Information-theoretic Analysis of Brain Dynamics

Neural Network Models Informed by Information Theory

Supervisors: Prof. Simon Schultz Dr. Pedro Mediano

IMPERIAL

<jin.yu21@imperial.ac.uk> <jyu@turing.ac.uk>

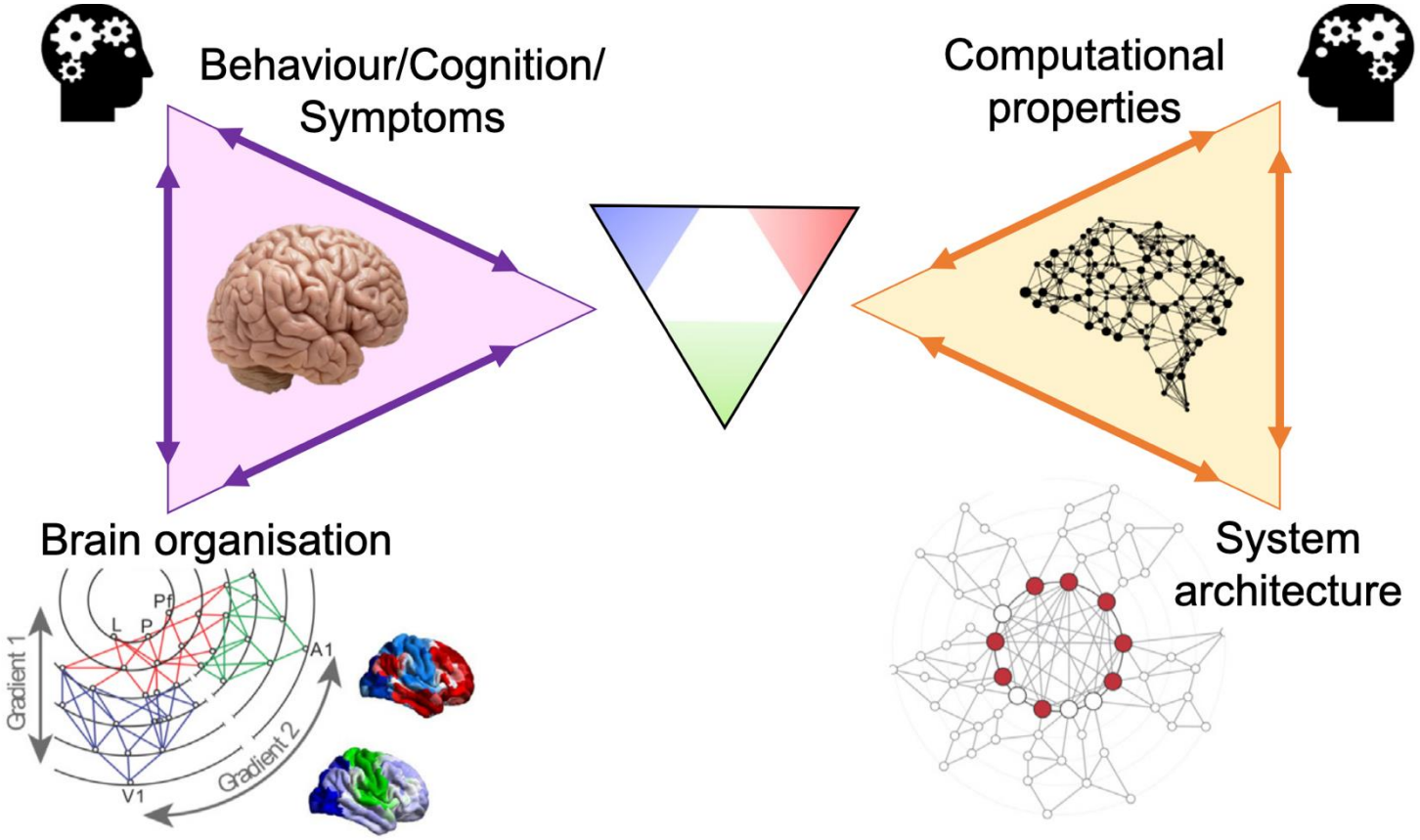
The Alan Turing Institute

Jess Yu

PhD Candidate in Computational Neurodynamics

Research interest:

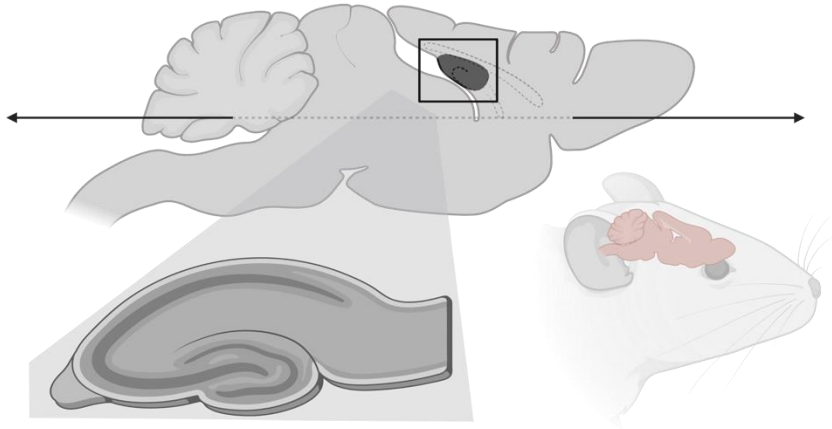
- Information theory in neuroscience
- Information theory in machine learning

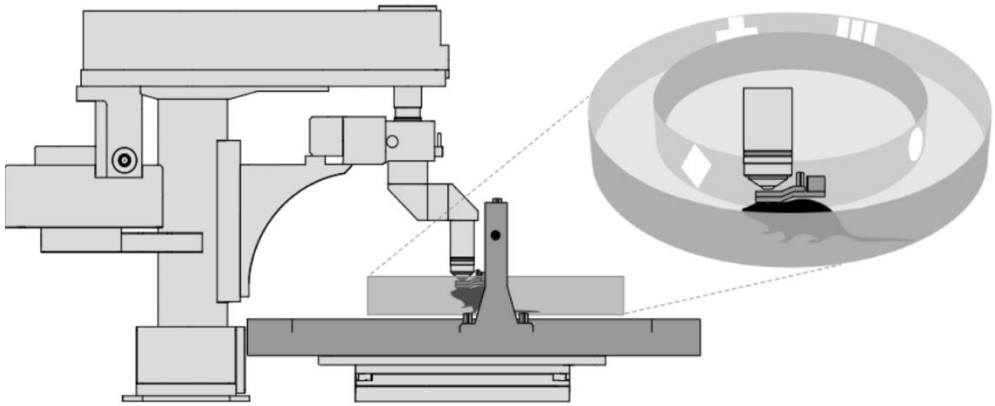


IMPERIAL

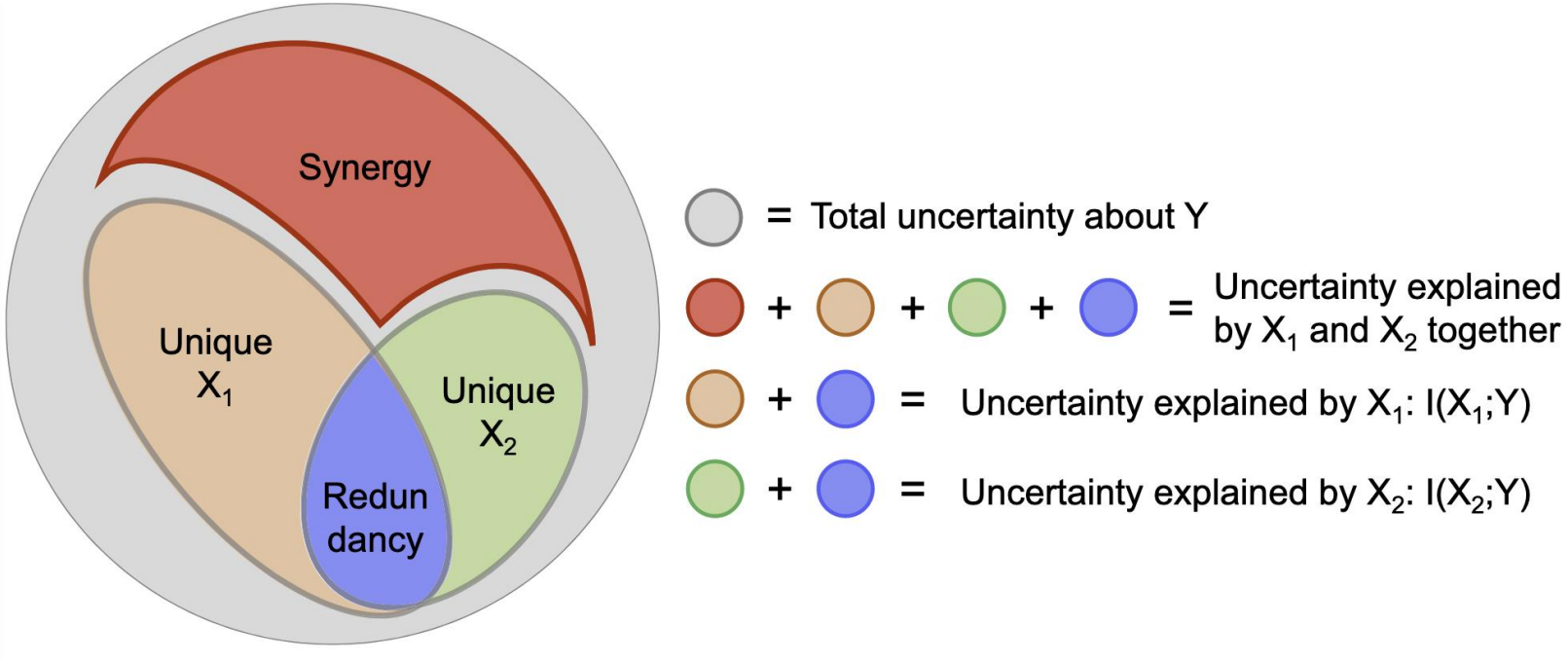
The Alan Turing Institute

Deciphering the Dynamics of Memory Encoding and Recall in the Hippocampus using Information theory



