] Antonio Arista-Jalife and Eduardo Gomez-Ramirez

Session We4-3: Spiking Neural Networks II, Chair: Sebastien Helie, Room: Continental

3:10PM	*A Novel Reservoir Network of Asynchronous Cellular Automaton based Neurons for MIMO Neural System Reproduction* [no. 1585] Takashi Matsubara and Hiroyuki Torikai
3:30PM	*Power Analysis of Large-Scale, Real-Time Neural Networks on SpiNNaker* [no. 1455] Evangelos Stromatias, Francesco Galluppi, Cameron Patterson and Steve Furber
3:50PM	*Morphological Learning: Increased Memory Capacity of Neuromorphic Systems With Binary Synapses Exploiting AER Based Reconfiguration* [no. 1220] Shaista Hussain, Roshan Gopalakrishnan, Arindam Basu and Shih-Chii Liu
4:10PM	*A Spiking Neural Network for Illuminant-Invariant Colour Discrimination* [no. 1099] Sivalogeswaran Ratnasingam and Antonio Robles-Kelly
4:30PM	*New Spiking Neuron Model* [no. 1065] Chandra Bala and Kv Naresh Babu
4:50PM	*Modeling Populations of Spiking Neurons for Fine Timing Sound Localization* [no. 1460] Qian Liu, Cameron Patterson, Steve Furber, Zhangqin Huang, Yibin Hou and Huibing Zhang

Session We4-4: Support Vector Machines and EM Algorithms II, Chair: Jose Principe, Room: Oak

3:10PM	*Survival Kernel With Application to Kernel Adaptive Filtering* [no. 1080] Badong Chen, Nanning Zheng and Jose Principe
3:30PM	*Mixture Kernel Least Mean Square* [no. 1561] Rosha Pokharel, Sohan Seth and Jose Principe
3:50PM	*A Support Vector Machine Classifier From a Bit-Constrained, Sparse and Localized Hypothesis Space* [no. 1284] Davide Anguita, Alessandro Ghio, Luca Oneto and Sandro Ridella
4:10PM	*SVM Classification of Epileptic EEG Recordings Through Multiscale Permutation Entropy* [no. 1529] Domenico Labate, Isabella Palamara, Nadia Mammone, Giuseppe Morabito, Fabio La Foresta and Francesco Carlo Morabito
4:30PM	*Rejection Based Support Vector Machines for Financial Time Series Forecasting* [no. 1024] Yasin Ivan Rosowsky and Robert Elliott Smith
4:50PM	*Closed-Form Projection Operator Wavelet Kernels in Support Vector Learning for Nonlinear Dynamical Systems Identification* [no. 1566] Zhao Lu and Wen Yan

Wednesday, August 7, 5:20PM–6:20PM

Session We5-1: Dynamical Models of Spiking Neurons, Chair: Emilio Del Moral Hernandez, Room: Gold

5:20PM	*Analysis of Various Transient Phenomena and Co-existing Periodic Spike-Trains in Simple Digital Spike Maps* [no. 1304] Narutoshi Horimoto and Toshimichi Saito
5:40PM	*Neural Spiking Dynamics in Asynchronous Digital Circuits* [no. 1228] Nabil Imam, Kyle Wecker, Jonathan Tse, Rob Karmazin and Rajit Manohar
6:00PM	*Bifurcation Phenomena of Simple Pulse-Coupled Spiking Neuron Models With Filtered Base Signal* [no. 1142] Shota Kirikawa and Toshimichi Saito

Session We5-2: Bioinformatics, Chair: Aluizio Araújo, Room: Parisian

5:20PM	*A Neural Network Based Algorithm for Gene Expression Prediction From Chromatin Structure* [no. 1360] Marco Frasca and Giulio Pavesi
5:40PM	*Predicting Nerve Guidance Conduit Performance for Peripheral Nerve Regeneration Using Bootstrap Aggregated Neural Networks* [no. 1433] William Koch, Yan Meng, Munish Shah, Wei Chang and Xiaojun Yu
6:00PM	*Artificial Neural Networks for Predicting 3D Protein Shapes From Amino Acid Sequences* [no. 1229] Herna Viktor, Eric Paquet and Jing Zhao

Session We5-3: Mind, Brain, and Cognitive Algorithms, Chair: Leonid Perlovsky, Room: Continental

5:20PM	*Is Cognitive Dissonance Compatible With Human Evolution?* [no. 1397] Leonid Perlovsky, Nobuo Masataka and Michel Cabanac
5:40PM	*Neuromodulation Based Control of An Autonomous Robot* [no. 1517] Biswanath Samanta and Akimul Prince
6:00PM	*Modeling the Effects of Neuromodulation on Internal Brain Areas: Serotonin and Dopamine* [no. 1337] Zejia Zheng, Kui Qian, Juyang Weng and Zhengyou Zhang

Session We5-4: President Obama's Brain Mapping Initiative, Chair: Terence Sejnowski, Room: Oak

5:20PM	Presentation by Dr. Sejnowski followed by questions and answers: possible additional presenters to be announced.

Thursday, August 8, 8:00AM–9:10AM

Plenary Talk Th-Plen4: Plenary Session Chair: Marley Vellasco, Room: International Ballroom

8:00AM	*From Robots to Biomolecules: Computing for the Physical World* Lydia Kavraki (Rice University)

Thursday, August 8, 9:30AM–11:30AM

Session Th1-1: Cognitive Neuroscience, Chair: Leonid Perlovsky, Room: Gold

9:30AM	*A Spatial Selective Visual Attention Pattern Recognition Method Based on Joint Short SSVEP* [no. 1210] Songyun Xie, Fangshi Zhu, Klaus Obermayer, Petra Ritter and Linan Wang
9:50AM	*A Study on Visual Attention Modeling-A Linear Regression Method Based on EEG* [no. 1143] Qunxi Dong, Bin Hu, Jianyuan Zhang, Xiaowei Li and Martyn Ratcliffe
10:10AM	*Olfaction Recognition by EEG Analysis Using Differential Evolution Induced Hopfield Neural Net* [no. 1600] Anuradha Saha, Amit Konar, Pratyusha Rakshit, Anca L. Ralescu and Atulya K. Nagar
10:30AM	*Cortical Neural Correlates to Trial-and-Error Learning Dynamics* [no. 1461] Yuan Yuan and Jennie Si

10:50AM	*Towards the Encoding of Human Working Memory* [no. 1255] Guoqi Li, Wei He, Kiruthika Ramanathan and Luping Shi
11:10AM	*Spatial Alignment of Scalp EEG Activity During Cognitive Tasks* [no. 1348] Mark Myers, Robert Kozma, Charlotte Joure, Carley Johnston, Aaron Canales and Akshay Padmanabha

Session Th1-2: Crossdisciplinary Topics II, Chair: Jon Roach, Room: Parisian

9:30AM	*A Multi-Resolution-Concentration Based Feature Construction Approach for Spam Filtering* [no. 1022] Guyue Mi, Pengtao Zhang and Ying Tan
9:50AM	*Autonomous Reinforcement of Behavioral Sequences in Neural Dynamics* [no. 1235] Sohrob Kazerounian, Matthew Luciw, Mathis Richter and Yulia Sandamirskaya
10:10AM	*A New Hybrid Swarm Optimization Algorithm for Power System Vulnerability Analysis and Sensor Network Deployment* [no. 1247] Haopeng Zhang and Qing Hui
10:30AM	*Tactical Task Allocation and Resource Management in Non-Stationary Swarm Dynamics* [no. 1356] Jon Roach, Robert Marks and Ben Thompson
10:50AM	*An Application of Quantum-Inspired Particle Swarm Optimization to Function Optimization Problems* [no. 1269] Koichiro Tazuke, Noriyuki Muramoto, Nobuyuki Matsui and Teijiro Isokawa
11:10AM	*Climate Control Planning for Manufacturing Industry Using a Hybrid Optimization of BA and NN* [no. 1601] Arash Marzi, Hosein Marzi and Elham Marzi

