

The 21st IEEE/WIC/ACM International Conference on Web Intelligence and Intelligent Agent Technology (WI = Artificial Intelligence in the Connected World)

# November 17-20, 2022 Niagara Falls, Canada















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## Welcome Message

The 2022 IEEE/WIC/ACM International Conference on Web Intelligence and Intelligent Agent Technology (WI-IAT'22) provides a premier international forum to bring together researchers and practitioners from diverse fields for presentation of original research results, as well as exchange and dissemination of innovative and practical development experiences on Web intelligence and intelligent agent technology research and applications. The first international conference of Web Intelligence and Intelligent Agent Technology (WI-IAT'01) was held in Maebashi, Japan, 2001. Then, it followed by WI-IAT'03 in Halifax, Canada, WI-IAT'04 in Beijing, China, WI-IAT'05 in Compiegne, France, WI- IAT '06 in Hong Kong, WI-IAT'07 in Silicon Valley, USA, WI-IAT'08 in Sydney, Australia, WI-IAT'09 in Milano, Italy, WI-IAT'10 in Toronto, Canada, WI-IAT'11 in Lyon, France, WI-IAT'12 in Macau, China, WI-IAT'13 in Atlanta, USA, WI-IAT'14 in Warsaw, Poland, and WI-IAT'15 in Singapore. The goal of WI-IAT conferences is to provide a global forum for scientists, engineers and educators to present the latest WI-IAT technologies, discuss how to develop future intelligent systems for complex applications. After these years, in 2016, WI-IAT conferences have been merged as one brand (WI'16 in Omaha, USA, WI'17 in Leipzig, Germany, WI'18 in Santiago de Chile, and WI'19 in Thessaloniki, Greece) by redefining and vitalizing the WI aims and topics. In recognition of the strong connection of Web Intelligence and Intelligent Agent Technology, the classic brand of WI-IAT was resumed in 2020. After the great successful online WI-IAT'20 and hybrid WI-IAT'21 during the global pandemic, WI-IAT'22 will be held in Niagara Falls, Canada, and once again, in the hybrid mode.

Web Intelligence and Intelligent Agent Technology (WI-IAT) aims to achieve a multidisciplinary balance between research advances in theories and methods usually associated with collective intelligence, data science, human-centric computing, knowledge management, network science, autonomous agents and multi-agent systems. It is committed to addressing research that both deepen the understanding of computational, logical, cognitive, physical, and social foundations of the future Web, and enable the development and application of intelligent technologies. WI-IAT'22 provides a premier forum and features high-quality, original research papers and real-world applications in all theoretical and technology areas that make up the field of Web Intelligence and Intelligent Agent Technology. WI-IAT'22 welcomes research, application as well as Industry/Demo-Track paper submissions. Tutorial, Workshop and Special-Session proposals and papers are also welcome. WI-IAT'22 in Niagara Falls is officially sponsored by IEEE Computer Society Technical Committee on Intelligent Informatics (TCII), Web Intelligence Consortium (WIC), Association for Computing Machinery (ACM), Wilfrid Laurier University, York University, and IOS Press. WI-IAT'22 will provide a broad forum that academia, professionals and industry people can exchange their ideas, findings and strategies in utilizing the power of human brains and man-made networks to create a better world. More specifically, the fields of how intelligence is impacting the Web of People, the Web of Data, the Web of Things, the Web of Trust, the Web of Agents, and emerging Web in health and smart living in the 5G Era. Therefore, the theme of WI-IAT'22 will be "Web Intelligence = AI in the Connected World".

Keynotes for WI-IAT'22:

- Ophir Frieder, Fellow of the American Association for the Advancement of Science, Fellow of the Association for Computing Machinery, Fellow of the Institute of Electrical and Electronics Engineering, Georgetown University, USA: "*Computational Intelligence for Health*"
- Kevin Leyton-Brown, Fellow of the Association for the Advancement of Artificial Intelligence, Fellow of the Association of Computing Machinery, University of British Columbia, Canada: "*BetterPeer Review via AI*"
- Ming Li, Fellow of the Royal Society of Canada, Fellow of the Association for Computing Machinery, Fellow of the Institute of Electrical and Electronics Engineering, University of Waterloo, Canada: "A Model for Human K-shot Learning"
- Witold Pedrycz, Fellow of the Royal Society of Canada, Fellow of the Institute of Electrical and Electronics Engineering, University of Alberta, Canada: "Green Machine Learning and Granular Modeling: Fostering New Development Avenues"
- Cynthia Rudin, Fellow of the Association for the Advancement of Artificial Intelligence, Fellow of the American Statistical Association, Fellow of the Institute of Mathematical Statistics, Duke University, USA: "*Do Simpler Machine Learning Models Exist and How Can We Find Them*?"
- Yiyu Yao, Fellow of the International Rough Set Society, University of Regina, Canada: "Symbols-Meaning-Value (SMV) Space Perspectives on Web Intelligence"

We thank all keynotes and invited speakers for their contribution to the success of the conference, and their willingness to share their brilliant expertise and wisdom with our participants.

Overall, the WI-IAT'22 conference received 229 submission, including 103 regular papers and 126 workshop papers, with 363 authors from 35 countries across the world. After a rigorous peer review process undertaken by the Program Committee members and

additional reviewers, 31 top quality papers are included in the proceedings as regular papers, marking an acceptance rate of 30.0%. Also included in the proceedings are 23 short papers with semi-top research merit. Alongside the main conference, there are jointly 22 workshops and special sessions, which include many pioneered and exploratory works in the companion proceedings. We truly congratulate the authors of these papers for such a great achievement. We also sincerely thank all the authors of non-accepted papers for their contributions to WI-IAT'22, and wish to express our gratitude to all the reviewers who provided valuable feedback.

