

Applying maths to understand biological systems

Magdalene College outreach residential

Stephen J Eglén

University of Cambridge

2017-04-07

Background

Aim of lecture

- Introduce you to problems where maths can be applied to Biological systems.
- Example of interdisciplinary research.
- Neuroscience → artificial intelligence/machine learning

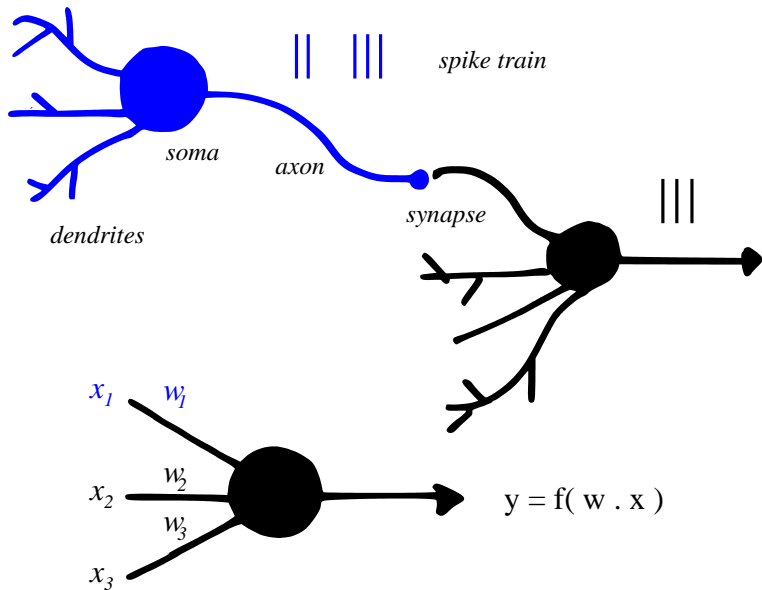
Please ask questions.

TODO: slides available at Available at: <http://bit.ly/eglen-mag17>

What is mathematical biology?

Cohen quote. PLOS Computational Biology

Neurophysiology 101



Deep learning

Deep learning is everywhere. New Scientist, April 2017

DAILY NEWS 4 April 2017

Google uses neural networks to translate without transcribing



Reinforcement learning

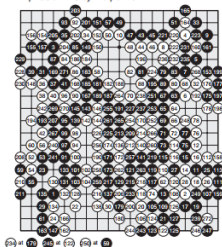
Examples

GO

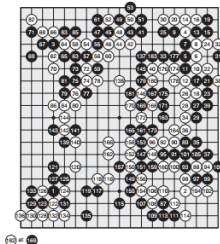
Atari video games

(Silver et al (2016) Nature 529:484–489)

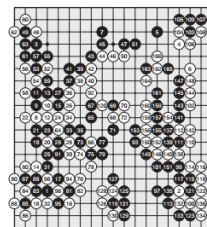
Game 1
Fan Hui (Black), AlphaGo (White)
AlphaGo wins by 2.5 points



Game 2
AlphaGo (Black), Fan Hui (White)
AlphaGo wins by resignation



Game 3
Fan Hui (Black), AlphaGo (White)
AlphaGo wins by resignation



Game 4
AlphaGo (Black), Fan Hui (White)
AlphaGo wins by resignation



Game 5
Fan Hui (Black), AlphaGo (White)
AlphaGo wins by resignation



Further reading