



INNS Members News

<https://www.inns.org/>

INSIDE

— IJCNN 2021 Highlights - By Prof Zeng-Guang

— New research publications – By Supriyo Mandal

— Research publication Using AI for detecting skin cancer – By Karl Thurnhofer-Hemsi

— Donald C. Wunsch II becomes NSF Program Director

— SHIFT15M: multiobjective large-scale fashion dataset with distributional shifts - By Masanari Kimura

— Neuro Control T&L Framework for Improving Learning and Retention in Higher Education - By Dr. Nabeel Murshed

— Towards symbiotic autonomous systems
Theme issue compiled and edited by Okyay Kaynak, Wei He, Francesco Flammini and Zhijie Liu

Annual traditional exchange of ties between IEEE CIS and INNS presidents

Memorable event! for the first time, the annual traditional exchange of ties between IEEE CIS and INNS presidents was an exchange of scarves between two women presidents at the IJCNN 2021 conference!



Prof Chrisina Jayne – President of INNS (top) and IEEE CIS President, Bernadette Bouchon-Meunier (bottom).

IJCNN 2021 Highlights

- By Prof Zeng-Guang

The 2021 International Joint Conference on Neural Networks (IJCNN2021), the flagship annual conference of the International Neural Network Society (INNS), was held on July 18th to July 23rd 2021. The event was planned to be held in Shenzhen, China, however, due to COVID-19 restrictions, it was held virtually. The main organizer of the conference were INNS and IEEE Computational Intelligence Society, assisted by the Institute of Automation, Chinese Academy of Sciences and Southern University of Science and Technology, China. The goal of IJCNN2021 was to bring together experts from the fields of all aspects of neural networks theory, analysis, and applications, disseminate the recent advances in the area, discuss future research directions, and exchange application experience.

This year IJCNN has received 2032 papers submitted by 7743 authors from over 74 different countries, 38 of which were later withdrawn. Of these, 1183 papers (59.3%) were accepted. All of them are included in the program as virtual oral presentations. The top ten countries where the submitting authors come from are (in descending order): China, United States, India, Brazil, Australia, United Kingdom, Germany, Japan, Italy, and France. The program features 29 special sessions, two competitions, eight tutorials, and three workshops.

Our technical program was highlighted with seven distinguished plenary speakers. They addressed the following topics:

- "Smart Interactive Buildings" by Professor Marios M. Polycarpou of the KIOS Research and Innovation Center,
- "Active Inference" by Professor Karl J. Friston of the University College London,
- "What neuroimaging can tell about human brain function" by Professor Riitta Salmelin of the Aalto University,
- "Fascinating World of Recurrent Networks: A Personal View" by Professor Peter Tino of the University of Birmingham,
- "Self-Organized Criticality in the Brain" by Dr. Dietmar Plenz of the National Institute of Mental Health,
- "On Presuppositions of Machine Learning: A Best-fitting Theory" by Professor Zongben Xu of the Xi'an Jiaotong University, and
- "Transfer Learning and Knowledge Transfer Between Humans and Machines with Brain-Inspired Spiking Neural Networks for Adaptable and Explainable AI" by Professor Nikola Kasabov of the Auckland University of Technology.

The IJCNN series is renowned for its dedication to recognizing research outcomes achieved by researchers and fellow students. With that goal in mind, this year several awards have been presented, and they are as follows:

Best Paper Award

- "Relevance-Aware Anomalous Users Detection in Social Network via Graph Neural Network" by Li Yangyang, Ji Yipeng, Li Shaoning, He Shulong, Cao Yin hao, Liu Yifeng, Li Xiong, Shi Jun, and Yang Yangchao.

INNS Members News

Best Paper Finalist

- “Deep Recurrent Neural Networks with Attention Mechanisms for Respiratory Anomaly Classification” by Conor Wall, Li Zhang, Yonghong Yu, and Kamlesh Mistry,
- “Robust quantum classifier with minimal overhead” by Daniel K. Park, Carsten Blank, and Francesco Petruccione,
- “Neural inverse optimal control applied to design therapeutic options for patients with COVID-19” by Victor M. Chan, Esteban A. Hernandez-Vargas, and Edgar N. Sanchez, and
- “Under sampling with Support Vectors for Multi-Class Imbalanced Data Classification” by Bartosz Krawczyk, Colin Bellinger, Roberto Corizzo, and Nathalie Japkowicz.