It is impossible to organize a first-class conference without the support and expertise of many outstanding researchers, leaders, volunteers, and sponsors. We acknowledge the time and effort dedicated by the members of the WI-IAT'22 Organizing Committee and Program Committee. They assured the success and academic merit of the conference. We would like to thank the keynote speakers and workshop and special session organizers, who selflessly contributed their time, knowledge, and expertise to WI-IAT'22 and helped make the WI-IAT'22 Technical Program interesting and beneficial. We would also like to thank the WI-IAT Steering Committee Co-chairs, Ning Zhong and Jiming Liu, whose guidance was essential for the success of the conference. Our gratitude also goes to Hongzhi Kuai and Juzhen Dong, who always dealt with issues in a timely and patient manner, no matter how late and how often they arose. We also thank the sponsors of WI-IAT'22 such as IEEE Computer Society Technical Committee on Intelligent Informatics (TCII), Web Intelligence Consortium (WIC), Association for Computing Machinery (ACM), Wilfrid Laurier University, York University, and IOS Press for their trust and support. Last but not least, we cannot extend enough thanks to the authors who contributed to the WI-IAT'22 conference. Without them, WI-IAT'22 wouldn't be possible.

We wish you many rewarding experiences at WI-IAT'22, a hybrid conference with both online and offine modes!

Yours sincerely.

Jiashu Zhao, Wilfrid Laurier University, Canada (PC Co-Chair WI-IAT 2021) Ebrahim Bagheri, Ryerson University, Canada (PC Co-Chair WI-IAT 2021) Norbert Fuhr, University of Duisburg-Essen, Germany (PC Co-Chair WI-IAT 2021) Atsuhiro Takasu, National Institute of Informatics, Japan (PC Co-Chair WI-IAT 2021) Yixing Fan, Chinese Academy of Sciences, China (PC Co-Chair WI-IAT 2021) Gabriella Pasi, University of Milano-Bicocca, Italy (General Co-Chair WI-IAT 2022) Jimmy Huang, York University, Canada (General Co-Chair WI-IAT 2022) Jie Tang, Tsinghua University, China (General Co-Chair WI-IAT 2022) Christopher W. Clifton, Purdue University, USA (General Co-Chair WI-IAT 2022)

October 2022

General Chairs:	Gabriella Pasi <i>(University of Milano-Bicocca, Italy)</i> Jimmy Huang <i>(York University, Canada)</i> Jie Tang <i>(Tsinghua University, China)</i> Christopher W. Clifton <i>(Purdue University, USA)</i>
Program Committee Chairs:	Jiashu Zhao (Wilfrid Laurier University, Canada) Ebrahim Bagheri (Ryerson University, Canada) Norbert Fuhr (University of Duisburg-Essen, Germany) Atsuhiro Takasu (National Institute of Informatics, Japan) Yixing Fan (Chinese Academy of Sciences, China)
Local Organizing Chairs:	Mehdi Kargar <i>(Ryerson University, Canada)</i> George J. Georgopoulos <i>(York University, Canada)</i>
Workshop/Special Session Chairs:	Hiroki Matsumoto <i>(Maebashi Institute of Technology, Japan)</i> Ameeta Agrawal <i>(Portland State University, USA)</i> Cathal Gurrin <i>(Dublin City University, Ireland)</i> Chao Huang <i>(University of Hong Kong, China)</i>
Publicity Chairs:	Hongzhi Kuai <i>(Maebashi Institute of Technology, Japan)</i> Yang Liu <i>(Wilfrid Laurier University, Canada)</i> Yan Ge <i>(University of Bristo, UK)</i>
Tutorial Chairs:	Vivian Hu <i>(Ryerson University, Canada)</i> Xing Tan <i>(Lakehead University, Canada)</i> Shuaiqiang Wang <i>(Baidu, China)</i>
Proceeding Chairs:	Amran Bhuiyan (York University, Canada) Jingyuan Li (Beijing Technology and Business University, China)
Industry Chairs:	Stephen Chan <i>(Dapasoft, Canada)</i> Long Xia <i>(Baidu, China)</i>
Treasurer:	Hajer Ayadi (York University, Canada)

