2017 Computer Science RET

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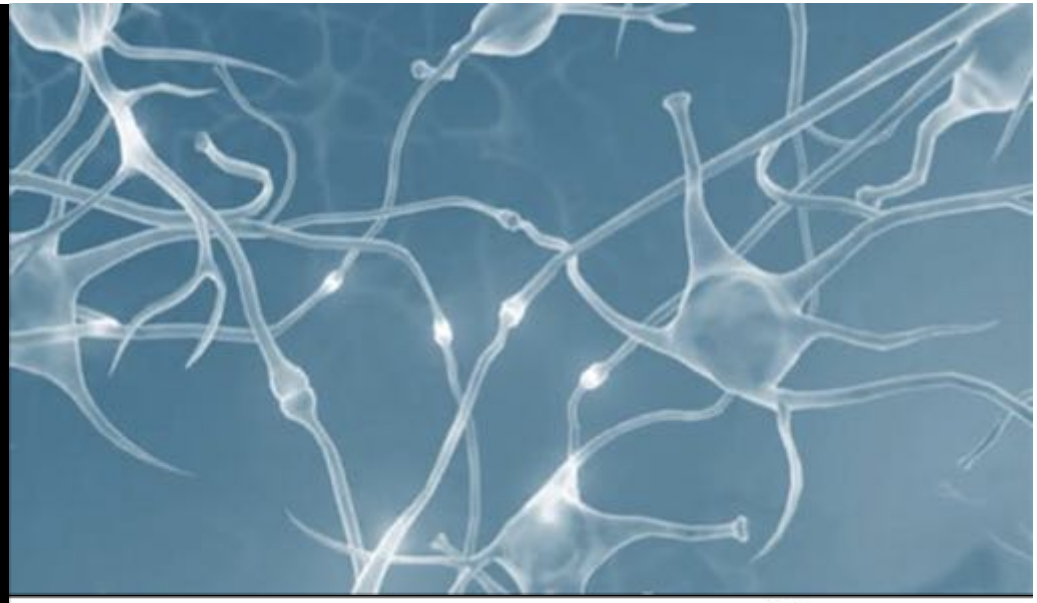
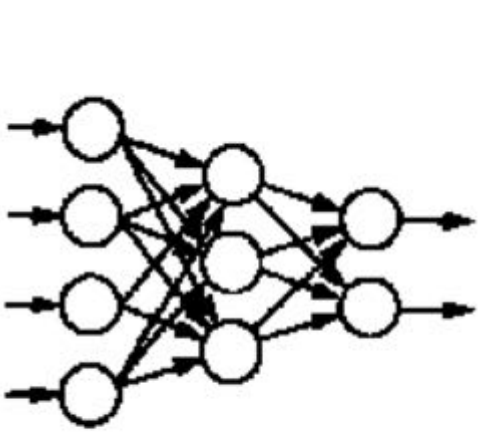
Biology

- **International Baccalaureate Higher Level**
  - Juniors (year 1 of 2 year course)
  - Lessons 1, 2, & 3
- **Regular & Honors 9-12 grades**
  - Lessons 1 & 4
- **Marine Biology**
  - Not impacted (Possible future connection: discuss how ANNs could help with identification of new species)

Themes from RET…

- Theme 1: Structure of a Neural Network
- Human brain is the model for neural networks
- Structure vs function
- Sending & receiving signals (inputs/outputs)
- Feedback leads to learning
  - De/sensitization of tissues to certain neurotransmitters





