HW 2 – Jupyter Notebook

Questions:

*How is the strength of the connection between two neurons determined (when modeling real neurons)*

*Why model and study the brain, when it is immensely complicated – irreducible to simple parts, what is your motivation?*

*Makes sure your mind is as active as you hands*

Logistic/Sigmoid Curve –

Relu – rectified linear unit

Two ways of creating and manipulating arrays

* *For* loop
* *Vectorized* loop

Modeling the Mind

Physical Models:

Made of model and material (has the same shape on a gross level)

Modeling how the brain reacts to large forces (predict what will happen during car accident)

Mechanistic Models:

Modeling how the brain functions

Simple models of the mind

Mathematics – outputs can be deduced from the start

Simulation – predictions can only be understood by running model

The model represents the system (and its state)

Simulation represents the process by which the system change over time

Computation?

“Computational” physics, fluid dynamics, mechanics

Perspective in which brain is a computer –

Modeling – forces theories to be precise, and make multiple theories of what a process is comparable

We can’t always see the properties a theoretical system with parallelism and learning involved

The neuron

Signals are carried out using both movements of current and chemicals

Action potentials – run down axon towards the terminal

Terminals – Release neurotransmitters into synaptic clefts which are picked up by adjacent neurons, and their electrical properties are changed

Purkinje Cells of Cerebellum – 100,000 dendrites per neuron that change during learning

Involved in coordinating movement

Digital Computers vs Brain

If 1:1 Neurons to transistor ratio (100 Billion transistor computers needed to model the brain)

CUDA cores

GPU = graphical processing unit

Where does the resonance come from – when you here words and get chills, shake from bottom to top

HM – Had hippocampus scooped out 🡪 Could not make new memories

Computational Neuroscience is not a chase after coming up with statistics (like psychology), it is a chase after the source of those statistics. If a behavior is an expression, where does this expression emerge from?

Representing the brain as a weighted graph, nodes represent neurons, edges and their weights represent axon and the strength of their connections

David Marr – Vision

Implementation / Biophysical – Look at action potentials sent from V1 neurons

Algorithm / Representation - Look at what computations in V1 neurons could be doing

Computation – what are the goals (start and end of the process?)

The analogy of Computer – Hardware, Software, Normative