# Program at a Glance

PS: please note	the time zone in	Niagara Falls is Eastern Daylight Time (EDT) r	iow.
Time	Duration	Thursday, 17	of November
9:00-20:30		Worksh	ops Day
Time	Duration	Friday, 18 c	of November
8:45-9:00	15 mins	Opening Cerer	nony [Zoom 1]
9:00-9:50	50 mins	Keynote: Cynthia	a Rudin [Zoom 1]
10:00-10:50	50 mins	Keynote: Ophir	Frieder [Zoom 1]
10:50-11:00	10 mins	Coffee	: Break
11:00-12:00	60 mins	Web of People 1 [Zoom 1]	Web of Data 1 [Zoom 2]
12:00-13:00	60 mins	Lu	nch
13:00-13:50	50 mins	Keynote: Kevin Ley	ton-Brown [Zoom 1]
13:50-14:00	10 mins	Coffee	Break
14:00-15:40	100 mins	Web of People 2 [Zoom 1]	Web of Data 2 [Zoom 2]
15:40-15:50	10 mins	Coffee	Break
15:50-17:30	100 mins	Web of Things [Zoom 1]	Web of Data 3 [Zoom 2]
Time	Duration	Saturday, 19	of November
9:00–9:50	50 mins	Keynote: Witold	Pedrycz [Zoom 1]
9:50-10:00	10 mins	Coffee Bre	ak [Onsite]
10:00-10:50	50 mins	Keynote: Yiyu Yao	[Onsite & Zoom 1]
10:50-11:40	50 mins	Special Event: Introduction of Web Int	telligence Academy [Onsite & Zoom 1]
11:40-12:10	30 mins	Lunch Bre	eak[Onsite]
12:10-13:55	105 mins	OnSite Session 1	Onsite & Zoom 1]
13:55-14:05	10 mins	Coffee Bre	ak [Onsite]
14:05-15:30	85 mins	OnSite Session 2	Onsite & Zoom 1]
15:30-15:40	10 mins	Coffee Bre	ak [Onsite]
15:40-17:30	110 mins	Web of Trust [Zoom 1]	Web of Agents [Zoom 2]
17:30-20:30	180 mins	Banquet	[Onsite]
Time	Duration	Sunday, 20 d	of November
9:00-9:50	50 mins	Keynote: Min	g Li [Zoom 1]
9:50-10:00	10 mins	Coffee	Break
10:00-11:20	80 mins	Special Track: Emerging Web in Health and Smart Living 1 [Zoom 1]	Special Track: Cyber System, Software Network, and Internet of Things [Zoom 2]
11:20-11:30	10 mins	Coffee	Break
11:30-12:30	60 mins	Special Track: Emerging Web in Health and Smart Living 2 [Zoom 1]	Web of Data 4 [Zoom 2]
12:30-13:00	30 mins	Closing Ceremony: Best Paper Awards Ceremo	ony and WI-IAT 2023 Announcement [Zoom 1]

Zoom 1: https://us02web.zoom.us/j/81080144821; Passcode: 864437 Zoom 2: https://us02web.zoom.us/j/6462144749; Passcode: 654321

## Do Simpler Machine Learning Models Exist and How Can We Find Them?



#### Cynthia Rudin

Duke University, USA

Fellow of the Association for the Advancement of Artificial Intelligence (AAAI), Fellow of the American Statistical Association (ASA), Fellow of the Institute of Mathematical Statistics (IMS)

**Time:** November 18, 9:00-9:50 **Room:** Zoom 1

**Abstract:** While the trend in machine learning has tended towards building more complicated (black box) models, such models are not as useful for high stakes decisions - black box models have led to mistakes in bail and parole decisions in criminal justice, flawed models in healthcare, and inexplicable loan decisions in finance. Simpler, interpretable models would be better. Thus, we consider questions that diametrically oppose the trend in the field: for which types of datasets would we expect to get simpler models at the same level of accuracy as black box models? If such simpler-yet-accurate models exist, how can we use optimization to find these simpler models? In this talk, I present an easy calculation to check for the possibility of a simpler (yet accurate) model before computing one. This calculation indicates that simpler-but-accurate models do exist in practice more often than you might think. Also, some types of these simple models are (surprisingly) small enough that they can be memorized or printed on an index card.

**Short Bio:** Cynthia Rudin is the Earl D. McLean, Jr. Professor of Computer Science and Engineering at Duke University. She directs the Interpretable Machine Learning Lab, and her goal is to design predictive models that people can understand. Her lab applies machine learning in many areas, such as healthcare, criminal justice, and energy reliability. She holds degrees from the University at Buffalo and Princeton. She is the recipient of the 2022 Squirrel Al Award for Artificial Intelligence for the Benefit of Humanity from the Association for the Advancement of Artificial Intelligence (the "Nobel Prize of Al"). She received a 2022 Guggenheim fellowship, and is a fellow of the American Statistical Association, the Institute of Mathematical Statistics, and the Association for

the Advancement of Artificial Intelligence. Her work has been featured in many news outlets including the NY Times, Washington Post, Wall Street Journal, and Boston Globe.

### **Computational Intelligence for Health**



**Ophir Frieder** Georgetown University, USA Fellow of AAAS,ACM,IEEE

**Time:** November 18, 10:00-10:50 **Room:** Zoom 1

**Abstract:** We are just now slowly, physically recovering from the recent pandemic; mentally we have a long journey ahead of us, and many are touting a looming mental health crisis. Thus, initially, we describe a web-intelligent, social-media monitoring approach for depression detection and continue with a presentation of a patented, licensed, and proprietary intelligent agent that identifies behavioral deviancy, an early warning for potential mental health concerns. We then turn our attention towards web-intelligent monitoring of social media to detect physical disease outbreaks and describe the implications of such surveillance schemes to healthcare planning for a major children-focused hospital. We conclude by, once again, focusing on patented, licensed, and proprietary intelligent agent technology this time to screen for covid via the use of surrogates. Other medically oriented mining and search applications are briefly mentioned.

**Short Bio:** Ophir Frieder focuses on scalable information processing systems with particular emphasis on health informatics. He is a Fellow of the AAAS, ACM, AIMBE, IEEE, and NAI, and a Member of the Academia Europaea, the European Academy of Sciences and Arts, and the ACM SIGIR Academy. Heavily involved with industrial efforts, he is Chief Scientific Officer of Invaryant, Inc and Lead Science and Technology Advisor for Aurora Forge. He is a member of the computer science faculty at Georgetown University and the biostatistics, bioinformatics and biomathematics faculty in the Georgetown University Medical Center.