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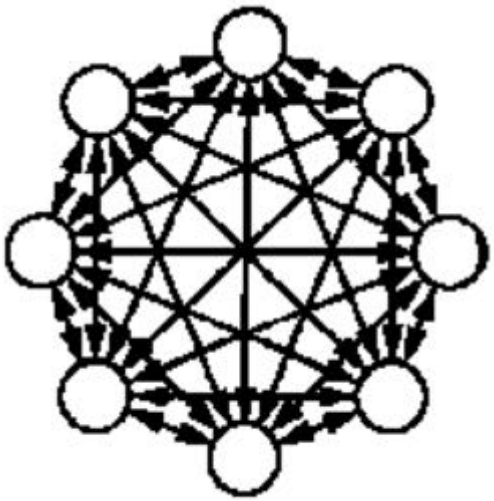
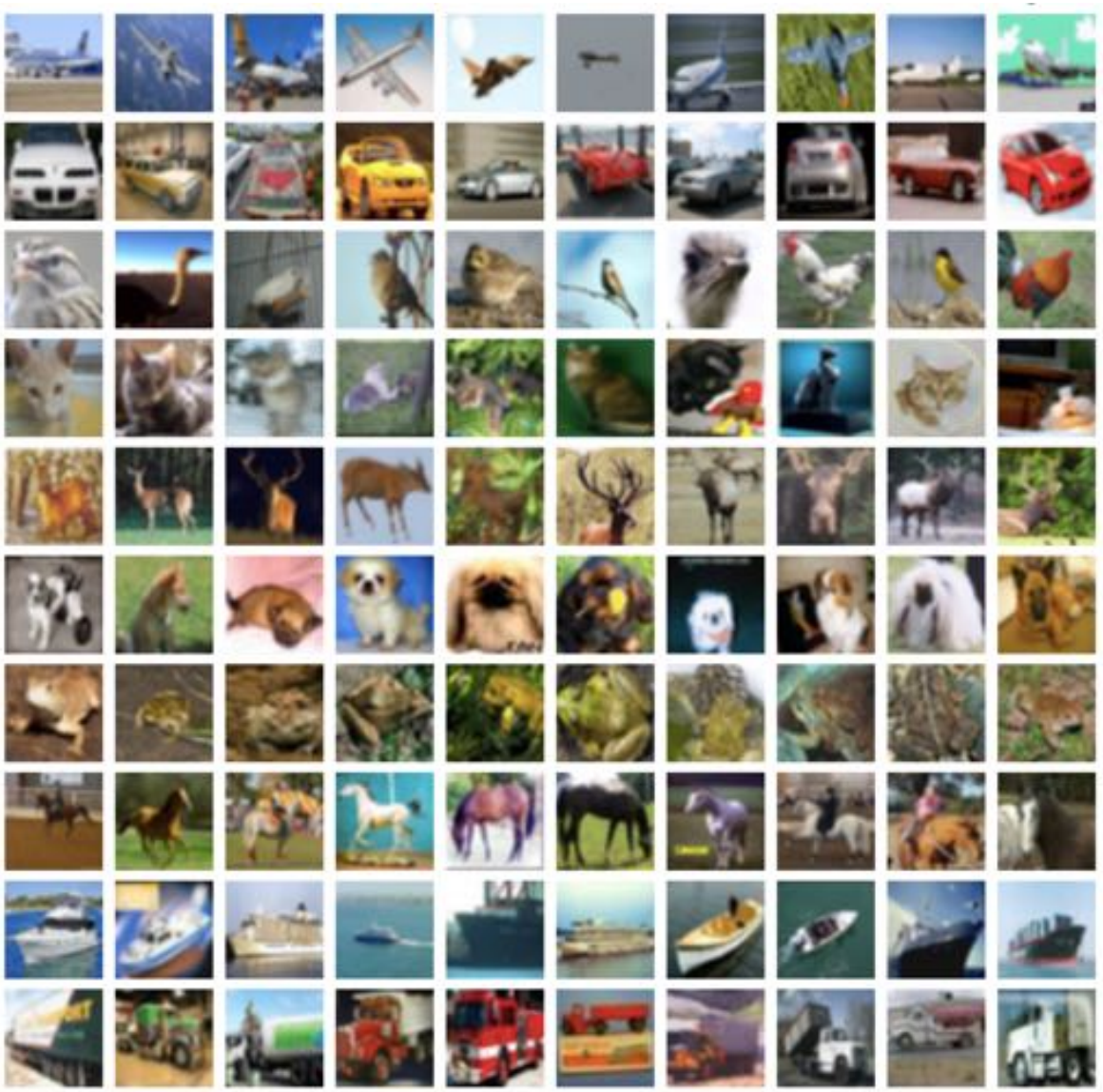