Session Th1-3: Mixed Topics in Neural Networks II, Chair: Teresa Ludermir, Room: Continental

9:30AM	*Unsupervised Multimodal Feature Learning for Semantic Image Segmentation* [no. 1481] Deli Pei, Huaping Liu, Yulong Liu and Fuchun Sun
9:50AM	*Sparse Maximum Entropy Deep Belief Nets* [no. 1169] How Jing and Yu Tsao
10:10AM	*A Guided Autowave PCNN for Improved Real Time Path Planning* [no. 1163] Usman Ahmed Syed, Usman Ali Malik, Mazhar Iqbal and Faraz Ahmed Kunwar
10:30AM	*A Perception Evolution Network for Unsupervised Fast Incremental Learning* [no. 1190] Youlu Xing, Furao Shen and Jinxi Zhao
10:50AM	*Evolutionary Extreme Learning Machine Based on Particle Swarm Optimization and Clustering Strategies* [no. 1058] Luciano Pacifico and Teresa Ludermir
11:10AM	*Weighted Entropy Cortical Algorithms for Modern Standard Arabic Speech Recognition* [no. 1602] Nadine Hajj and Mariette Awad

Session Th1-4: Cognitive Robots and Brain-Inspired Cognitive Systems, Chair: Paolo Arena, Room: Oak

9:30AM	*A Spiking Network for Spatial Memory Formation: Towards a Fly-Inspired Ellipsoid Body Model* [no. 1215] Paolo Arena, Salvatore Maceo, Luca Patanè and Roland Strauss
9:50AM	*A Spiking Network for Body Size Learning Inspired by the Fruit Fly* [no. 1214] Paolo Arena, Giuseppe Di Mauro, Tammo Krause, Luca Patanè and Roland Strauss
10:10AM	*A Study of Transformation-Invariances of Deep Belief Networks* [no. 1264] Shou Zheng, Yuhao Zhang and Hengjin Cai
10:30AM	*Neural Architecture for Complex Scene Recognition Based on Rank-order Features of IT Neurons* [no. 1316] Sergey Tarasenko and Natalia Efremova
10:50AM	*Neural and Statistical Processing of Spatial Cues for Sound Source Localisation* [no. 1352] Jorge Davila-Chacon, Sven Magg, Jindong Liu and Stefan Wermter
11:10AM	*A Location-Independent Direct Link Neuromorphic Interface* [no. 1321] Alexander Rast, Johannes Partzsch, Christian Mayr, Johannes Schemmel, Stefan Hartmann, Luis Plana, Steve Temple, David Lester, Rene Schueffny and Steve Furber

Panel Session Th-1-5: Adaptive Computing for 21st Century Applications, Chairs: Larry Medsker, Room Gold
Panelists: John McIntyre, Larry Medsker and Shiliang Sun

Thursday, August 8, 11:40AM–12:40PM

Session Th2-1: Brain-Machine Interface and Neural Engineering, Chair: Robert Kozma, Room: Gold

11:40AM	*Detection of Spatiotemporal Phase Patterns in ECoG Using Adaptive Mixture Models* [no. 1146] Roman Ilin and Robert Kozma
12:00PM	*A General Aggregate Model for Improving Multi-Class Brain-Computer Interface Systems' Performance* [no. 1577] Tuan Hoang, Dat Tran, Xu Huang and Wanli Ma
12:20PM	*The Effect of Methods Addressing the Class Imbalance Problem on P300 Detection* [no. 1581] Guoqiang Xu, Furao Shen and Jinxi Zhao

Session Th2-2: Cognitive Architectures, Cognitive Modeling, Chair: Asim Roy, Room: Parisian

11:40AM	*A Hierarchical Organized Memory Model Using Spiking Neurons* [no. 1186] Jun Hu, Huajin Tang and Kay Chen Tan
12:00PM	*The Use of Optical and Sonar Images in the Human and Dolphin Brain for Image Classification* [no. 1531] Sepehr Jalali, Paul Seekings, Cheston Tan, Aiswarya Ratheesh, Joo-Hwee Lim and Elizabeth Taylor
12:20PM	*Integrating Developmental and Conventional Markov Decision Processes: An Application to Robotic Navigation* [no. 1268] Shuqing Zeng and Yanhua Chen

Session Th2-3: Special Neural Networks (Fuzzy, Modular, Reservoir, Large-Scale) II, Chair: Paolo Arena, Room: Continental

11:40AM	*A Computational Model for Motor Learning in Insects* [no. 1218] Paolo Arena, Sergio Caccamo, Luca Patanè and Roland Strauss
12:00PM	*Exogenous Control and Dynamical Reduction of Echo State Networks* [no. 1250] Patrick Stinson and Keith Bush
12:20PM	*The Spectral Radius Remains a Valid Indicator of the Echo State Property for Large Reservoirs* [no. 1325] Ken Caluwaerts, Francis Wyffels, Sander Dieleman and Benjamin Schrauwen

Session Th2-4: Computational Neuroscience, Chair: Simona Doboli, Room: Oak

11:40AM	*Dynamics of Hodgkin and Huxley Model With Conductance Based Synaptic Input* [no. 1279] Priyanka Bajaj and Akhil Ranjan Garg
12:00PM	*A Computational Model of Perirhinal Cortex: Gating and Repair of Input to the Hippocampus* [no. 1114] Adam Lester, Michael Howard, Jean-Marc Fellous and Rajan Bhattacharyya
12:20PM	*A Hierarchical Model of Synergistic Motor Control* [no. 1587] Kiran Byadarhaly and Ali Minai

POST-CONFERENCE WORKSHOPS

Thursday, August 8, 2:00PM–5:00PM

Workshop W-1: Autonomous Learning Systems, Organizers: Asim Roy and Plamen Angelov, Room: Executive

Workshop W-2: What Language and Emotion Can Tell Us About the Brain: New Methods of Analysis, Organizers: Colleen Crangle and Patrick Suppes, Room: Royal

Friday, August 9, 9:00AM–12:00 noon

Workshop W-3: Perception and Cognition in the Brain: Integrating Single Cell Recordings, Spiking Neurons, and a Brain Theory, Organizers: Narayan Srinivasa, Moran Cerf, and Asim Roy, Room: Executive

SELECTED ABSTRACTS

Abstracts from Plenary Talks

Monday, August 5, 8:00AM-9:10AM

Neural Network Reinforcement Learning Structures for Real-Time Optimal Feedback Control and Games

Frank L. Lewis, University of Texas at Arlington

This talk will discuss some new neural network (NN) structures for the design of automatic feedback controllers for continuous-time dynamical systems. Optimal feedback control design has been responsible for much of the successful performance of engineered systems in aerospace, industrial processes, vehicles, ships, robotics, and elsewhere since the 1960s. Optimal feedback control design is performed offline by solving optimal design equations such as the algebraic Riccati equation. It is difficult to perform optimal designs for nonlinear dynamical systems since they rely on solutions to complicated Hamilton-Jacobi-Bellman or HJI equations. Finally, optimal design generally requires that the full system dynamics be known. Methods known as adaptive control have provided powerful techniques for online learning of effective controllers for unknown nonlinear systems. However, optimal control design and adaptive control design have traditionally represented two different philosophies that have not been unified:

Optimal Adaptive Control Using NN. In this talk we unify adaptive control and optimal control using NN and reinforcement learning (RL) ideas. We show how neural network structures can be used to design a novel class of adaptive controllers that learn the solutions to optimal feedback control problems in real time without knowing a full dynamical model of the controlled system. In the linear quadratic case, these algorithms learn the solution to the ARE by adaptation along the system motion trajectories. In the case of nonlinear systems with general performance measures, the algorithms learn the (approximate smooth local) solutions of HJ or HJI equations. Reinforcement Learning has traditionally been applied for feedback control design only for discrete-time systems. A novel approach known as Integral Reinforcement Learning allows applications of RL to continuous-time linear and nonlinear dynamical systems. IRL leads to a new form of Bellman equation that can be used to design adaptive controllers based on actor-critic mechanisms that converge in real time to optimal control and game theoretic solutions.