### Better Peer Review via Al



#### Kevin Leyton-Brown

University of British Columbia, Canada Fellow of the Association for the Advancement of Artificial Intelligence (AAAI), Fellow of the Association of Computing Machinery (ACM)

Time: November 18, 13:00-13:50 Room: Zoom 1

**Abstract:** Peer review is widespread across academia, ranging from publication review at conferences to peer grading in undergrad classes. Some key challenges that span such settings include operating on tight timelines using limited resources, directing scarce reviewing resources in a way that maximizes the value they provide, and providing incentives that encourage high-quality reviews and discourage harmful behavior. This talk will discuss two large-scale, fielded peer review systems, each of which was enabled by a variety of Al techniques.

First, I will describe and evaluate a novel reviewer-paper matching approach that was first deployed at the 35th AAAI Conference on Artificial Intelligence (AAAI 2021); it continues to be used by AAAI and has since been adopted (wholly or partially) by ICML, IJCAI, and ACM EC. This approach has three main elements: (1) collecting and processing input data to identify problematic matches and generate reviewer-paper scores; (2) formulating and solving an optimization problem to find good reviewer-paper matchings; and (3) employing a two-phase reviewing process that shifts reviewing resources away from papers likely to be rejected and towards papers closer to the decision boundary. Our evaluation of these innovations is based on an extensive post-hoc analysis on real data.

Second, I will discuss a peer grading system designed for repeated settings such as weekly assignments in large undergraduate courses. Our approach uses probabilistic modeling to simultaneously estimate each submission's true quality and all students' (and TAs') grading accuracy. We go beyond existing methods by detecting strategic behavior by students (reporting grades close to the class average without doing the work); correctly handling censored observations arising from discrete-valued grading rubrics; and improving the interpretability of the grades we ultimately assign to students. We evaluated our approach on real-world data obtained from four large classes, showing that our techniques accurately estimate true grades, students' likelihood of submitting uninformative grades, and the variation in their inherent grading error. We furthermore used synthetic data to characterize our models' robustness.

**Short Bio:** Kevin Leyton-Brown is a professor of Computer Science and a Distinguished University Scholar at the University of British Columbia. He also holds a Canada CIFAR AI Chair at the Alberta Machine Intelligence Institute and is an associate member of the Vancouver School of Economics. He is an Fellow of the Association for Computing Machinery (ACM; awarded in 2020) and the Association for the Advancement of Artificial Intelligence (AAAI; awarded in 2018). He was a member of a team that won the 2018 INFORMS Franz Edelman Award for Achievement in Advanced Analytics, Operations Research and Management Science, described as "the leading O.R. and analytics award in the industry." Leyton-Brown also received UBC's 2015 Charles A. McDowell Award for Excellence in Research, a 2014 NSERC E.W.R. Steacie Memorial Fellowship and a 2013 Outstanding Young Computer Science Researcher Prize from the Canadian Association of Computer Science.

## Green Machine Learning and Granular Modeling: Fostering New Development Avenues



#### Witold Pedrycz

University of Alberta, Canada Fellow of the Royal Society of Canada, Fellow of the Institute of Electrical and Electronics Engineering (IEEE)

**Time:** November 19, 9:00-9:50 **Room:** Zoom 1

**Abstract:** The visible trends of Machine Learning (ML) are inherently associated with the diversity of data and innovative ways they are used in order to carry out learning pursuits. The ongoing objectives of the research agenda are also investigated in the context of green ML (usually referred to as green AI). One can identify three ongoing challenges with far-reaching methodological implications, namely (i)completing designs in the presence of strict constraints of privacy and security, (ii) efficient model building completed with limited data of varying quality, and (iii) a reduction of computing effort knowledge transfer and distillation.

We advocate that to conveniently address these quests, it becomes beneficial to engage the fundamental framework of Granular Computing to enhance the existing approaches (such as e.g., federated learning in case of (i) and transfer knowledge in (iii)) or establish new directions to the problem formulation. Likewise, it is also essential to establish sound mechanisms of evaluation of the performance of the ML architectures. It will be demonstrated that various ways of conceptualization of information granules in terms of fuzzy sets, sets, rough sets, and others may lead to efficient solutions.

To establish a suitable conceptual ML framework, we include a brief discussion of concepts of information granules and Granular Computing. We show how granular models endow numeric models with their quantification mechanisms.

To proceed with a detailed discussion, a concise information granules-oriented design of rulebased architectures is outlined. A way of forming the rules through unsupervised federated learning is investigated along with algorithmic developments. A granular characterization of the model formed by the server vis-a-vis data located at individual clients is presented. It is demonstrated that the quality of the rules at the client's end is described in terms of granular parameters and subsequently the global model becomes represented as a granular construct. The roles of granular augmentations of models in the setting of granular knowledge distillation are outlined. It is shown how the agenda of green ML is effectively realized by exploring information granules and stressing an importance of the holistic perspective at critical trade-offs among interpretability, enormous computational overhead, and transparency of predictors and classifiers.