Best Student Paper Award

- “Disentangled-based Adversarial Network for Multiplex Network Embedding” by Shimeng Zhan, Nianwen Ning, Kai Zhao, Lianwei Li, Bin Wu, and Bai Wang, and
- “Robust Deep Multi-task Learning Framework for Cancer Survival Analysis” by Shuang Yun, Bo Du, and Yuren Mao.

Best Student Paper Finalist

- “A New Approach to Design Symmetry Invariant Neural Networks” by Piotr Kicki, Piotr Skrzypczynski, and Mete Ozay,
- “Generative Adversarial Networks: A Likelihood Ratio Approach” by Kalliopi Basioti and George V. Moustakides,
- “Benchmarking Inference Performance of Deep Learning Models on Analog Devices” by Omobayode Fagbohunge and Lijun Qian,
- “CAP-GAN: Towards Adversarial Robustness with Cycle-consistent Attentional Purification” by Mingu Kang, Trung Quang Tran, Seungju Cho, and Daeyoung Kim, and
- “The Case Against Sentiment Analysis for Natural Text” by Shamooun Siddiqui, Ghulam Rasool, and Ravi P. Ramachandran.

New research publications – By Supriyo Mandal

First work "Rating Prediction with Review Network Feedback: A New Direction in Recommendation" is accepted in IEEE Transactions on Computational Social Systems and another one "Graph Neural Networks for Heterogeneous Trust based Social Recommendation" is accepted in IEEE International Joint Conference on Neural Network (IJCNN 2021).

Research publication Using AI for detecting skin cancer – By Karl Thurnhofer-Hemsi, Universidad de Málaga

Skin lesions are caused due to multiple factors, like allergies, infections, exposition to the sun, etc. Melanoma is one of the best-known types of skin lesions due to the vast majority of skin cancer deaths. These skin diseases have become a challenge in medical diagnosis due to visual similarities, and sometimes these misclassifications can aggravate the lesion.

The Computational Intelligence and Image Analysis (ICAI) research group of the University of Málaga has developed an automatic classifier of skin lesions using the power of artificial intelligence. Deep neural networks were trained in order to recognize several types of moles, although their precision is not good enough yet. Therefore, we proposed a shifting technique in the testing phase that improves the classification accuracy by around 6%. Moreover, the proposed methodology is applicable to any other image classification model based on deep networks. Read more at <https://doi.org/10.1109/ACCESS.2021.3103410>

Donald C. Wunsch II becomes NSF Program Director, Missouri S&T / NSF

In 2021, Donald C. Wunsch II became a Program Director at the National Science Foundation, on contract from Missouri University of Science and Technology, where he is the Mary K. Finley Missouri Distinguished Professor and Director of the Applied Computational Intelligence Laboratory. He and his students and collaborators continue their research on unsupervised and reinforcement learning. At NSF he has supported programs in Energy, Power, Controls and Networks, Harnessing the Data Revolution, Foundational Research in Robotics, National Robotics Initiative, Mathematics of Deep Learning, CAREER, and more.

See more at https://www.nsf.gov/staff/staff_bio.jsp?lan=dwunsch&org=NSF&from_org=NSF

SHIFT15M: multiobjective large-scale fashion dataset with distributional shifts - By Masanari Kimura, ZOZO Research

We present a novel dataset aimed at properly evaluating machine learning models under distributional shifts. Our SHIFT15M dataset has several good properties:

1. Multiobjective. Each instance in the dataset has several numerical values that can be used as target variables.
2. Large-scale. The SHIFT15M dataset consists of 15million fashion images.

INNS Members News

3. Coverage of types of dataset shifts. SHIFT15M contains multiple dataset shift problem settings (e.g., covariate shift or target shift). SHIFT15M also enables the performance evaluation of the model under various magnitudes of dataset shifts by switching the magnitude. In addition, we provide software to handle SHIFT15M in a very simple way.

Arxiv: <https://arxiv.org/abs/2108.12992>

GitHub: <https://github.com/st-tech/zozo-shift15m>

Neuro Control T&L Framework for Improving Learning and Retention in Higher Education - By Dr. Nabeel Murshed, University of Dubai

Studies have shown that an increase in retention is related, among other things, to improvement in teaching and learning. To improve learning and retention, we developed a Neuro Control Teaching and Learning (T&L) Framework based on control system structure and Neural Networks (NNs). It has a controller, a process, dual Neuro feedback modules, and knowledge base. The controller component is the teaching methodologies, based on established learning theories and best practice. The process consists of lecture design and delivery, real-time formative and summative assessments. The feedback modules are based on fuzzy ARTMAP NNs. Initial results, produced 85.6% satisfactory improvement of student learning, compared to traditional approach. See more at <https://www.researchgate.net/profile/Nabeel-Murshed>

PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY A

MATHEMATICAL, PHYSICAL AND ENGINEERING SCIENCES

Towards symbiotic autonomous systems

Theme issue compiled and edited by Okyay Kaynak, Wei He, Francesco Flammini and Zhijie Liu

Published 16 August 2021. Available online and in print.