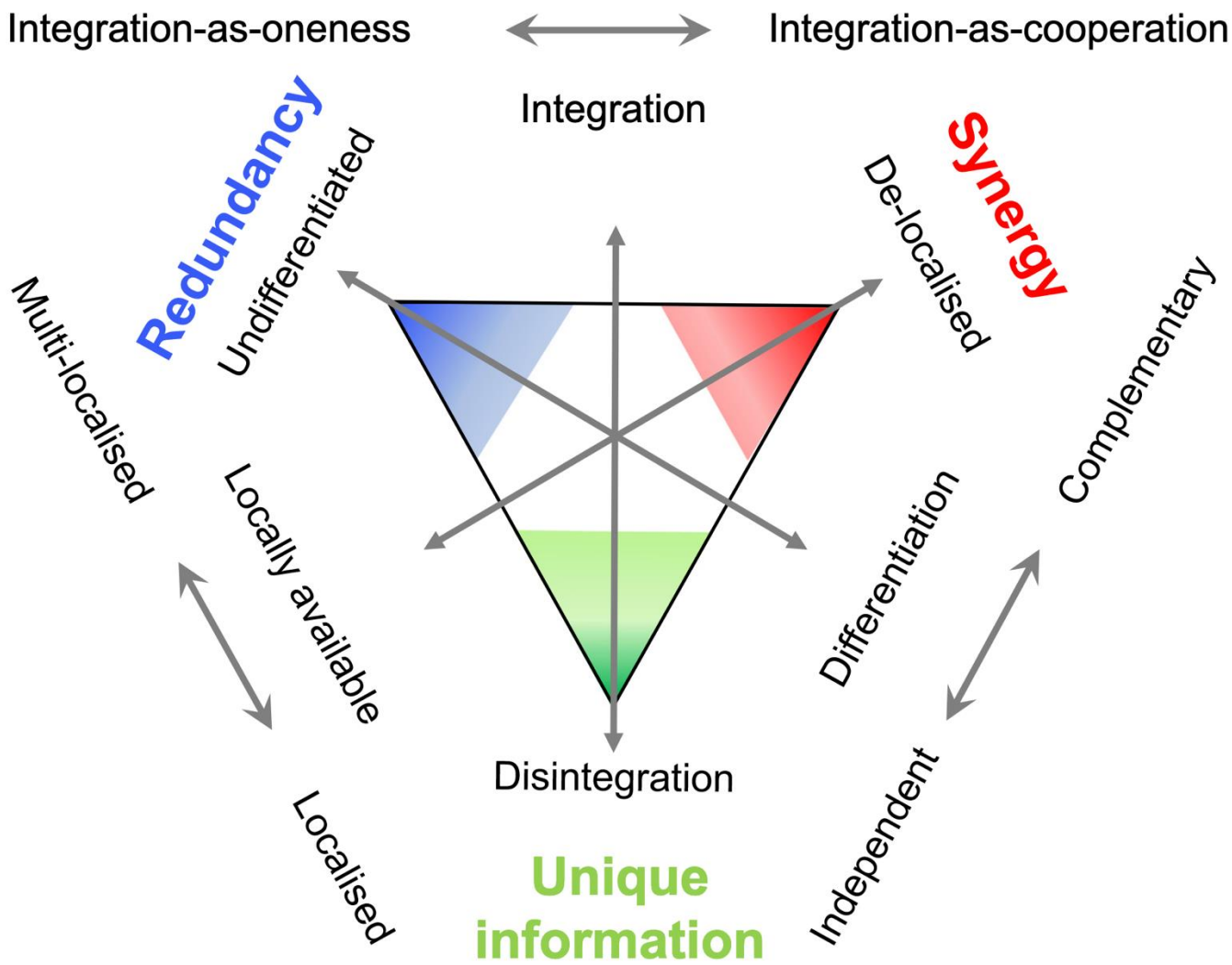


Information Theory



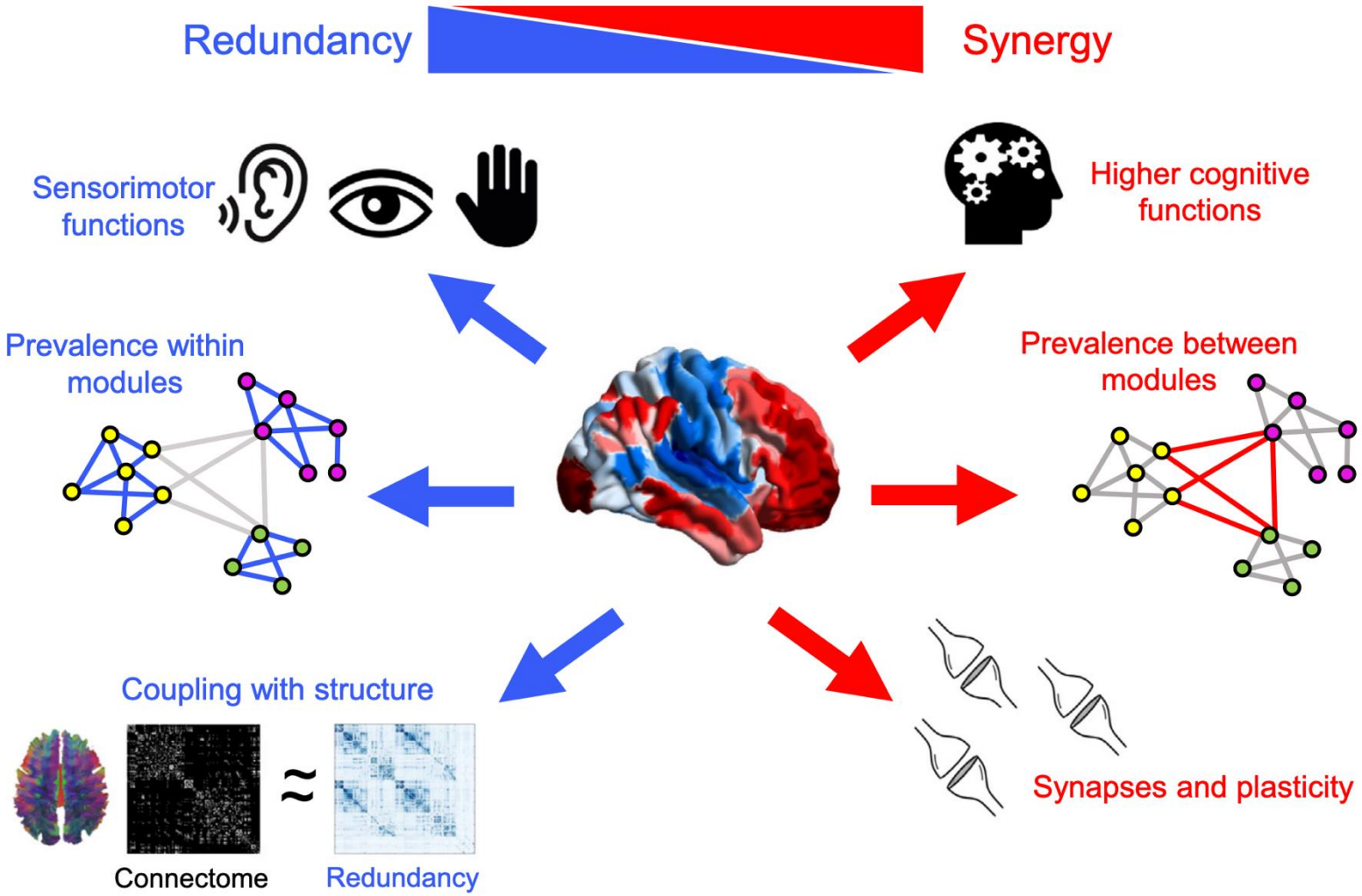
Luppi, Andrea I., et al. "Information decomposition and the informational architecture of the brain." *Trends in Cognitive Sciences* (2024).