**Short Bio:** Dr. Witold Pedrycz (IEEE Life Fellow) is Professor and Canada Research Chair (CRC) in Computational Intelligence in the Department of Electrical and Computer Engineering, University of Alberta, Edmonton, Canada. He is also with the Systems Research Institute of the Polish Academy of Sciences, Warsaw, Poland. Dr. Pedrycz is a foreign member of the Polish Academy of Sciences and a Fellow of the Royal Society of Canada. He is a recipient of several awards including Norbert Wiener award from the IEEE Systems, Man, and Cybernetics Society, IEEE Canada Computer Engineering Medal, a Cajastur Prize for Soft Computing from the European Centre for Soft Computing, a Killam Prize, a Fuzzy Pioneer Award from the IEEE Computational Intelligence Society, and 2019 Meritorious Service Award from the IEEE Systems Man and Cybernetics Society., His main research directions involve Computational Intelligence, fuzzy modeling and Granular Computing, knowledge discovery, pattern recognition, data science, knowledge-based neural networks among others., Dr. Pedrycz is involved in editorial activities. He is an Editor-in-Chief of Information Sciences, Editor-in-Chief of WIREs Data Mining and Knowledge Discovery (Wiley), and Co-editor-in-Chief of Int. J. of Granular Computing (Springer) and J. of Data Information and Management (Springer).

# Symbols-Meaning-Value (SMV) Space Perspectives on Web Intelligence



#### Yiyu Yao

University of Regina, Canada Fellow of the International Rough Set Society (IRSS)

**Time:** November 19, 10:00-10:50 **Room:** Molinara & Fallsview

**Abstract:** Twenty-two years ago, Professors Ning Zhong, Jiming Liu, Setsuo Ohsuga, and I wrote a two-page position paper that envisions a new field of Web Intelligence (WI). On the one hand, although profound advances in Artificial Intelligence (AI), Information Technology (IT), and the Web have been made over the last two decades, our vision that "WI exploits AI and advanced information technology on the Web and Internet" still remains meaningful. On the other hand, it might be a good time to take another look at Web Intelligence based on the experience of the twenty plus years. Since 2009, I have been working on a theory of three-way decision that encompasses thinking, problem-solving, and computing in threes (i.e., triads). My talk will focus on three-way decision perspectives on Web Intelligence. First, I will briefly comment on the past, present, and future of Web Intelligence, under the main theme of the Conference, "WI = Artificial Intelligence in the Connected World." Then, I will introduce the concept of a Symbols-Meaning-Value (SMV) space and its interpretations based on the triads of Data-Knowledge-Wisdom, Perception-Cognition-Action, and Seeing-Knowing-Doing. Finally, I will elaborate on an important implication of SMV spaces to research in Web Intelligence, based on the triad of the (Data) Web, the Semantic Web, and the Wisdom Web.

**Short Bio:** Yiyu Yao is a professor of computer science with the Department of Computer Science, University of Regina, Canada. His research interests include three-way decision, granular computing, Web intelligence, rough sets, formal concept analysis, information retrieval, and data mining. He proposed a theory of three-way decision, a decision-theoretic rough set model, and a triarchic theory of granular computing. He has published over 400 papers. He was selected as a highly cited researcher by Clarivate from 2015 to 2019.

## A Model for Human K-shot Learning



#### Ming Li

University of Waterloo, Canada Fellow of the Royal Society of Canada, Fellow of the Association for Computing Machinery (ACM), Fellow of the Institute of Electrical and Electronics Engineering (IEEE)

**Time:** November 20, 9:00-9:50 **Room:** Zoom 1

**Abstract:** From a basic principle of thermodynamics, we derive a model for human k-shot learning. We further justify our model with experiments, showing it has advantages over other deep learning models in various k-shot learning scenarios. From k-shot learning, we then explore consciousness.

**Short Bio:** Ming Li is a Canada Research Chair in Bioinformatics and a University Professor at the University of Waterloo. He is a fellow of Royal Society of Canada, ACM, and IEEE. He is a recipient of Canada's E.W.R. Steacie Fellowship Award in 1996, the 2001 Killam Fellowship and the 2010's Killam Prize. Together with Paul Vitanyi they have pioneered the applications of Kolmogorov complexity and co-authored the book ""An introduction to Kolmogorov complexity and its applications"". His recent research interests recently include bioinformatics, natural language processing, deep learning, and information distance.

# Main Conference Program

# Friday, 18 of November

08:45-09:00	Opening Ceremony
09:00–09:50	Keynote: Cynthia Rudin Title: Do Simpler Machine Learning Models Exist and How Can We Find Them?
10:00-10:50	Keynote: Ophir Frieder Title: Computational Intelligence for Health
10:50-11:00	Coffee Break
	Session: Web of People 1
	Room: Zoom 1; Chair: Fujio Toriumi, tori@sys.t.u-tokyo.ac.jp
11:00-11:20	Job Recommendation Based on Multiple Behaviors and Explicit Preferences; Yosuke Saito and Kazunari Sugiyama
11:20-11:35	Predicting response probability by embedding questions in online question recommendation; Yuki Hoshino, Makoto Tasaki, Keisuke Mizutani, Motoya Azami, Kota Ishizuka, and Kazuhide Nakata
11:35–11:50	Online Discussion Transition Analysis for Group Learning Support; Yasunobu Sumikawa, Akikazu Takada, Akira Ichinose, Ari Murakami, Yuki Toyono, Ryohei Ikejiri, Meiko Sakasegawa, Kaoru Sekine, and Yuhei Yamauchi
_	Session: Web of Data 1
Roc	om: Zoom 2; Chair:Joanna Olszewska, joanna.olszewska@ieee.org
11:00-11:20	SMAT: Semantic String Matching in Action Theory; Xing Tan
11:20-11:35	Organizing Search Results into a Table to Assist in Understanding and Expanding Search Target; Shin-ya Sato
11:35–11:50	Impact of Injecting Ground Truth Explanations in Embeddings on Relational Graph Convolutional Networks and their Explanation Methods for Link Prediction on Knowledge Graphs, Nicholas Halliwell; Nicholas Halliwell, Fabien Gandon, and Freddy Lecue