Multi-Player Differential Games. New algorithms will be presented for solving online non zero-sum multi-player differential games for continuous-time systems. We use an adaptive control structure motivated by reinforcement learning policy iteration and implemented using NN. The result is an adaptive control system with multiple tuned control loops that learns based on the interplay of agents in a game, to deliver true online gaming behavior.

Tuesday, August 6, 8:00AM-9:10AM

Network Models of the Human Brain

Olaf Sporns, Indiana University

Recent advances in network science have greatly increased our understanding of the structure and function of many networked systems, ranging from transportation networks, to social networks, the internet, ecosystems, and biochemical and gene transcription pathways. Network approaches are also increasingly applied to the brain, at several levels of scale from cells to entire brain systems. We now know that brain networks exhibit a number of characteristic topological features, including small-world attributes, modularity and hubs. I will review recent work on how complex brain networks are organized, and how their structural topology constrains and shapes their capacity to process and integrate information. I will place particular emphasis on models of the large-scale structure and neural dynamics of the human brain.

Wednesday, August 7, 8:00AM-9:10AM

Behavioral Economics and Neuroeconomics: Cooperation, Competition, Preference, and Risky Decision Making

Stephen Grossberg, Boston University

Behavioral economics and neuroeconomics concern how humans process multiple alternatives to make their decisions, and propose how discoveries about how the brain works can inform models of economic behavior. This lecture will survey how results about cooperative-competitive and cognitive-emotional dynamics that were discovered to better understand how brains control behavior can shed light on issues of importance in economics, including results about the voting paradox, how to design stable economic markets, irrational decision making under risk (Prospect Theory), probabilistic decision making, preferences for previously unexperienced alternatives over rewarded experiences, and bounded rationality.

Thursday, August 8, 8:00AM-9:10AM

From Robots to Biomolecules: Computing for the Physical World

Lydia Kavraki, Rice University

Over the last decade, the development of robot motion planning algorithms to solve complex geometric problems has not only contributed to advances in industrial automation and autonomous exploration, but also to a number of diverse fields such as graphics animation and computational structural biology. This talk will discuss the state of the art of sampling-based motion planning with emphasis on work for systems with increased physical realism. Recent advances in planning for hybrid systems will be described, as well as the challenges of combining formal logic and planning for creating safe and reliable robotic systems that can interact with humans. The talk will also demonstrate how the experience gained through robotics planning has led to algorithmic tools for analyzing the flexibility and interactions of molecules for the discovery of new medicines.

Abstracts from Contributed Presentations Without Full-Length Papers

Tuesday, August 6, 1:40PM-2:40PM
Session Tu3-4: Attention, Learning, and Memory

2:20PM-2:40PM: Dynamics of Cortical Neuropil is Gas-like in Sensation, Liquid-like in Perception

Walter J. Freeman, University of California at Berkeley; Robert Kozma, Memphis University; Roman Ormandy, Embody Corporation; Giuseppe Vitiello, Universita di Salerno

During intentional behavior perception proceeds cyclically from predicting through sampling, sensing, categorizing, recognizing, and updating the prediction, closing an action-perception cycle. Each cycle begins with a search for sensory information in all modalities. A set of Bayesian probabilities forms by preafference, which specifies an attractor landscape in every sensory cortex that predicts the likely outcomes of impending sampling. A learned stimulus excites sensory receptors that ignite a Hebbian assembly in each modality, which generalizes over equivalent sensory neurons and abstracts to a category. The assembly guides the cortical trajectory into the basin of the appropriate attractor, and the ignition provides the transition energy required to cross the boundary between the pre-stimulus and signal basins [2].

Vigorous firing of selected neurons from sparse, 'gas-like' random background firing signals sensing. A burst of gamma oscillation signals recognizing by generating a carrier wave that synchronizes the firing of all neurons in each cortex. Local firing rates are above or below the mean rate, giving a spatial pattern of amplitude modulation (AM) that carries the memory of the stimulus [2]. The wave packet manifests a 'liquid-like' state, owing to the high density of neural activity, as revealed by the probability of neural firing conditional on local electrocorticographic wave amplitudes. All sensory systems send wave packets to the entorhinal cortex, which integrates them into a gestalt, passes the gestalt through the hippocampus for labeling by time and place of formation, and returns to every cortex a sample that updates expectancy [2].

We postulate that the crucial step from categorizing to recognizing is mediated by a cortical phase transition [3, 4], by which the electrical energy density in the neuropil rises above a threshold, such that neuronal interactions are done by ephaptic transmission [1] that then accompanies synaptic transmission. We have modeled the process by describing the liquid-like phase as a Bose-Einstein condensate [3], which synchronizes all charged particles, including the water dipoles in and between the neurons and glia. We think the two phases may conform to collective electrodynamics [5]. Our complementary model uses random graph theory [4]. Our experimental evidence includes the extreme speed phase transition; the non-locality of the categorizing information; the extreme density of energy use [1]; the power-law distributions of background activity that manifest criticality; and the null spikes of power between wave packets manifesting singularity [2] required to dissipate preceding AM patterns. We conclude that the liquid-like phase can explain the richness of memories in flashes of insight, and the high energy cost.

[1] Capolupo A, Freeman WJ, Vitiello G (2013) Dissipation of 'dark energy' by cortex in knowledge retrieval. Phys Life Rev: in press, http://www.sciencedirect.com/
[2] Freeman WJ, Quian Quiroga R (2012) Imaging Brain Function with EEG. NY: Springer.
[3] Freeman WJ, Vitiello G (2006) Nonlinear brain dynamics as macroscopic manifestation of underlying many-body field dynamics. Phys Life Rev 3:93-118.
[4] Kozma, Puljic M, Balister P,Bollobas B, Freeman WJ (2004) Neuropercolation: A Random Cellular Automata Approach to Spatio-Temporal Neurodynamics. LNCS 3305:435-443.
[5] Mead C (2000) Collective Electrodynamics. Quantum Foundations of Electromagnetism. Cambridge MA: MIT.