HOPFIELD

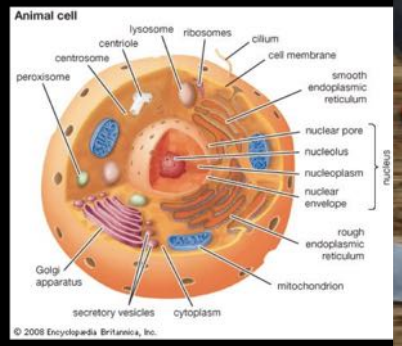
Themes from RET…

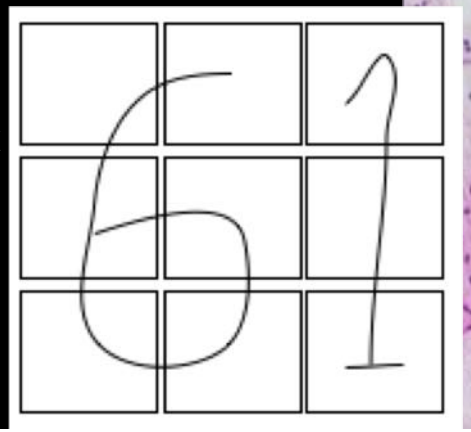
- Theme 2: Training Neural Networks
- Main goals:
  - understand that as the number of images increases, the accuracy increases
  - Eliminates the need to account for variables such as amount of caffeine ingested, amount of sleep, athletic ability, etc.
  - Much faster computation ability

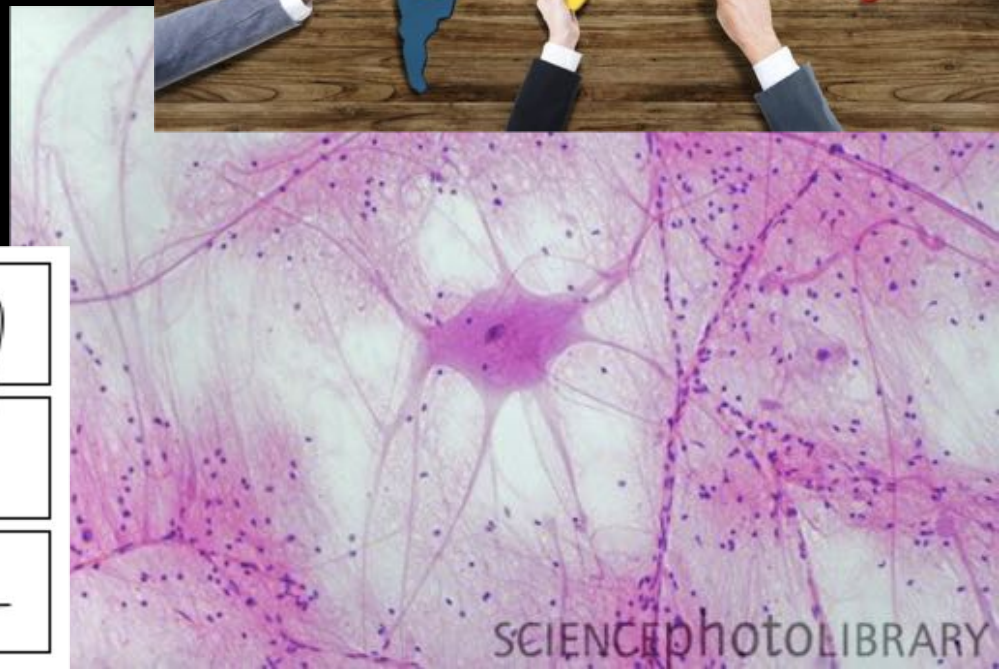


Module: Lesson 1

- Viewing multipolar neurons using microscopes
  - Observe the shape
  - Why is it shaped in this way?
  - Final question: describe 1 way that scientists are using cells to improve our lives
  - Day 2 Follow-up: puzzle (simulates a developing neural net)
  - Dr. Niemier
  - Goal: awareness & basic understanding of neural nets