12:00-13:00	Lunch
13:00-13:50	Keynote: Kevin Leyton-Brown Title: BetterPeer Review via Al
13:50-14:00	Coffee Break
F	Session: Web of People 2 Room: Zoom 1; Chair:Divya Sardana, divya.sardana@gmail.com
14:00-14:20	Predicting Hateful Discussions on Reddit using Graph Transformer Networks and Communal Context; Liam Hebert, Lukasz Golab, and Robin Cohen
14:20-14:40	EurOpi: Multilingual Aspect-Based Sentiment Analysis enabled by a Knowledge Base; Danny Suarez Vargas, Lucas R. Pessutto, Tiago de Melo
14:40-14:55	Intelligent Prediction-Intervention approach to Support Students' Success in Web-based Learning Environments: A Case Study in Higher Education; Tesnim KHELIFI, Nourhene BEN RABAH, Ibtissem DAOUDI, Bénédicte LE GRAND, and Farah BARIKA KTATA
14:55-15:10	What Really Matters in a Table? Insights from a User Study; Marco Cremaschi, Jessica Amianto Barbato, Anisa Rula, Matteo Palmonari, and Rossana Actis-Grosso
15:10-15:25	Entity Level QA Pairs Dataset for Sentiment Analysis; Aritra Kumar Lahiri and Qinmin Vivian Hu
15:25-15:40	An Entire Space Multi-gate Mixture-of-Experts Model for Recommender Systems; j ge and zheng ye
	Session: Web of Data 2 Room: Zoom 2: Chair:Marek Reformat, reformat@ualberta.ca
14:00-14:20	Active Learning Strategies Based on Text Informativeness; Ruide Li, Yoko Yamakata, and Keishi Tajima
14:20-14:40	Multiple Neighbor Relation Enhanced Graph Collaborative Filtering; Riwei Lai, Shitong Xiao, Rui Chen, Li Chen, Qilong Han, and Li Li
14:40-14:55	Question answering over knowledge graphs: a graph-driven approach; Sareh Aghaei, Sepide Masoudi, Tek Raj Chhetri, and Anna Fensel

14:55-15:10	Retrieving and Ranking Relevant Products from Boolean Natural Language Queries; Matthew Moulton, Siqi Gao, and Yiu-Kai Ng
15:10-15:25	Accurate Context Extraction from Unstructured Text Based on Deep Learning; Maha Mallek, Ramzi Guetari, Sébastien Fournier, Wided Lejouad Chaari, and Bernard Espinasse
15:25-15:40	Pointspectrum: Equivariance Meets Laplacian Filtering for Graph Representation Learning; Marinos Poiitis, Pavlos Sermpezis, and Athena Vakali
15:40-15:50	Coffee Break
	Session: Web of Things Room: Zoom 1; Chair:Atsuhiro Takasu, takasu@nii.ac.jp
15:50-16:10	User Embedding Sharing with Deep Canonical Correlation Analysis for Dual-Target Cross-Domain Recommender System; Pongsakorn Jirachanchaisiri, Saranya Maneeroj, and Atsuhiro Takasu
16:10-16:30	POWoT: a Privacy Ontology for the Web of Things; Yacine Sam, Kamel Adi, Nasredine Cheniki, and Noé Breton
16:30–16:50	Mixture of Linear Additive Markov Processes: A Probabilistic Model for Joint Clustering and History-Dependent Transition Estimation; Masahiro Kohjima
	Session: Web of Data 3 Room: Zoom 2: Chair:Marek Reformat, reformat@ualberta.ca
15:50-16:10	Coalitional Game Theoretic Federated Learning; Masato Ota, Yuko Sakurai, and Satoshi Oyama
16:10-16:30	Morphologically-Aware Vocabulary Reduction of Word Embeddings; Chong Cher Chia, Maksim Tkachenko, and Hady Lauw
16:30-16:50	Discovering Structural Hole Spanners in Dynamic Networks via Graph Neural Networks; Diksha Goel, Hong Shen, Hui Tian, and Mingyu Guo
16:50-17:10	Predicting the Score of Atomic Candidate OWL Class Axioms; Ali Ballout, Andrea G. B. Tettamanzi, and Celia da Costa Pereira

17:10-17:30	Optimizing the Computation of a Possibilistic Heuristic to Test OWL 2 SubClassOf Axioms Against RDF Data; Rémi FELIN, Olivier CORBY,
	Catherine FARON, and Andrea TETTAMANZI