Tuesday, August 6, 6:30PM-8:30PM
Poster Session Tu-PB: Poster Session B, Regency Ballroom

P361: Phase Response Curves Explain How Multiplicative Feedback on Neural Phase Elements Differs from Adaptive Physical Feedback in Robotic Motion Controls

Kazuki Nakada, Kyushu University; Keiji Miura, Tohoku University; and Hiroaki Wagatsuma, Kyushu Institute of Technology

Bio-inspired approaches for designing a control system particularly in rhythmic movements have been advanced in robotic research fields and recently focused in biomedical engineering. The conventional approaches were at the basis of the concept of the central pattern generator (CPG), a neuronal ensemble capable of producing spontaneously adaptive synchronous rhythmic activities for motion control in animals. CPGs are generally described as coupled nonlinear oscillators, which interact with others via synaptic connections representing internal neuronal coupling. It provides coordinated rhythmic activities known as global entrainment in the form of a limit-cycle globally organized through interactions among the coupled oscillators, to achieve the system's purpose in a dynamic environment, such as locomotion. Recent arguments insist non-necessity of the neuronal couplings to establish a global entrainment for adaptive motor control if sensory and kinetic feedbacks are sustainable by using external kinetic interactions in different physical systems, such as legs and arms or robotic joints, as the substitute function for neuronal couplings [1,2]. However, its biological plausibility and mathematical verifications are still unclear. In the present study, we investigated a neural phase element having excitatory and oscillatory modes due to the saddle-node bifurcation [3] in a feedback system consisting of the phase elements and a robotic joint as a physical system. In theoretical analyses, we focus on the effects of sensory feedback on the dynamics as an interaction between the phase element and the robotic joint. In our computer experiments, the phase response curves (PRCs) of the entire system clearly demonstrated that sensory feedback modulation is sensitive to the relationship between the resonance frequency of the phase element and the filtering properties of the robotic joint. Interestingly, the resulting PRC has dual peaks having different local maxima and the dual maxima become equal at a certain bifurcation condition. The results imply that the phase response properties of the system is strongly influenced by multiplicative feedback on the neural phase element and indicate the significance of the neuronal interactions even with external feedbacks beyond a substitution for mechanical couplings. Our findings highlight the importance of PRC analyses for designing a robotic system and suggest that the phase resetting control in rhythmic movements is the key to investigate biomedical applications [4, 5].

[1] D. Owaki, L. Morikawa, A. Ishiguro, in Proc. IROS 2012, 1950-1955 (2012)
[2] T. Kano, D. Owaki, A. Ishiguro, in Proc. IROS 2012, 4873-4878 (2012)
[3] H. Wagatsuma, Y. Yamaguchi, Neural Computation, 16(12), 2665-2697 (2003)
[4] T. Yamasaki, T. Nomura, S. Sato, Biol. Cybern. 88(6), 468-96 (2003)
[5] J. Nakanishi, J. Endo, G. Cheng, S. Schaal, M. Kawato, Robotics and Autonomous Systems, 47, 79-91 (2004)

P362: Object Recognition and Tracking in a Context-Aware Application

Tan Vo and Dat Tran, University of Canberra

In this paper, the problems of Object Recognition and Tracking are revisited in a different setting, in which the interactions between humans and objects around them play an important role (context-awareness). A novel method is proposed to improve the overall accuracy and performance of the system by combining modern depth sensor information with conventional machine vision techniques such as SIFT to produce a system that is capable of performing object recognition and tracking with satisfactory accuracy in real-time. A prototype was created and was tested to confirm that the proposed model can provide better performance comparing with current models used in image processing.

P363: Learning to Discriminate With Generative Features

Bonny Banerjee, Jayanta Dutta, and Juan Gu, University of Memphis

The traditional approach to building a brain-inspired neural network based classification system proceeds in two stages. First, the features are learned from sensory data in an unsupervised manner often using a multilayered generative model. The discriminative weights are then learned between the top feature layer and a classification layer in a supervised manner. The classification layer consists of n neurons, each representing a class, which is a highly inefficient representation.

It is more efficient to use a sparse representation whereby a small set of m (m<<n) neurons represents each class. Theoretically, n-choose-m classes can then be represented using the n neurons. This is consistent with the hypothesis that the brain uses a sparse representation (Olshausen and Field, 1996). We observe that, while all features learned from the data are necessary for reconstructing different stimuli, only a small subset of features are necessary and sufficient for discriminating a stimulus from those belonging to other classes. That is, if these discriminative or salient features are observed in a stimulus, it can be classified as correctly as when all features are observed. We show how an expected degree of uniqueness or discriminative capability may be assigned to each feature as they are learned in a generative model such that classification may be achieved using a sparse representation. We present a model where the expected uniqueness of a feature is captured by the adaptive threshold of the neuron encoding it. When a stimulus is presented, a neuron is less likely to fire if it encodes a less discriminative feature and vice versa. The firing pattern of the population of neurons encodes the class using a sparse representation.

This model is consistent with recent findings in neuroscience that individual neurons respond to a class of surprise in the stimuli (see for example, Gill et al., 2008; Meyer and Olson, 2011). A surprise is evoked when an unexpected feature occurs in the stimulus. More discriminative features occur less often, are less expected, and therefore evoke greater surprise. Thus, firing pattern of the population of neurons in our model is in response to surprises in the stimuli.

Gill, P., Woolley, S. M. N., Fremouw, T. and Theunissen, F. E. (2008). What's that sound? Auditory area CLM encodes stimulus surprise, not intensity or intensity changes. J. Neurophysiol., 99:2809-2820.

Meyer, T. and Olson, C. R. (2011). Statistical learning of visual transitions in monkey inferotemporal cortex. Proc. Natl. Acad. Sci., 108(48):19401-19406.

Olshausen, B. A. and Field, D. J. (1996). Emergence of simple-cell receptive field properties by learning a sparse code for natural images. Nature, 381(6583):607-609.

P365: Simple Dynamic Binary Neural Networks With Sparse Connection

Jungo Moriyasu, Ryota Kouzuki, and Toshimichi Saito, Hosei University

The simple dynamic binary neural network (SDNN) is constructed by applying the delayed feedback to a two-layer network and is characterized by the signum activation function, ternary weighting parameters and integer threshold parameters. Depending on the parameters, the SDNN can exhibit various binary periodic orbits (BPOs). The SDNN can be regarded as a digital version of the recurrent neural network [1] and a simple version of the three-layer dynamic binary neural network (DBNN [2]). We present a novel SDNN with sparse connection and consider its learning capability. The study of SDNN can be a basic step to bridge between digital systems and neural information processing function. For a basic learning to store one BPO, we present a simple learning algorithm based on the correlation learning [1]. The weighting parameters are given by ternarizing the correlation matrix. The threshold parameter can be determined to guarantee storage of a class of BPOs. In order to realize the sparse connection, we insert zero elements into the weighting matrix by a heuristic method. This algorithm is much simpler than the learning algorithm of the DBNN. Performing basic numerical experiments to two examples of teacher signals (an artificial BPO and a BPO corresponding to a switching signal of power converters [3]), we have confirmed the following: (1) The BPOs are stored successfully, (2) The stored BPO is stable, and (3) As the sparsity of the connection increases, the stability of the stored BPO tends to be reinforced.

[1] K. Araki and T. Saito, Neural Networks, 7 (1994)1267.

[2] R. Ito, Y. Nakayama and T. Saito, Proc. of IJCNN (2012) 502

[3] B. K. Bose, IEEE Trans. Ind. Electron, 54 (2007) 14

P367: Improved Separability in Motor Cortical Neural Representation Through Learning of a Directional Control Task
Hongwei Mao and Jennie Si, Arizona State University

Extracellular single unit recordings have revealed that changes in neuronal firing activities could be correlated with learning sensorimotor associations and motor skills [1, 2]. Here we further investigate how neural representations adapted while rats performed a directional control task, in which they learned to associate light cues with appropriate directional control strategies.

In our recording apparatus, a rat would press a center lever to start a trial at his own will. One of five cue lights would appear. The rat could press either a left or right control lever to "move" the cue light to the right or left by one position, respectively. The goal was for the rat to "move" the light to the center light position to receive a food reward. By trial and error, rats could reach an accuracy of 80% or above in about 30 sessions on average. Neural waveforms were recorded in all sessions, and action potentials were detected and sorted offline. Data in a 1500 ms time window after cue onset were used, during which rats made a control decision and moved towards either the left or right control lever.