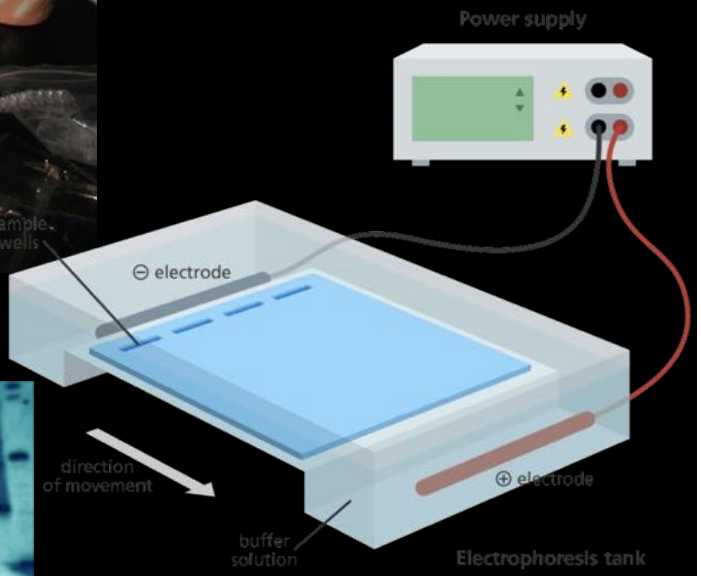


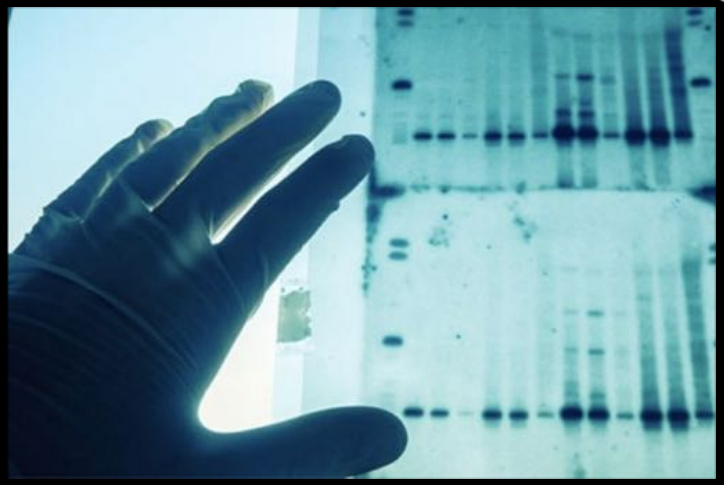
Module: Lesson 2

- Image ID Accuracy (Karpathy)
- Practice using statistics
- Gathering data on human reaction times
- Goal: to SEE that values will be less varied when human variables are removed
  - Athlete vs Non-athlete
  - Caffeinated teen vs sleep-deprived

Module: Lesson 3

- Genetics Unit
- PCR
- Gel electrophoresis
- Identifying presence/absence of gene of interest
- Our gene of interest: Alzheimer's disease
- Goal: neurodegenerative diseases= "unlearning"; loss of communication & connection between neurons





Module: Lesson 4 (Final Project)

- Research project and presentation on a neurodegenerative disorder
- Part 1: following the rubric to create a powerpoint with a partner
- Part 2: completing a follow-up worksheet on their own:
  - 1. If you had a computer or smart phone affected by the disorder you researched, what would you expect to see happening to it?
  - 2. How might you try to fix it?
  - 3. Thinking along the cellular level, relate what happens as your disorder progresses in computer science terms.

Using RET purchases…

- Lesson 1:
  - Preserved neuron slides
  - Neuron model
  - Fun foam
- Lesson 2:
  - Reaction timer
- Lesson 3:
  - PCR machine & gene ID materials