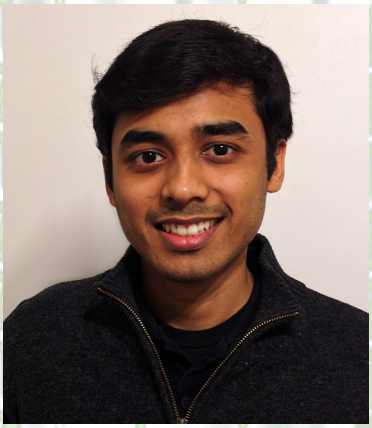
# Center for Science of Information

**NSF Science and Technology Center**

## Fall Seminar Series 2020



Praveen Venkatesh
Ph.D. Candidate
ECE
Carnegie Mellon University

**Wednesday, September 30**
**2:00pm EDT**

**ONLINE**

https://www.soihub.org
See under Events & Activities

PURDUE UNIVERSITY

Center for Science of Information

## Information Flow and Representation in Neural Circuits

Abstract:
A central problem in neuroscience is to understand the representation and flow of information in healthy and diseased states of the brain. Such an understanding can help inform interventions to modulate information flows and treat brain diseases and disorders. The first part of my talk will provide a new framework for thinking about information flow in the brain, and propose a definition for information flow about a "message", e.g., the stimulus. Drawing from existing literature and simple examples, we will see that an important aspect of defining information flow in a meaningful way is to recognize and account for "synergistic" information representation. With this, I will show that it is possible to verifiably track information flow about a given message. To tackle the issue of synergistic representation, I leverage recent developments in information theory on "Partial Information Decomposition", which provides new tools for defining and estimating unique, redundant and synergistic information. In showing how these new measures can be utilized, I also explain how synergy can arise in unexpected ways in the brain, through a case study on grid cells. Finally, I will touch upon some of my work on improving neurotechnologies: investigating the fundamental limits of the spatial resolution of high-density EEG, and validating its efficacy through novel experiments.

Bio:
Praveen Venkatesh received a B.Tech. (Hons.) in Electrical Engineering from the Indian Institute of Technology, Madras in 2014. He is currently pursuing a Ph.D. in Electrical and Computer Engineering at Carnegie Mellon University, with Professor Pulkit Grover. His work lies at the intersection of information theory, statistics, neuroscience and neuroengineering. He has collaborated with theorists and practitioners to identify fundamental theoretical problems, and addressed these using formal mathematical and computational models. His broad goal is to contribute to the development, study and application of new information-theoretic and statistical methods in neuroscience and neuroengineering.

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