

2nd Workshop on Uncertainty Reasoning and Quantification in Decision Making

Xujiang Zhao
xuzhao@nec-labs.com
NEC Laboratories America
Princeton, New Jersey, USA

Chen Zhao
charliezhaoyinpeng@gmail.com
Baylor University
Waco, Texas, USA

Feng Chen
feng.chen@utdallas.edu
University of Texas at Dallas
Richardson, Texas, USA

Jin-Hee Cho
jicho@vt.edu
Virginia Tech
Blacksburg, Virginia, USA

Haifeng Chen
haifeng@nec-labs.com
NEC Laboratories America
Princeton, New Jersey, USA

ABSTRACT

Uncertainty reasoning and quantification play a critical role in decision making across various domains, prompting increased attention from both academia and industry. As real-world applications become more complex and data-driven, effectively handling uncertainty becomes paramount for accurate and reliable decision making. This workshop focuses on the critical topics of uncertainty reasoning and quantification in decision making. It provides a platform for experts and researchers from diverse backgrounds to exchange ideas on cutting-edge techniques and challenges in this field. The interdisciplinary nature of uncertainty reasoning and quantification, spanning artificial intelligence, machine learning, statistics, risk analysis, and decision science, will be explored. The workshop aims to address the need for robust and interpretable methods for modeling and quantifying uncertainty, fostering reasoning decision-making in various domains. Participants will have the opportunity to share research findings and practical experiences, promoting collaboration and advancing decision-making practices under uncertainty.

CCS CONCEPTS

• **Computing methodologies** → **Machine learning algorithms.**

KEYWORDS

uncertainty, reasoning, decision making

ACM Reference Format:

Xujiang Zhao, Chen Zhao, Feng Chen, Jin-Hee Cho, and Haifeng Chen. 2023. 2nd Workshop on Uncertainty Reasoning and Quantification in Decision Making (UDM). In *Proceedings of the 29th ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD '23)*, August 6–10, 2023, Long Beach, CA, USA. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/3580305.3599230>

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for third-party components of this work must be honored. For all other uses, contact the owner/author(s).

KDD '23, August 6–10, 2023, Long Beach, CA, USA

© 2023 Copyright held by the owner/author(s).

ACM ISBN 979-8-4007-0103-0/23/08.

<https://doi.org/10.1145/3580305.3599230>

1 BACKGROUND

Deep neural networks (DNNs) have received tremendous attention and achieved great success in various applications, such as image and video analysis, natural language processing, recommendation systems, and drug discovery. However, inherent uncertainties derived from different root causes have been serious hurdles for DNNs to find robust and trustworthy solutions for real-world problems [1–6]. A lack of consideration of such uncertainties may lead to unnecessary risk. For example, a self-driving autonomous car can misclassify a human on the road. A deep learning-based medical assistant may misdiagnose cancer as a benign tumor. Uncertainty has become increasingly important, and it has been attracting attention from academia and industry due to its increased popularity in real-world applications with uncertain concerns. It also emphasizes decision-making problems, such as autonomous driving and diagnosis systems. Therefore, the wave of research at the intersection of uncertainty reasoning and quantification in data mining and machine learning has also influenced other fields of science, including computer vision, natural language processing, reinforcement learning, and social science.

2 RELEVANCE TO SIGKDD

ACM SIGKDD conference is the premier international forum for knowledge discovery and data mining researchers and practitioners from academia, industry, and government to share their research findings, results, and experiences. The organizers and invited PC members of this workshop have a wealth of experience and a strong interest in uncertainty reasoning and quantification and they come from different backgrounds in academia, industry, and government. Knowledge discovery and data mining are core uncertainty reasoning and quantification topics, with significant implications in uncertainty reasoning and quantification, but have not yet received significant attention from the uncertainty reasoning and quantification community at SIGKDD. This workshop will provide a great opportunity for all SIGKDD attendees to exchange ideas and thoughts on opportunities, challenges, and techniques in uncertainty reasoning and quantification and it will build a bridge of communication for people with different backgrounds and promote the future development of uncertainty reasoning and quantification in decision making.

3 TOPIC OF INTEREST

We encourage submissions in various degrees of progress, such as new results, visions, techniques, innovative application papers, and progress reports under the topics that include, but are not limited to, the following broad categories:

- Uncertainty quantification in classification and regression
- Out-of-distribution detection
- Conditional Reasoning with Uncertainty
- Quantification of multidimensional uncertainty
- Sequential uncertainty estimation
- Interpretation of Uncertainty.
- Uncertainty-Aware Deep Reinforcement Learning
- Decision-making with uncertainty

And with particular focuses but not limited to these application domains:

- Application of uncertainty methods in large-scale dataset
- Computer vision (uncertainty in face recognition, object detection)
- Natural language processing (language uncertainty, sentence uncertainty)
- Reinforcement learning (uncertainty-aware offline reinforcement learning exploration vs. exploitation)

4 INVITED KEYNOTE SPEAKER

We are proposing to have 2 keynote speakers.