Neuronal firing rate differences were observed between left side movements in response to left side cues (L-L trials) and right side movements to right side cues (R-R). Spike counts in 500 ms non-overlap bins of each neuron were calculated for each trial, and then averaged over 5 randomly selected trials (L-L and R-R separately) within one session. Data of simultaneously recorded neurons were concatenated to form a neural ensemble vector representation. A linear SVM was trained to classify the two classes, and Matthews correlation coefficient (MCC) was used to measure the quality of classification. As an example, for rat T10, when L-L and R-R trials from all sessions were pooled together, respectively, the MCC of the classifier was 0.7718, which shows a reasonably good discrimination and suggests that there were distinct neural representations underlying different behavioral contexts.

Then SVM classifiers were trained on data of single sessions, and tested using all other sessions' data. Low classification errors (<20%) were achieved at most in several (typically less than 5) adjacent sessions. This indicates that neural ensemble representations of L-L and R-R trials adapted over sessions. These classifiers were also tested using data from the same session as the training data. And the margin (in SVM's kernel space) between the two testing data classes was calculated. An increased separation margin was observed over session numbers. For rat K11, for instance, this value was 1.39, 2.00 and 2.12, respectively, in 3 learning stages separated by 60% and 75% accuracy. This result suggests that rats had developed clearer neural representations of decision and execution of directional control movements as they achieved higher behavioral performance accuracy.

The research was supported in part by the NSF under grant ECS-1002391.

[1] Rony Paz, Thomas Boraud, Chen Natan, Higai Bergman, and Eilon Vaadia. Preparatory activity in motor cortex reflects learning of local visuomotor skills. Nat. Neurosci., 6 (8), 882-890 (2003).
[2] Dana Cohen and Miguel A.L. Nicolelis. Reduction of single-neuron firing uncertainty by cortical ensembles during motor skill learning. J. Neurosci., 24 (14), 3574-3582 (2004).

P368: Learning Complex Cell Receptive Field Properties by Explaining Simple Cell Responses over Time
Jayanta Dutta and Bonny Banerjee, University of Memphis

Learning invariances to transformations within a complex neuron's receptive field plays a crucial role in learning feature hierarchies by facilitating abstraction of more stable spatiotemporal features as we ascend up the hierarchy. Real-world transformations can be arbitrarily complex. For example, the transformation of a balloon from deflated to inflated is much more complex than mere scaling or translation. In hierarchical neural models of vision, such as HMAX (Serre et al., 2007), transformation invariance is typically achieved in the complex layer by pooling from a subset of lower layer simple neurons. Deciding the set to pool from is the crux of the invariance learning problem.

We hypothesize that, any arbitrary transformation may be learned from time-varying data by pooling from the subset of simple neurons that are repeatedly used in close temporal proximity for explaining (or reconstructing) the data. To verify this hypothesis we propose a generative neural model consisting of a simple and complex layer with exhaustive bottom-up (simple to complex), top-down (complex to simple) and lateral (in each layer) connections. The complex neurons have a temporal receptive field, and reconstruct the activations of the simple neurons occurring within that receptive field. The bottom-up connections to a complex neuron encode the subset of simple neurons to pool from. The top-down connections encode correlations between the activations of simple and complex neurons while lateral connections in the complex layer encode correlations between the activations of different complex neurons. The top-down and lateral connections may be conceived as short-term memory while the bottom-up is longer-term.

Our model was learned from natural videos recorded with a camera mounted on a cat's head (Betsch et al., 2004). These videos provide a continuous stream of stimuli similar to that received naturally by the cat's visual system, preserving its temporal structure, and has been used for evaluating models on learning complex cell receptive field properties (e.g., Einhauser et al., 2002; Masquelier et al., 2007). Upon learning, each complex neuron in our model becomes invariant to bars or edges moving in different directions. The lateral connections in the simple layer were learned to encode transition probabilities. Using these, the complex neurons learn sequences of varying lengths (bounded by their temporal receptive field size) and can predict the stimuli for the remaining part of the sequence.

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P369: Mining Transformation-invariances of Deep Belief Networks by Transformed Weights Training

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Background: Deep architectures such as Deep Belief Networks (DBN) achieve satisfying results in recognizing high dimensional data and extracting essential features in data [1]. In order to learn transformation-invariant features, several effective deep architectures like Convolutional Deep Belief Networks and additional layers/units/filters have been presented [2]. Considering the complexity of those structures, people are interested in whether DBN itself has transformation-invariances.

Method: First of all, almost same results, which are achieved by using original DBN to test original data, will be achieved, if we change weights in the bottom interlayer according to transformations occurred in testing data. Additionally, we find that weights in the bottom interlayer could store the knowledge to handle transformations such as rotation, shifting, and scaling. Transforming weights in other interlayers cannot decrease recognizing error rates for transformed data. These results are consistent with discoveries in brain neural networks that some neurons in inferior temporal cortex play the role of handling intermediate features [3]. Along with continuous learning ability and good storage of DBN, we are inspired to present our weight-transformed training algorithm (WTTA) without augmenting other layers, units or filters to original DBN. Based upon original training method in [4], WTTA is aiming at transforming weights in the bottom interlayer and is still an unsupervised learning method.

Results: In experiments, we choose 784-100-100-100 DBN to compare the differences of recognizing ability during weight-transformed ranges. Relied on transformed MNIST tasks originated in [5], three cases are used to evaluating rotational-invariance, shifting-invariance, and scaling-invariance respectively. The error rates generated by WTTA are mostly below 25% while most of rates generated by original training algorithm are far above 25%. As is indicated in [1], the best performance of a 784-500-500-2000-10 DBN can reach 1.2% error rate. With larger maximum loop time and more units, our DBN could achieve lower error rates. Besides, similar results can be achieved by training datasets having ample possible kinds of data, but WTTA just need original training data and simply transform weights after each training loop.

Conclusion: According to above results, DBN can recognize transformed data at satisfying error rates without extra components. Consequently, DBN can be trained via WTTA to learn transformation-invariant features by itself. Therefore, transformation-invariances are inherent property of DBN.

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P373: Volumetric Visualization Technique for Brain Imaging Data

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FMRI data is usually visualized in slice plane or brain surface form which eschew voxel patterns with complicated three-dimensional structure and complicated interior structure. Slice views preserve familiar anatomical landmarks for reference, while brain surface renderings relate patterns to the cortical surface. These methods are problematic because localization masks and voxel activation patterns tend to have complicated three-dimensional (3D) structures and complicated interior structures. Although all of thedata is available to the researcher to look at slice-by-slice, humans in general cannot integrate a series of planar views into an accurate perception of a complex 3D shape. Even more difficult is reconstructing a mental image of a 3D shape from its intersection with a single complex possibly deformed surface.

Our lab decided based on these problems that two main criteria should be used in evaluating a potential solution, the ability to see physiological landmarks and the complex 3D structure of experimental data and masks. Our lab approached these criteria by creating a program that uses 3D rendering, slice planes, and transparency to create volumetric representations of brain imaging data. Additional criteria we used for evaluating our technique included cross-platform compatibility, ease of use, customization, and incorporation into existing workflow routines. In order to address compatibility and ease of use the program was developed in MATLAB and features a full GUI for all of its core features. In order to encourage customization the program was designed around layering multiple channels of volumetric information and adjusting their appearance. The ability to incorporate it into existing workflows is being addressed by adding data format compatibilities and automatic detection of conflicting representations

In regards to the main criteria of highlighting landmarks and 3D structure our program works well. This program can create the appearance of a translucent gray and or white matter whose surface is emphasized making landmarks apparent and draw simple or complex representations of activity data. When all channels of information are co-registered to be in structural MRI coordinates publication quality renderings can be created and manipulated in real time. In addition to giving new visualization capabilities our program also offers the ability to cut into the visualization along any of the main axes relating the 3D structure to traditional slice-plane representations. The application is still being developed with regards to simplifying user workload and importing various data types and formats.