Information Theory



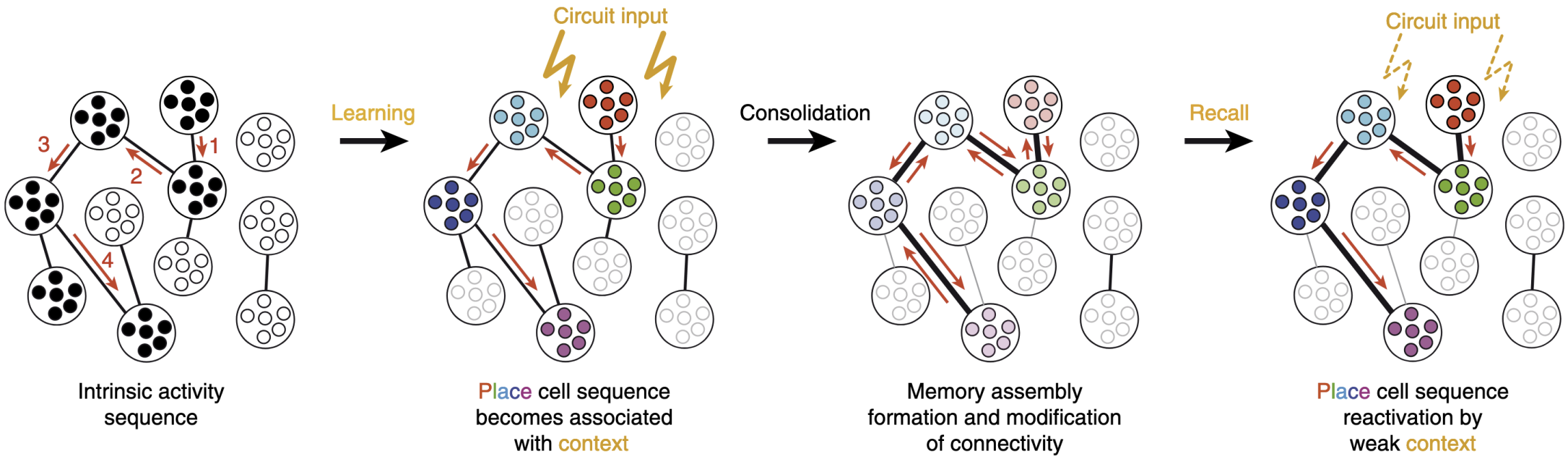
Luppi, Andrea I., et al. "Information decomposition and the informational architecture of the brain." *Trends in Cognitive Sciences* (2024).

Information Theory



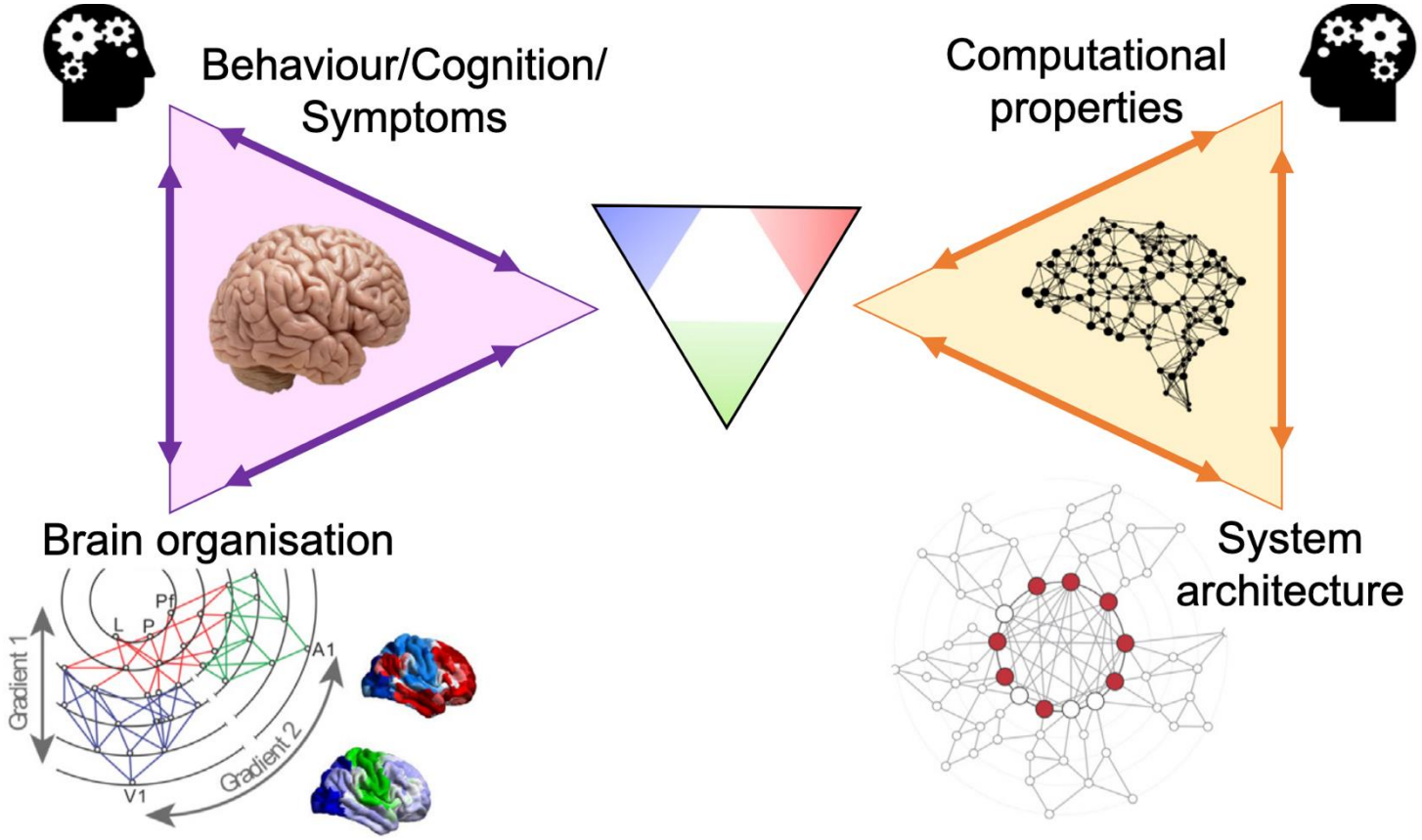
Luppi, Andrea I., et al. "Information decomposition and the informational architecture of the brain." *Trends in Cognitive Sciences* (2024).