## Saturday, 19 of November

	Keynote: Witold Pedrycz
09:00-09:50	Title: Green Machine Learning and Granular Modeling:
	Fostering New Development Avenues
09:50-10:00	Coffee Break
10.00-10.20	Keynote: Yiyu Yao
10.00 10.00	Title: Symbols-Meaning-Value (SMV) Space Perspectives on Web Intelligence
10:50-11:40	Special Event: Introduction of Web Intelligence Academy
11:40-12:10	Lunch Break
	Onsite Session 1
Ro	oom: Zoom 1, Chair:Amran Bhuiyan; amran.apece@gmail.com
12:10-12:25	Morphologically-Aware Vocabulary Reduction of Word Embeddings; Chong Cher Chia, Maksim Tkachenko, and Hady Lauw
12:25-12:40	Optimizing the Computation of a Possibilistic Heuristic to Test OWL 2 SubClassOf Axioms Against RDF Data; Rémi FELIN, Olivier CORBY, Catherine FARON, and Andrea TETTAMANZI
12:40-12:55	NLI-based Filtering for Data Augmentation in Topic Classification; Yanan Chen and Yang Liu
12:55-13:05	Real-World Popularity Estimation from Community Structure of Followers on SNS; Shuhei Kobayashi and Keishi Tajima
13:05-13:20	MENTA: how to balance authorial intention and user agency in virtual environments; Domitile Lourdeaux, Mohamed Sallak, and Rémi Lacaze-Labadie
13:20-13:35	Behavior Trees as executable representation of Milner Calculus notations; Torsten Spieldenner and André Antakli
13:35-13:45	ProxySense: A novel approach for gas concentration estimation using Long Short-Term Memory Recurrent Neural Network (LSTM-RNN); Nwamaka Okafor, Ugochukwu Mathew, and Declan Delaney
13:45-13:55	Time-Series Flexible Resampling for Continuous and Real-Time Finger Character Recognition; Takuma Nitta, Shinpei Hagimoto, Kyosuke Miyamura, Ryotaro Okada, and Takafumi Nakanishi

13:55-14:05	Coffee Break
	Onsite Session 2 Room: Zoom 1, Chair:Mehdi Kargar; kargar@ryerson.ca
14:05-14:15	Visualization and Extraction of Important Structural Changes via Dynamic Hypergraph Embedding ; Shuta Ito and Takayasu Fushimi
14:15-14:25	Comparative Analysis of Information Spreading Focused on Topics and Emotions via Temporal Point Process ; Kennosuke Yoshida and Takayasu Fushimi
14:25-14:35	A Study on Agent Expression and User Gaze Behavior in Product Endorsement Videos ; Chisa Kondo, Hiroshi Sakuma, and Yoshinori Hijikata
14:35-14:45	Adversarial Sample Generation Method for Spam SMS Classification; Ling Su, Yu Liu, Feiyan Chen, Yingqi Zhang, Haiming Zhao, Mengfei Xu, and Yujie Zeng
14:45-14:55	Investigating Users' Motives for Engaging in Flaming by Analyzing Despise Tweets ; Wonseok Lee, Takanori Komatsu, and Fujio Toriumi
14:55-15:05	Can higher-order structural features improve the performance of graph neural networks for graph classification? ; Xin Chen, Miao Liu, Yue Peng, and Benyun Shi
15:05-15:15	Oscillation Patterns of A Complex Exponential Neural Network ; Lei Zhang
15:15-15:25	KEvent - A Semantic-Enriched Graph-Based Approach Capitalizing Bursty Keyphrases for Event Detection in OSN ; Sielvie Sharma, Muhammad Abulaish, and Tanvir Ahmad
15:30-15:40	Coffee Break
	Session: Web of Trust Room: Zoom 1. Chair: Ameeta Agrawal: ameeta@pdx.edu
15:40-16:00	LMs go Phishing: Adapting Pre-trained Language Models to Detect Phishing Emails; Kanishka Misra and Julia Rayz
16:00-16:20	Adaptive Neighborhood Distribution-based Model for Estimating Helpful Votes of Customer Review; Ristu Saptono and Tsunenori Mine

16:20-16:40	Explainable Recommendation Enhancing Review Properties and PPLM; Akihiro Kokubo and Kazunari Sugiyama
16:40-16:55	Proof of Earnestness- Subjective information's Trustworthiness in Blockchains as a Service; Hang Thanh Bui, Omar K. Hussain, Morteza Saberi, and Farookh K. Hussain
16:55-17:10	Real-World Popularity Estimation from Community Structure of Followers on SNS; Shuhei Kobayashi and Keishi Tajima
17:10-17:25	Filtering Relevant Comments in Social Media using Deep Learning; David Ramamonjisoa and Hidenori Iguma
Ro	Session: Web of Agents om: Zoom 2; Chair:Maha Khemaja, khemajamaha@gmail.com
	Agent-Based Modeling for Studying the Spontaneous Emergence of
15:40-15:55	Money; Mattia Di Russo, Zakaria Babutsidze, Celia da Costa Pereira, Maurizio Iacopetta, and Andrea G. B. Tettamanzi
15:55-16:15	Search on Asymmetric DCOPs by Strategic Agents; Yair Vaknin and Amnon Meisels
16:15-16:35	Improving generalization to new environments and removing catastrophic forgetting in Reinforcement Learning by using an eco-system of agents; Olivier Moulin, Vincent Francois-Lavet, Mark Hoogendoorn, and Paul Elbers
16:35-16:55	MENTA: how to balance authorial intention and user agency in virtual environments; Domitile Lourdeaux, Mohamed Sallak, and Rémi Lacaze-Labadie
16:55-17:15	Behavior Trees as executable representation of Milner Calculus notations; Torsten Spieldenner and André Antakli
17:15-17:35	Obtaining and Providing Partial Information in Binary Contests; Noam Simon, Priel Levy, and David Sarne
17:30-20:30	Banquet