We hope that this program will aid researchers who want to create sophisticated and clear representations of their complex three-dimensional brain imaging data. The papers cited below are examples of the diverse range of novel analysis methods that we believe could benefit from our visualization technique. In general we hope that this program along with others out there will enable the scientific community to generally communicate this type of information better.

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P375: Seam Carved Image Detection by Hopfield Networks

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Seam carving, introduced by Shamir and Avidan in 2007, is the most famous content-aware image resizing and tampering method. Seam carving assigns a Sobel-operator-based energy value to each pixel. Seams are defined as the paths connecting pixels of lowest energy, either vertically from top to bottom or horizontally from left to right. Successive removal of these seams allows reduction in image size. Pixels with lower energy are generally removed earlier. This basic idea of seam carving implies that (1) the modifications to the image are difficult to identify and (2) low energy can be deliberately assigned to particular earlier. This basic idea of seam carving implies that (1) the modifications to the image are difficult to identify and (2) low energy can be deliberately assigned to particular objects so that they can be removed from the image. These two observations reveal that, although difficult, it is important to design a seam carving detection method.

Here we propose a novel method based on Hopfield networks, which recovers an image for possible seam carving effect and thus can detect seam carved images. After converting the test image into its intensity component I, our method divides I into 2x2 blocks called mini-squares. For each mini-square, we have nine types of 2x3 patches that roll it back from possible seam removal. These nine patches form the target patterns for the Hopfield networks to associate with. The beginning pattern of the association procedure is a 2x3 sub-image generated from the local area of the corresponding mini-square. Resulting from the association procedure, we assign each mini-square one type number in {0,1, ...,8} to indicate the optimal patch type. We can consequently calculate three patch transition probability matrices that connect the mini-squares in three directions, namely, subdiagonal, vertical, and diagonal. The entries in these three 9x9 matrices, together with the probabilities of the nine types, form a 252-dimensional detection feature. This feature is sent to an SVM classifier system that detects whether the test image has been seam carved.

Our method achieves a detection accuracy of 89.1 and 93.2 for 20% and 30% seam- carved images respectively. Experimental results reveal that the performance thereof is better than those of other existing methods. Besides the detection accuracy, this method has potential applications that deserve further research, for example, identification of the hot regions frequently crossed by carved seams.

P377: What a Dynamical Connectome Informs Us About Large-Scale Neural Circuits and Whole-Brain Activity

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To unravel neural circuit mechanisms and whole-brain activity patterns, we build a dynamical brain connectivity network as a virtual reality based large-scale dynamic simulation for 3D reconstruction of whole-brain activity over the human cortical connectome in real-time. Using DTI structural connectivity data from [1] we built an interactive 3D visualization of the human connectome network in an immersive virtual reality environment, using the Unity 3D gaming engine. Further, the virtual reality brain network in Unity is coupled to a real-time neuronal simulator, iqr [2]. It turns out that coupling structural connectivity data with detailed enough neuronal population dynamics is sufficient in predicting functional correlations and large-scale activity patterns. We model neuronal dynamics by a linear-threshold filter (as work in progress, we are currently implementing population dynamics from mean-field models [3]). Each population module is stochastic, having Gaussian noise. The user can stimulate any region or simultaneous regions of the network with external input currents. The simulation then reconstructs reverberating neural activity propagating throughout the network in real-time. As an explicit example, we stimulate the superior parietal areas and observe causal activity propagating in the parietal lobe, indicative of visuo-motor integration. This is a first step to unearthing large-scale neural circuits by simulating and mapping whole-brain activity in real-time.

As quantitative analysis methods and data-collection tools in neuroscience make improvements, it is becoming evident that large-scale dynamics and whole-brain quantitative measures play an increasingly important role. For instance, oscillations across large brain regions are precursors to several cognitive functions. Moreover, the causal direction of these interactions is crucial. Compared to functional correlations, large-scale temporal activity maps across directionally connected brain structures serve as powerful tools to unravel mechanisms of large-scale neural circuits. Our results show that stimulating brain areas triggers a sequence of causal activations in associated network loops that represent cognitively related functions.

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P378: Energy Normalization in Population Coding: From Theory to Practice

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In population coding, each individual neuron is thought to be selective to a single and limited feature of the stimulus, while it is the whole population that provides a comprehensive representation. Although many biological plausible models have been proposed, how the information is first encoded and then decoded by the cortex is still an intriguing and open issue. In this abstract we point out the salient properties of a population of neurons characterized by Gabor-like tuning curves (TC), respect to a standard population coding, and how the different coding strategies provide different and meaningful advantages and drawbacks.

A standard population coding is characterized by Gaussian-shaped TCs, where the peak position of the TCs is equally distributed over the feature space [1]. Given the equivalence between the TCs, seen as basis functions, and the population response, the response itself can be decoded with different strategies. First among them, the population vector (center of mass) provides an estimate of the feature through a weighted sum of the population response, where the activity of each cell is weighted by its preferred activity. The weighted sum is further normalized by the summed activity of the whole population.

On the other side, a population characterized by Gabor-like TCs has likewise a peak position of the cells equally distributed, but the TC is periodic over the feature space, thus constraining the decoding of the population response in a limited range. Despite this (meaningful) drawback, this encoding strategy has a strong practical advantage with respect to the bell-shaped approach. Indeed, the overall activity of the population as a function of the driving stimulus directly correlates with the distance of the system from its zero value.

A salient example is provided by the neural architecture that encodes the retinal binocular disparity, which is the visual feature at the base of depth perception and vergence eye movements [2]. By following the binocular energy model [3], the complex cell is characterized by a Gabor-like tuning curve, deriving directly from the receptive field shape.

Including a divisive normalization stage [3], the response of each cell is divided by a local mean of the activity of the population, which is proportional to the Fourier energy of the binocular image. Besides the effect on the single cell (insensitive to binocular contrast difference) the normalization has strong practical influence activity of the whole neural architecture (seldom analysed [4]).

The normalized population response is characterized by a unitary mean and by an overall activity that monotonically decreases with the increasing of disparity [5]. The resulting computational substrate can be practically used in different applications:

- Confidence measure for the estimation of the disparity,
- Decoding strategies based on recurrent networks,
- Switch signal for dual-mode vergence control,
- Reward signal in learning a vergence control.

As a conclusion, the divisive normalization contributes to make the neural architecture stable and robust, and allowing to exploit a network with "realistic" tuning curves to be effectively employed in practical tasks.

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P379: V'Ger: Virtual Generalizing Random Access Memory Weightless Neural Network Computer

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We propose a Virtual Generalizing Random Access Memory (VG-RAM) Weightless Neural Network (WNN) Computer, or V'Ger Computer for short. VG-RAM WNNs are very effective pattern recognition tools, offering fast training (one shot training) and test [ALE98]. The V'Ger architecture was inspired on the organization of the human neocortex, and is composed of several interconnected layers of VG-RAM WNN neurons. One layer is connected to another in a way similar to cortico-cortical feed-forward and feedback connections between functionally adjacent and hierarchically organized areas of the neocortex [Shepherd04].

V'Ger has 3 neural layers organized hierarchically and named program (the highest level), function and command (lower level) layers. The neurons of these layers project their outputs to the layer below in the hierarchy, to itself, and to the layer above in the hierarchy. So, the neurons of all three layers have 3 input sources: (i) the layer immediately above in the hierarchy, (ii) itself, and (iii) the layer immediately below. This interconnection architecture allows the creation of neuron state machines that can execute sophisticate programs.

By examining the interconnection architecture described above, it is possible to note that one input of the layer program and one of the layer command are not accounted for. The input of the layer program receive a program specification in a form of an image, and the input of the command layer might receive data, also in the form of images, from the environment probed by V'Ger. In our experiments, all outputs are trained to output images given the specified training inputs (also images).

