Biological Sciences

Spring 2024

Louise Ince, PhD

University of Texas at Austin

"Neuroimmunology around the clock: the role of circadian rhythms in regulating immunity and behavior"

Hosted by: Dr. Marvin Bentley

Monday, January 22, 2024

12:00 Noon

CBIS Auditorium

Coffee, tea, and snacks available at 11:50am

ABSTRACT

Life on Earth has its own rhythm; a 24-hour cycle that guides biological processes from gene expression to behavior patterns. The immune system is modulated by these circadian rhythms, resulting in time-of- day variation in inflammatory responses. Inflammation in the body is sensed by the brain and elicits behavioral changes such as social withdrawal and impaired memory. As we age, both circadian rhythms and immune responses are compromised, and chronic inflammation occurs. My work focuses on the links between these two critical biological systems to investigate how circadian disruption may potentiate neuroinflammation and elicit behavioral changes. Using rodent models, I have identified a key role for the microglial clock in regulating neuroinflammatory responses and behavior, and I have found that manipulation of circadian rhythms in aged mice dampens neuroinflammation and increases sociability. Thus, targeting the circadian system is an exciting new way to tackle age-related neuroinflammation and behavioral changes. Future work will focus on determining the role of circadian rhythms in neuroimmune niches (e.g., the choroid plexus) in regulating brain immunosurveillance and age-related neuroinflammation, and how immune signaling feeds back to the circadian clock to propagate disrupted function. With this work, I aim to identify novel therapeutic strategies to slow cognitive decline and promote healthy aging.

MATHEMATICAL SCIENCES COLLOQUIUM

Jialin Liu

(Alibaba DAMO Academy)

Bellevue, WA.

Monday, January 22, 2024

4pm

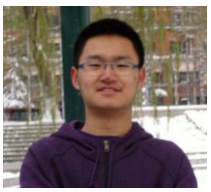
PITTS 4206

Towards Explainable and Reliable AI Models for Optimization

AI and data science have demonstrated remarkable potential in enhancing optimization algorithms. Utilizing AI/ML techniques, we aim to complement and potentially enhance traditional optimization methods, offering improvements in aspects like computational speed and solution quality. Despite these advancements, a deep, systematic understanding of these methods remains underdeveloped. In this talk, the speaker will demonstrate through concrete examples how mathematical tools, particularly optimization theory, can be used to unravel the mysteries of these "black boxes." The speaker will also discuss the development of interpretable and reliable AI models for optimization, grounded in these mathematical principles.

Biographical Sketch

Jialin Liu received B.S. degree in automation from Tsinghua University in 2015 and received the Ph.D. degree in applied



mathematics at University of California, Los Angeles (UCLA) in 2020. He is currently a senior algorithm engineer at DAMO Academy, Alibaba Group US. His research interest lies in the intersection of optimization and machine learning, with a particular focus on developing and analyzing machine-learning-driven algorithms for solving various optimization problems, such as continuous and combinatorial optimization. He won "Best Student Paper: Third Place" at the 2017 International Conference on Image Processing (ICIP).

Refreshments served at 3:30pm 4th floor Lounge – Amos Eaton

ELECTRICAL, COMPUTER, and SYSTEMS ENGINEERING

Distributed Compression in the Era of Machine Learning

Elza Erkip

Institute Professor, Electrical and Computer Engineering

New York University

CII 4050

Wednesday, January 24, 2024 at 4:00 PM

Refreshments served at 3:30pm

Many modern applications from camera arrays to federated learning depend on distributed collection, processing and communication of correlated data, requiring efficient compression techniques to minimize the induced communication overhead. While information-theoretic foundations of distributed compression are well-investigated, the impact of theory on practice has been somewhat limited. As the field of data compression is undergoing a significant transformation with the emergence of learning-based techniques, it is natural to ask whether machine learning can reap the benefits of distributed compression promised by information theory long ago. In this talk we answer this question affirmatively by focusing on a simple distributed lossy compression setting, also known as the Wyner-Ziv problem, in which the decoder has direct access to correlated information that is unknown at the encoder. We show that for some well-studied source distributions, neural compression techniques mimic information theoretically optimal solutions such as “binning” or “grouping” in the source space as well as optimal combination of the quantization index and side information. These interpretable behaviors appear even though we neither impose a particular structure nor assume any prior knowledge about the source distributions. Binning is a widely-used tool in network information theory, and its emergence from data-driven learning can have implications beyond the setting considered in this talk.

Elza Erkip is an Institute Professor in the Electrical and Computer Engineering Department at New York University Tandon School of Engineering. She received the B.S. degree in Electrical and Electronics Engineering from Middle East Technical University, Ankara, Turkey, and the M.S. and Ph.D. degrees in Electrical Engineering from Stanford University, Stanford, CA, USA. Her research interests are in information theory, communication theory, and wireless communications. Dr. Erkip is a member of the Science Academy of Turkey and is a Fellow of the IEEE. She received the NSF CAREER award in 2001, the IEEE Communications Society WICE Outstanding Achievement Award in 2016, the IEEE Communications Society Communication Theory Technical Committee (CTTC) Technical Achievement Award in 2018, and the IEEE Communications Society Edwin Howard Armstrong Achievement Award in 2021. She was the Padovani Lecturer of the IEEE Information Theory Society in 2022. Her paper awards include the IEEE Communications Society Stephen O. Rice Paper Prize in 2004, the IEEE Communications Society Award for Advances in Communication in 2013 and the IEEE Communications Society Best Tutorial Paper Award in 2019. She was a member of the Board of Governors of the IEEE Information Theory Society 2012-2020, where she was the President in 2018. She was a Distinguished Lecturer of the IEEE Information Theory Society from 2013 to 2014.

Physics, Applied Physics and Astronomy Colloquia

Title and abstract to be announced

Professor Damien West, Physics, Applied Physics and Astronomy, Rensselaer Polytechnic Institute

January 24, 2024

Darrin Communications Center (DCC) Room 337 4:00 pm