Information Theory

(Module 1)

- We want to view intelligent behavior as resulting from computations performed on information
- First order of business: define and quantify "information"
- Information Theory (Shannon 1948) provides the most important formulation
- Allows us to measure the amount of information present
- Extremely general: information in the English language, electrical signals in the brain

Computational Neuroscience

(Module 3)

- Detailed (cellular and multi-cellular) study of the physiology and functioning of the brain: neurons and synapses
- Methods of "coding" information in the brain
- Neuronal selectivity
- Learning in the brain
- Information content of neurological signals
- Computational models of the brain: neural networks

Learning: Biological and Machine

(Module 7)

- Perhaps the most important and ubiquitous example of intelligent behavior
- What do we mean by learning?
- How do we tell that learning has occurred?
- Are there general principles for learning?
- Compressing the past versus predicting the future
- Algorithms for learning
- Learning in the brain

Reasoning and Inference

(Module 8)

- Learning studies how agents might acquire knowledge from experience in the world
- We often make insights without new experience or data
- Deliberation and introspection
- Example: All birds can fly + Tweety is a bird implies. . .
- How to formulate? How would a computer do it?
- Logical versus probabilistic approaches

Game Theory

(Module 9)

- Much of AI/CogSci focused on interaction with "Nature"
- Agent (human, animal or machine) making its way through a complex but indifferent world
- Computer vision versus financial markets
- Game Theory (Nash):
  - Model strategic interaction between agents
  - Fundamental notion: equilibrium among agents
  - Can model both competitive and cooperative scenarios
  - Applications: politics, economics, evolution,. . .