Neural Community



Holtmaat, Anthony, and Pico Caroni. "Functional and structural underpinnings of neuronal assembly formation in learning." *Nature neuroscience* 19.12 (2016): 1553-1562.

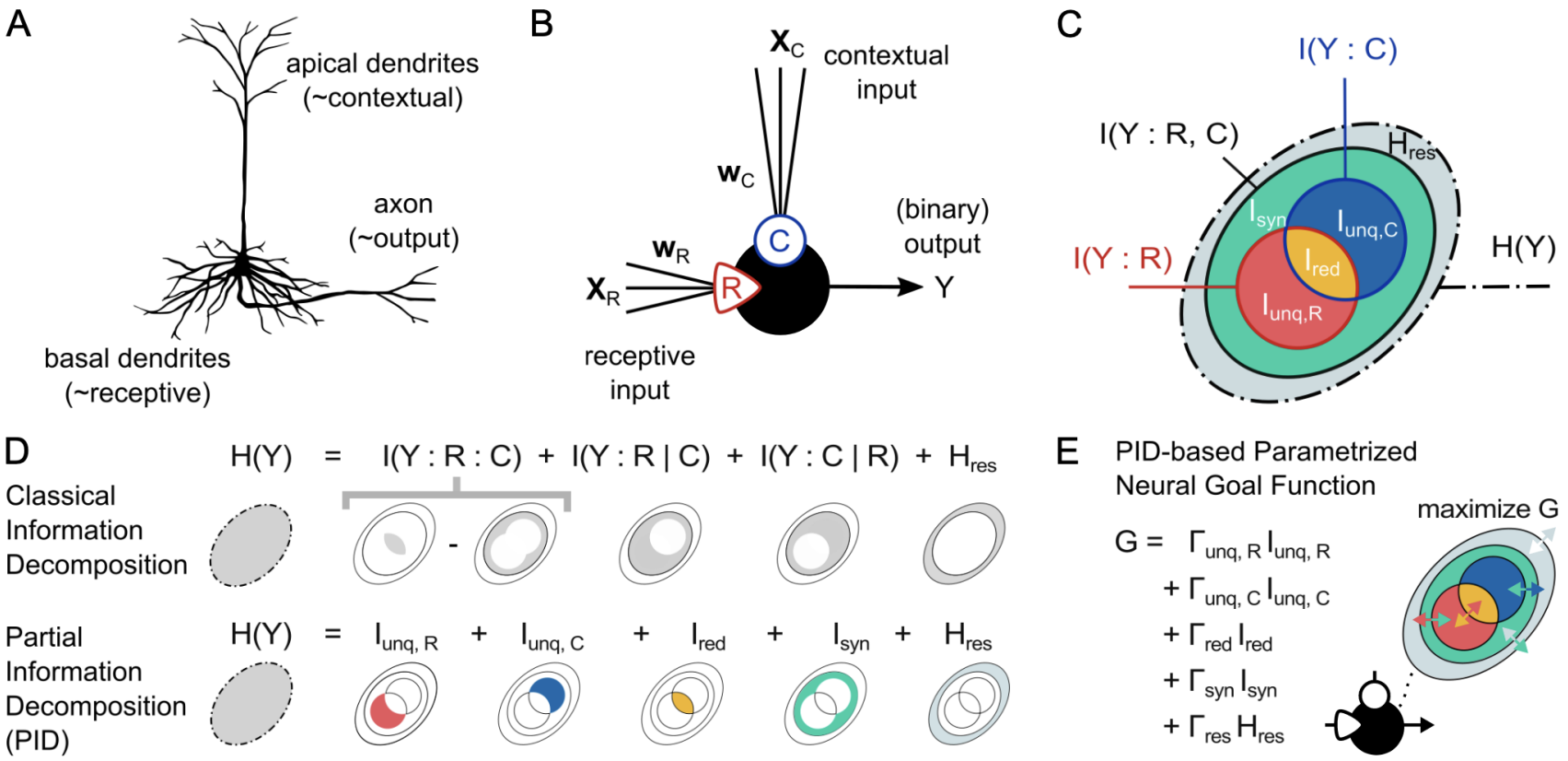
Neural Network Models
Informed by Information Theory