We have trained V'Ger, for example, to count from 0 to 30 in an hierarchical way, were we specified the program using an image with the text "count from 0 to 9 three times" applied to the input of the program layer. We taught this layer to output the text "count from

1 to 10 one" when receiving the mentioned input, which acts as a request for the layer function to operate. The layer function, then, generates outputs ("after empty", "after 0", ..., "after 9") for the layer command, which makes it produce a sequence of images with the text "0", "1", ..., and "9" (the feedback between these layers allows the generation of the sequence). When the layer program detects the image "after 9" on the layer function's output, it changes to "count from 1 to 10 two" and, later, to "count from 1 to 10 three" and, finally, to "end program", that propagates throughout the whole architecture stopping the program "count from 0 to 9 three times". The important point about this program is that, the highest the layer, the smaller the number of states (images) learned. Also, states in the lower levels can be reused in other programs, and the outputs learned can have multiple colors, where specific colors can inhibit, excite or be ignored by layers below or above the hierarchy.

We have "programmed" V'Ger for executing sophisticate programs for controlling a Pioneer 3-DX robot equipped with a Kinectic sensor. Currently, we are investigating techniques for programming V'Ger in a way similar to the proceduralization of motor actions.

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P380: Neuromorphic Adaptations of Restricted Boltzmann Machines (RBMs) and Deep Belief Networks (DBNs)

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Restricted Boltzmann Machines (RBMs) and Deep Belief Networks (DBNs) have been demonstrated to perform efficiently on a variety of applications, such as dimensionality reduction and classification. Implementation of RBMs on neuromorphic platforms, which emulate large-scale networks of spiking neurons, has significant advantages from concurrency and low-power perspectives. This work outlines a neuromorphic adaptation of the RBM, which uses a recently proposed neural sampling algorithm (Buesing et al 2011), and examines its algorithmic efficiency. Results show the feasibility of such alterations, which will serve as a guide for future implementation of such algorithms in neuromorphic very large scale integration (VLSI) platforms.

P381: Resting State and Task-Related Network Analysis Using Multi-Channel EEG to Assess Brain Functional Connectivity in Chronic Stroke Patients

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The human brain is a complex system comprised of several highly interconnected regions. Recently graph theory has emerged as a valuable tool for analyzing functional and structural connectivity in the human brain. Within graph theory, a network is defined as a set of nodes or vertices and the edges/lines (i.e., the connections) between them. Networks can be computed from electroencephalographic signals recorded from the scalp using the individual electrodes to represent the nodes and various measures of connectivity (cross correlation, coherence, and synchronization likelihood) to represent the edges or links between them. Once the network is constructed, graph theory metrics such as small-worldness are computed to study potential changes in the information transfer (e.g., efficiency) within the network. This study compares changes in graph theory derived networks before and after 3 weeks of seated ankle robotics training designed to improve paretic ankle motor control. EEG from 10 chronic hemiparetic stroke survivors was recorded during resting-state and active ankle robotics training (task-related). Functional networks were constructed for each condition pre vs. post. For the ankle robotics training participants played a videogame while seated by moving their ankle in dorsi-plantar-flexion ranges to attempt to navigate a cursor through gates that moved across the screen. The training participants were randomly assigned to a high- or low-reward group (monetary rewards). EEG coherence was computed offline from all possible pairs of electrodes and used to calculate correlation matrices between different brain regions. Each correlation matrix was weighted using the amplitude coherence values and then used to construct association matrices. From these association matrices graph theory metrics such as clustering coefficient and path length were calculated. Results showed that interregional connections derived from coherence values were different between the task and resting conditions. Furthermore, during active ankle robotics training (task condition), participants in the high-reward group had higher small-worldness values pre vs. post compared to the low-reward group. These findings indicate that knowledge of functional connectivity can be used to probe behavioral impairments, group differences (high- vs. low-reward motivation) and task-related vs. resting state brain dynamics in clinical populations. Further studies in stroke may advance our basic understanding of the sequelae of brain injury and may eventually aid in the design of individualized and more efficacious neurorehabilitation strategies.

P382: Nested Mutualism of Brain Information Processing Networks
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Neural reuse theories of the development of the functional structure of the brain [1] state that it is normal and common that neural circuits evolved for one purpose can and will be exapted (exploited, recycled and redeployed) by newer and later developed functions. This organizational hypothesis of the nature of neural evolution supports many observations on how and why the embodied nature of cognition works. In this paper we introduce the neural reuse paradigm, and relate it to theories of hierarchically arranged mutualisms in the development of natural ecosystems. In such nested structures of functional mutualism, the ecosystems evolve to support more diverse types of species (or functions) [2]. This diversity has many advantages for natural ecosystems. We will argue that these same concepts can be applied to understanding the functional ecosystem of the evolved neural circuits of the brain. We will discuss how these ideas relate to the robustness and flexibility of embodied cognitive functioning and discuss ways that this concept could be tested in natural neural networks and artificial cognitive systems.

The question is: Why might hierarchical or nested mutual organization be beneficial? The answer from biological ecosystems and other types of hierarchical self-organizing functional networks appears to be that nested mutualism allows for, not unlimited, but vastly more levels of nested hierarchical specialization than networks that don't have the right types of nesting nor that don't evolve specializations that reuse existing generalist functions. This robustness of the information processing ecosystem of neural circuits has several implications. First of all, as already mentioned, we would expect that certain types of failures or injuries will have disastrous consequences, while others can and will be easily absorbed by the diverse ecosystem of a nested mutualistic network. So the death of a hub species can result in the collapse of a biological ecosystem, and likewise in collapse in an information processing network. However, the robustness of the mutualistic network will allow such systems to withstand many other types of serious injuries or threats relatively unharmed. But this robustness is not simply a factor in the injury or damage to the physical components of the network. Again by analogy, in a biological ecosystem, the continued increasing specialization supported by the ecosystem gives rise to many unique functions. As this diversity of function increases, the biodiversity of the ecosystem increases and in a self-catalytic type of way supports even more varied niches for even more varied specialization opportunities. We believe that the impressive ability of the human information processing network importantly and crucially relies on the self-catalytic nature of increasing specialization of functions supported by the nested mutualistic nature of the massively redeployed neural circuits.

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P383: Object Selection and Search via a Brain Machine Interface in a Co-Robotic Assistant
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Co-robotic assistants, or Cobots, can reduce the cost of living and improve the quality of life for physically disabled individuals by allowing augmented control over their surroundings. Implemented in collaboration with the Boston University Unlock Project [1], this work provides a proof of concept of a semi-autonomous Cobot for patients with locked-in syndrome (LIS) where a robot's actions are controlled in part by a brain-machine interface (BMI). It uses steady state visually evoked potentials (SSVEP) for target selection and CogEye [2,3], a massively parallel neural network for object localization and identification. CogEye is an autonomous active vision system that models the functionality of the primate 'Where' and 'What' visual pathways. The simulated visual processes perform object recognition on images streamed from an iRobot Create equipped with a pan-and-tilt camera.

In the present Cobot's implementation, an iRobot Create, was placed in the middle of an arena populated with objects and set to stream images back to the computer running CogEye. The system's graphical user interface shows a grid of objects previously used to train CogEye and four checkerboard patterns positioned at the far left, right, top, and bottom of the screen each flashing at a unique frequency. The user selects his/her intended direction of movement on the object grid by selectively attending to one of four visual stimuli. In response to this visual stimulation, neural activity with frequency equal to the fundamental frequency of stimulation and its harmonics (SSVEP) is generated. The portable EEG headset worn by the patient detects this neural activity and wirelessly transmits the signal to a system that decodes the patient's intended direction of movement on the grid. Information about the selected object is passed on to CogEye via Asimov, a Python-based middleware [4]. CogEye then uses the pan-tilt camera installed on an iRobot Create to search for and identify the objects in the scene. Directing the camera simulates saccadic eye movements. As of the current implementation, we have CogEye providing feedback on the classification of areas of interest in the scene. When CogEye chooses the next foveation position based on location saliency, which is currently driven by simple visual features (luminosity), the Cobot is sent corresponding motor commands to move and turn in the arena.