## Sunday, 20 of November

09:00-09:50	Keynote: Ming Li Title: A Model for Human K-shot Learning
09:50-10:00	Coffee Break
Speci R	ial Track: Emerging Web in Health and Smart Living 1 coom: Zoom 1; Chair:Reza Sadeghi, reza.sadeghi@marist.edu
10:00-10:15	ProxySense: A novel approach for gas concentration estimation using Long Short-Term Memory Recurrent Neural Network (LSTM-RNN); Nwamaka Okafor, Ugochukwu Mathew, and Declan Delaney
10:15-10:35	Personalized Video Fragment Recommendation; Jiaqi Wang, Ricky Kwok, and Edith Ngai
10:35-10:55	Auto-tagging system based on song's latent representations for inferring contextual user information; Álvaro Lozano Murciego, Diego M. Jiménez-Bravo, André Sales Mendes, Vivian F. López Batista, and Maria N. Moreno-García
10:55-11:15	Emotion Detection for Children on the Autism Spectrum using BCI and Web Technology; Akib Zaman, Anika Tahsin, Mostafizur Rahman, Rabeya Akhter, Hinoy Rahman, Shobnom Mustary, and Dewan Md. Farid
Speci F	ial Track: Emerging Web in Health and Smart Living 2 Room: Zoom 1; Chair:Reza Sadeghi,reza.sadeghi@marist.edu
11:30-11:45	Patient History Summarization on Outpatient Conversation; Hsin-Yu Tsai, Hen-Hsen Huang, Che-Jui Chang, Jaw-Shiun Tsai, and Hsin-Hsi Chen
11:45-12:05	Stable Trade Coordinations in Smart Agriculture; Pascal Francois FAYE, Mariane SENGHOR, and Gregroire Aly NDIONE
12:05-12:25	Gesture Recognition Using MediaPipe for Online Realtime Gameplay; Urvil Patel, Sourabh Rupani, Vipin Saini, and Xing Tan
12:00-13:00	Lunch
Special Tra Roo	nck: Cyber System, Software Network, and Internet of Thing m: Zoom 2, Chair:Alexander Ryjov, alexander.ryjov@gmail.com

10:00-10:15	Using Multi-task Deep Neural Network to Explore Person Interaction from Social Media; Yung-Chun Chang, Tzu-Ying Chen, Ting-Yu Lin, and Yu-Lun Hsieh
10:15-10:30	Time-Series Flexible Resampling for Continuous and Real-Time Finger Character Recognition; Takuma Nitta, Shinpei Hagimoto, Kyosuke Miyamura, Ryotaro Okada, and Takafumi Nakanishi
10:30-10:50	PININ: increasing customer awareness through an innovative IoT and blockchain-based high quality food product tracking system; Federica Cena, Claudio Schifanella, Cristina Tortia, Valeria Maritano, Oscar Bruschi, Valentina Cobetto, and Serena Ambrosini
10:50-11:05	Educational Decision Support System Adopting Sentiment Analysis on Student Feedback; Thanveer Shaik, Xiaohui Tao, Christopher Dann, Carol Quadrelli, Yan Li, and Shirley O'Neill
11:05-11:20	Categorizing Citation Relations in Scientific Papers Based on the Contributions of Cited Papers; Po-Chun Chen, Hen-Hsen Huang, and Hsin-Hsi Chen
14:30-14:40	Coffee Break
14:30-14:40	Coffee Break Web of Data 4 Room: Zoom 2, Chair:Lei Qi, qiruilei@gmail.com
14:30–14:40 11:30-11:50	Coffee Break Web of Data 4 Room: Zoom 2, Chair:Lei Qi, qiruilei@gmail.com Handling out of vocabulary words at the semantical level using recurrent neural networks; Paula Myrian Lima Pedroso, Eveline de Jesus Viana Sá, Fábio Manoel França Lobato, and Antonio Fernando Lavareda Jacob Jr
14:30-14:40 11:30-11:50 11:50-12:10	Coffee Break Web of Data 4 Room: Zoom 2, Chair:Lei Qi, qiruilei@gmail.com Handling out of vocabulary words at the semantical level using recurrent neural networks; Paula Myrian Lima Pedroso, Eveline de Jesus Viana Sá, Fábio Manoel França Lobato, and Antonio Fernando Lavareda Jacob Jr Discovering Causal Rules in Knowledge Graphs using Graph Embeddings; Lucas Simonne, Nathalie Pernelle, Fatiha Sais, and Rallou Thomopoulos
14:30-14:40 11:30-11:50 11:50-12:10 12:10-12:30	Coffee Break         Web of Data 4         Room: Zoom 2, Chair:Lei Qi, giruilei@gmail.com         Handling out of vocabulary words at the semantical level using recurrent neural networks; Paula Myrian Lima Pedroso, Eveline de Jesus Viana Sá, Fábio Manoel França Lobato, and Antonio Fernando Lavareda Jacob Jr         Discovering Causal Rules in Knowledge Graphs using Graph Embeddings; Lucas Simonne, Nathalie Pernelle, Fatiha Sais, and Rallou Thomopoulos         NLI-based Filtering for Data Augmentation in Topic Classification; Yanan Chen and Yang Liu

**Talks** will be held at the **Molinara & Fallsview Room** of **Marriott Fallsview Hotel**. It is situated on the second floor of the Marriott Fallsview Hotel.



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