THE
ROYAL
SOCIETY
PUBLISHING

About this issue

Starting in the second half of the last century, the widespread use of computers significantly changed the lifestyle of humankind. Since then, with the explosive and perhaps disruptive developments in digital technology, the internet, and IoT, and artificial intelligence have promoted a growing interaction among humans and machines, with technology capable of extending human capabilities (augmentation) and making devices seamlessly interact with humans. In the longer term, there is a growing consensus that this will create symbiotic autonomous systems (SASs). Although this is a trend that will see maturity possibly in the next decade, research and industry interest are already strong, resulting in several concrete results ready to hit the market. What matters most in the context of SAS is the varying degrees of autonomy they have, their capability to evolve (e.g., to learn and adapt), and their ability to interact with their environment, between themselves, and with humans.

Access content online at bit.ly/TransA-2207

Purchase the print issue at the reduced price of £35 (usual price £60) by visiting bit.ly/TA-print and entering the promotional code **TA 2207** when prompted, or contact:

Turpin Distribution

T +44 1767 604951

E royalsociety@turpin-distribution.com

For more information, contact:

The Royal Society

6 – 9 Carlton House Terrace

London

SW1Y 5AG

T +44 20 7451 2500

W royalsociety.org

E philtransa@royalsociety.org

To find out more about proposing a theme issue and becoming a Guest Editor of the journal, please visit:

bit.ly/TAGuestEd

Cover image:

The image represents the interaction of the human and the robot where the goal is to bridge the gap between the physical and the digital world. Within the image are several icons which represent the emerging technologies that have been identified as primary focus areas (Machine Learning, Artificial Intelligence, Robotics, Digital Twins, Autonomous Systems, etc.). These efforts focus on leveraging technologies that touch a vast array of industries (industrial, healthcare, finance, etc.). Image Credit: J. Bernicker. IEEE Digital Reality, an initiative supported by IEEE (<https://digitalreality.ieee.org/>).

Contents

INTRODUCTION

Towards symbiotic autonomous systems

O Kaynak, W He, F Flammini and Z Liu

ARTICLES

The winding path towards symbiotic autonomous systems

R Saracco, K Grise and T Martinez

On the philosophical, cognitive and mathematical foundations of symbiotic autonomous systems

Y Wang, F Karray, S Kwong, KN Plataniotis, H Leung, M Hou, E Tunstel, IJ Rudas, L Trajkovic, O Kaynak, J Kacprzyk, M Zhou, MH Smith, P Chen and S Patel

A model of symbiomemesis: machine education and communication as pillars for human-autonomy symbiosis

H Abbass, E Petraki, A Hussein, F McCall and S Elsawah

Artificial intelligence explainability: the technical and ethical dimensions

JA McDermid, Y Jia, Z Porter and I Habli

Towards the realization of dynamically adaptable manufacturing automation systems

R Harrison, D Vera and B Ahmad

Potential for combining semantics and data analysis in the context of digital twins

B Vogel-Heuser, F Ocker, I Weiß, R Mieth and F Mann

Industrial applications of digital twins

Y Jiang, S Yin, K Li, H Luo and O Kaynak

The personal digital twin, ethical considerations

D de Kerckhove

Legal aspects related to digital twin

M Teller

Digital twins as run-time predictive models for the resilience of cyber-physical systems: a conceptual framework

F Flammini

Engineering human-focused Industrial Cyber-Physical Systems in Industry 4.0 context

AW Colombo, S Karnouskos and C Hanisch

Co-carrying an object by robot in cooperation with humans using visual and force sensing

X Yu, S Zhang, Y Liu, B Li, Y Ma and G Min

Stochastic model predictive control framework for resilient cyber-physical systems: review and perspectives

J Chen and Y Shi

Adaptive neural network control for nonlinear cyber-physical systems subject to false data injection attacks with prescribed performance

Z Liu, J Tang, Z Zhao and S Zhang

Development of an industrial cyber-physical platform for small series production using digital twins

EI Yablochnikov, AV Chukichev, OS Timofeeva, OA Abyshv, GE Abaev and AW Colombo