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P384: Audio Features as Marker of Autism Spectrum Disorders in Children

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Identifying neurophysiological markers of autism spectrum disorders (ASD) in young children is an imperative, albeit difficult, problem. ASD is characterized, among other things, by language difficulties. It has been hypothesized that this difficulty may be due to a subtle sensory shortcoming of ASD children in making fine auditory discriminations (e.g., Roberts et al., 2010). To test this hypothesis, we present typically developing (TD) and ASD children with similar speech sound pairs, where the members of each pair differ in the voice onset time of the initial consonant and the pairs differ in place of articulation of the initial consonant (e.g., /ba/-/pa/, /ga/-/ka/, /da/-/ta/). We record the evoked magnetic fields to these speech sounds and analyze them with the purpose of determining if the same distinctive features expected to differentiate these stimuli are also found in ASD children. Absence of distinctive features differentiating speech sounds can then serve as a neurophysiological marker of ASD.

Researchers have developed computational models capable of decoding mental content from brain activity (e.g., Kay et al., 2008; Nishimoto et al., 2011). The dictionary of features, i.e. the battery of Gabor filters, used in these models is handcrafted while the weights for those features are learned using regression methods. In order to detect the absence or distortion of distinctive features, a model is required to learn the dictionary of features as well as their weights. Thus, while the above models work well for identifying stimuli from brain activity, they are insufficient for detecting absence or distortion of features in ASD children. We present a neural model that learns the features and corresponding weights for each subject for the same set of audio stimuli. The model is generative in that it takes an audio stimulus as the input and produces the corresponding brain response of a subject as the output. It consists of two layers of neurons with exhaustive feedforward, feedback and lateral (only in second layer) connectivity. The first layer operates as an input layer while each neuron in the second layer gets tuned to a unique feature encoded in the feedforward weights. Our features resemble those learned by the model proposed by Smith and Lewicki (2006). Comparisons will be drawn between the features learned by our model for TD and ASD children to judge their suitability as neurophysiological marker of ASD.

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P387: Model of Cortical Cell Processing to Estimate Binocular Disparity

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3D vision is a key process in the spatial understanding of the world. For decades, numerous researches worked on model describing how the brain extracts depth cues from 2D images (monocular and binocular) to create a 3D percept. Among these cues, retinal disparity holds a particular role because it allows stereoscopic vision. According to the objective, vision researchers pursued two different paths. Computer vision models such as matching algorithm can compute reliable depth map, whereas biological inspired

models have to describe the mechanism of depth perception from visual input to cortical processes to compute depth map.
The starting point of our work are the physiological and psychophysical studies made on 3D vision, we attempt to build a model of stereoscopic vision. Hence, we used 2D Gabor filters to model the simple and complex cells sensitive to horizontal binocular disparity (Barlow 1967, Daugman 1985). Each of these cells has a preferred disparity and is sensitive to spatial frequency and orientation. It has been shown by Prince et al (2002) that the range of preferred disparities depends on the spatial frequency. We designed a bank of filters in which the distribution of preferred disparity follows the same principle. Moreover, since the stereo-threshold was found to be increasing with the magnitude of disparity inside each spatial frequency channel, the disparity distribution is not uniform. The preferred disparities are closer for small disparity and sparser for larger disparity representing. The magnitude of disparities and spatial frequencies were selected from psychophysical studies (Farrell, 2004) and according to the parameters of an experimental situation. We took the energy model of Ohzawa et al (1986), based on difference of position between the receptive field of simple cells, as a basis since it has been demonstrated that it fits well with the disparity sensitive cells response from V1 in front of most of stimuli. We modified the classical model by normalizing the complex binocular response by the monocular complex response. This step allows the final complex response to be adapted to the spectral content of the stimulus. We took different measures to reduce false matches such as a pooling procedure and an orientation averaging already used by Chen and Qian (2004). As already demonstrated for 2D vision, a coarse-to-fine process seems to be the best way to deal with multiple spatial frequency channels for stereoscopic vision (Smallman 1995, Menz and Freeman 2003). Indeed, the disparity estimation in our model is determined by the most activated cell for each pixel of the image (Winner Takes All, WTA). The first estimation based on low spatial frequencies determines if the estimation will be refined channels depending on its inclusion in the disparity range of the higher spatial frequency channel. If the estimation is included, the coarse to fine process keeps on going whereas it will stay at this stage for estimation out of range. We tested our model both on artificial and natural images. The disparity estimation is quite accurate, but the spatial accuracy is still too low because of the low frequencies. We attempted to enhance it by extracting disparity frontier thanks to a variant of the "2Subunit" model (Haefner and Cumming 2008) and refine depth map by a fine to coarse process that was studied in some studies (Smallman,1995).

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Thursday, August 8, 9:30AM-11:30AM
Session Th1-1: Cognitive Neuroscience

10:30-10:50AM: Cortical Neural Correlates to Trial-and-Error Learning Dynamics
Yuan Yuan and Jennie Si, Arizona State University

Trial-and-error learning is a method of problem solving and knowledge acquisition. Behavioral evidence of post-error adaptations by human and non-human primates is well-documented [1]. The accompanying brain adaptation was mainly observed through fMRI and EEG [2,3], while neural adaptation taking place at single unit level remains unclear. It is believed that the frontal cortex plays an important role in trial-and-error learning [4]. However, the specific functional roles of the premotor (PM) and primary motor (M1) cortices during trial-and-error learning are being debated. In this study, we devised a directional control task to examine neural activities in PM and M1 in relation to behavioral trial-and-error learning dynamics using a rat model. Eight male Long-evans rats were recorded while performing a directional control task. The task required a rat to choose and press one of the two directional control paddles - left side cues for a left side control press and vice versa. Sugar pellets were delivered only after a successful trial. Rats were implanted in the PM and M1 areas in the left hemisphere, and cortical recording accompanied the entire behavioral learning process. The rats were originally naive and achieved an average behavioral accuracy of 70% around the 20th session.

Our major findings from this study are as follows. (1) The firing rates of individual PM and M1 neurons are dynamically modulated by task factors including directional control (left press, right press or no press), within trial outcome (success or failure) and previous trial outcome (success or failure). During the response period when the rat was required to make a response, 48.69% of neurons were modulated by directional control. Upon the feedback tone of a trial outcome, 30.21% of neurons encoded within trial outcome. 44.08% of PM and M1 neurons encoded the previous trial outcome after the start of the next trial. This also reveals that the information of trial outcome encoded in single PM and M1 neurons is not transient but extended into the next trial. (2) The fraction of neurons encoding previous trial outcome is related to the rat's behavioral learning performance. Three learning stages were identified: the learning stage was the period when the rat's behavioral performance accuracy steadily increased; the pre-learning stage was the first several sessions prior to the learning stage with no steady upward trend; the learned stage was the period after the rats reached 75%. In the learning stage, rats exhibited the strongest behavioral error correction (the rats were more likely to complete a successful trial after a failure rather than after a success), while no such or only weak correction was found in the pre-learning and learned stages; the fraction of previous trial outcome selective neurons in the learning stage (58%) outnumbered the pre-learning (42%) and learned (54%) stages.

These results reveal the cognitive functional roles of PM and M1, which is beyond what have been observed for motor control and preparation, and suggest that M1 and PM may be a part of a supervisory network involved in decision making and evaluation of outcome.

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