- B. Aditya Prakash (Georgia Tech). Dr. B. Aditya Prakash is an Associate Professor in the College of Computing at the Georgia Institute of Technology (“Georgia Tech”). He received a Ph.D. from the Computer Science Department at Carnegie Mellon University in 2012, and a B.Tech (in CS) from the Indian Institute of Technology (IIT) – Bombay in 2007. He has published one book, more than 80 papers in major venues, holds two U.S. patents and has given several tutorials at leading conferences. His work has also received multiple best-paper/best-of-conference selections and travel awards. His research interests include Data Science, Machine Learning and AI, with emphasis on big-data problems in large real-world networks and time-series, with applications to epidemiology, health, urban computing, security and the Web. His work has been supported by the National Science Foundation (NSF), the Centers for Disease Control (CDC), the Department of Energy (DoE), the National Security Agency (NSA), the National Endowment for Humanities (NEH) and various companies. He received a Facebook Faculty Award in 2015, was named as one of ‘AI Ten to Watch’ 2017 by IEEE, and received the NSF CAREER award in 2018.
- Satoshi Morinaga (NEC Corporation). Dr. Satoshi Morinaga obtained the B.E., M.E., and Ph.D. degrees from the University of Tokyo in 1992, 1994 and 1999, respectively. He joined NEC Corporation in 1994, and was seconded to the Financial Supervisory Agency (FSA) from 2000 to 2008 as a deputy director and a special researcher. Currently, he is an Executive Research Fellow of Data Science Research Laboratories in NEC Corporation, Deputy Director of NEC-AIST AI Cooperative Research Laboratory in AIST, and Deputy Director of

RIKEN AIP-NEC Collaboration Center in RIKEN. In IEICE, he is/was a member of the editorial board of journals, and a member of the technical committee on Information-Based Induction Sciences and Machine Learning. Currently, he is mainly engaged in research and social implementation of mathematical modeling, machine learning, and automated negotiation. He is the author of “The Challenge of Advanced Operational Risk Management” published by Kinzai Institute for Financial Affairs.

- Rose Yu (UC San Diego). Dr. Rose Yu is an Assistant Professor at the UC San Diego, Department of Computer Science and Engineering. She earned her Ph.D. in Computer Sciences at the University of Southern California in 2017. She was subsequently a Postdoctoral Fellow at the California Institute of Technology. She was an assistant professor at Northeastern University prior to her appointment at UC San Diego. Her research focuses on advancing machine learning techniques for large-scale spatiotemporal data analysis, with applications to sustainability, health, and physical sciences. A particular emphasis of her research is on physics-guided AI which aims to integrate first-principles with data-driven models. Among her awards, she has won Google Faculty Research Award, Adobe Data Science Research Award, NSF CRII Award, Best Dissertation Award in USC, and was nominated as one of the ‘MIT Rising Stars in EECS’.

5 IMPORTANT DATES

Following are the proposed important dates for the workshop.

- Paper submission deadline: June 7th, 2023.
- Paper review begins: June 8th, 2023.
- Paper review due: June 21st, 2023.
- Notification of decision: June 23rd, 2023.
- Camera-ready due: July 27th, 2023.

Workshop website: <https://charliezhaoyinpeng.github.io/UDM-KDD23/>

ACKNOWLEDGMENTS

The workshop was supported by the National Science Foundation under grant numbers IIS-2107449 and 2107450.

REFERENCES

- [1] Xujiang Zhao, Feng Chen, and Jin-Hee Cho. 2018. Deep Learning Based Scalable Inference of Uncertain Opinions. In *2018 IEEE International Conference on Data Mining (ICDM)*. IEEE, 807–816.
- [2] Xujiang Zhao, Feng Chen, and Jin-Hee Cho. 2018. Deep learning for predicting dynamic uncertain opinions in network data. In *2018 IEEE International Conference on Big Data (Big Data)*. IEEE, 1150–1155.
- [3] Xujiang Zhao, Feng Chen, Shu Hu, and Jin-Hee Cho. 2020. Uncertainty aware semi-supervised learning on graph data. *Advances in Neural Information Processing Systems* 33 (2020), 12827–12836.
- [4] Xujiang Zhao, Shu Hu, Jin-Hee Cho, and Feng Chen. 2019. Uncertainty-based decision making using deep reinforcement learning. In *22th International Conference on Information Fusion (FUSION)*. IEEE, 1–8.
- [5] Xujiang Zhao, Xuchao Zhang, Wei Cheng, Wenchao Yu, Yuncong Chen, Haifeng Chen, and Feng Chen. 2022. Seed: Sound event early detection via evidential uncertainty. In *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, 3618–3622.
- [6] Xujiang Zhao, Xuchao Zhang, Chen Zhao, Jin-Hee Cho, Lance Kaplan, Dong Hyun Jeong, Audun Jøsang, Haifeng Chen, and Feng Chen. 2023. Multi-Label Temporal Evidential Neural Networks for Early Event Detection. In *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. IEEE, 1–5.