IMPERIAL

The Alan Turing Institute

A General Framework for Interpretable Neural Learning

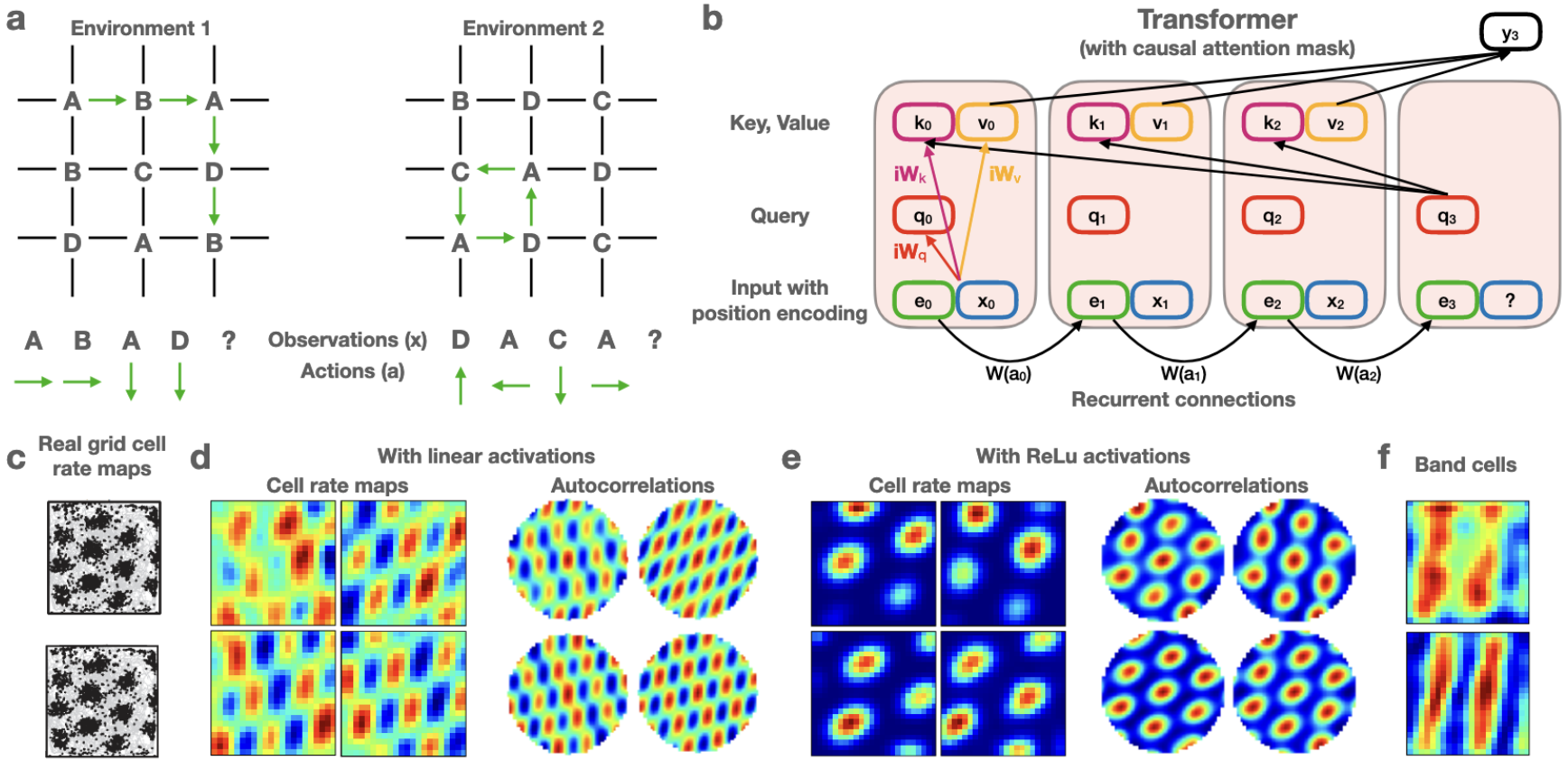


Makkeh, Abdullah, et al. "A General Framework for Interpretable Neural Learning based on Local Information-Theoretic Goal Functions." *arXiv preprint arXiv:2306.02149*(2023).

IMPERIAL

The Alan Turing Institute

RELATING TRANSFORMERS TO MODELS AND NEURAL REPRESENTATIONS OF THE HIPPOCAMPAL FORMATION

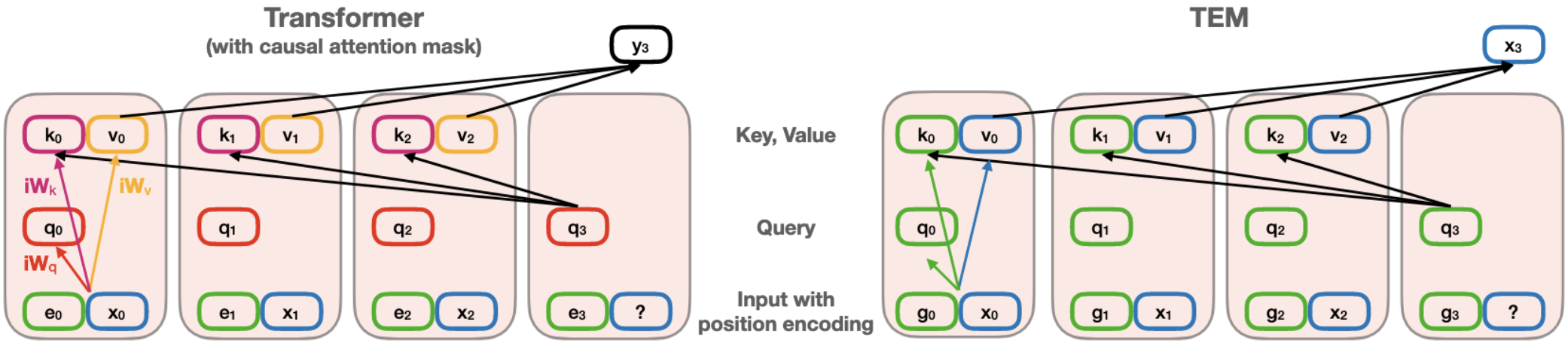


Whittington, James CR, Joseph Warren, and Timothy EJ Behrens. "Relating transformers to models and neural representations of the hippocampal formation." *arXiv preprint arXiv:2112.04035* (2021).

IMPERIAL

The Alan Turing Institute

RELATING TRANSFORMERS TO MODELS AND NEURAL REPRESENTATIONS OF THE HIPPOCAMPAL FORMATION



Whittington, James CR, Joseph Warren, and Timothy EJ Behrens. "Relating transformers to models and neural representations of the hippocampal formation." *arXiv preprint arXiv:2112.04035* (2021).

IMPERIAL

The Alan Turing Institute

? Analyzing Hippocampal Representations Using Transformer Models and Partial Information Decomposition

- How transformer-based neural network models can replicate and elucidate the information processing mechanisms of the hippocampus, with a focus on spatial representations
- Employing Partial Information Decomposition (PID) to dissect the contributions of individual neurons or neural assemblies to the overall information structure

Whittington, James CR, Joseph Warren, and Timothy EJ Behrens. "Relating transformers to models and neural representations of the hippocampal formation." *arXiv preprint arXiv:2112.04035* (2021).
Ehrlich, David A., et al. "A measure of the complexity of neural representations based on partial information decomposition." *arXiv preprint arXiv:2209.10438* (2022).
Makkeh, Abdullah, et al. "A General Framework for Interpretable Neural Learning based on Local Information-Theoretic Goal Functions." *arXiv preprint arXiv:2306.02149*(2023).

IMPERIAL

The Alan Turing Institute