# MACHINE LEARNING

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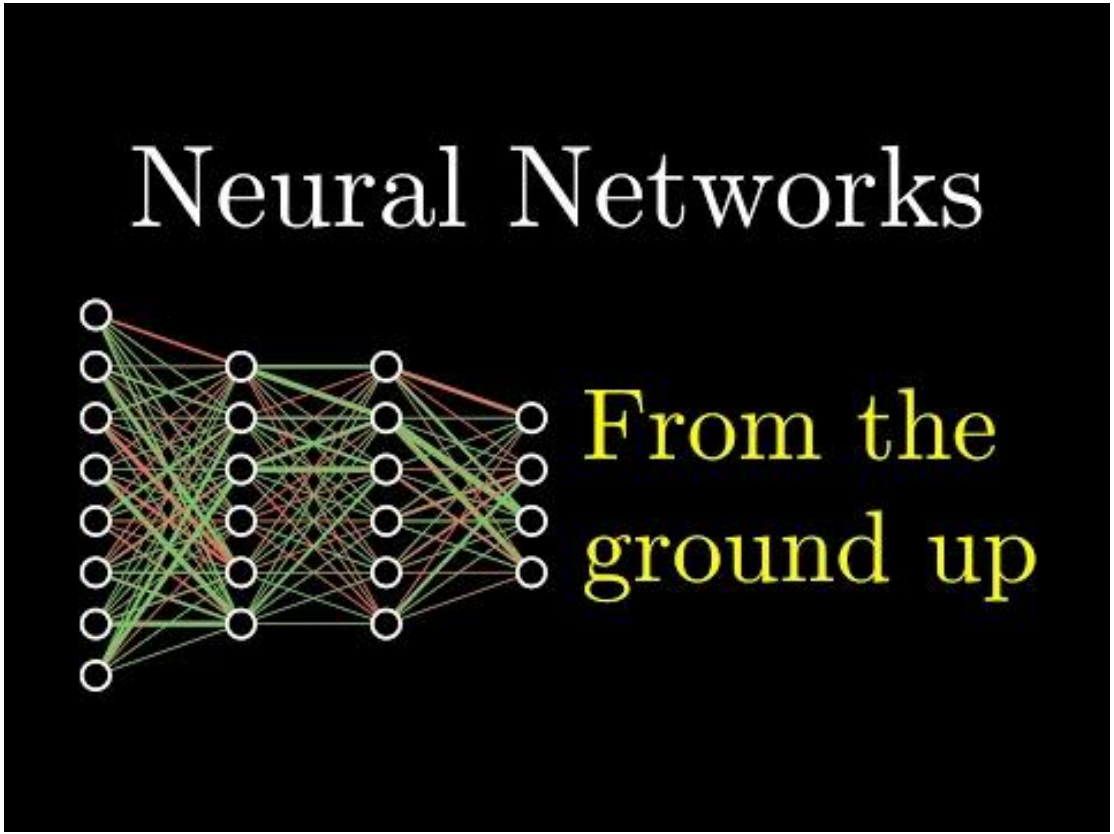
# AGENDA

- An Introduction
- First Steps
- MNIST Database
- Population-Based Training
- Demo
- Recap
- Going Forward

# AN INTRODUCTION



# FIRST STEPS

# RESEARCH AND PLANNING

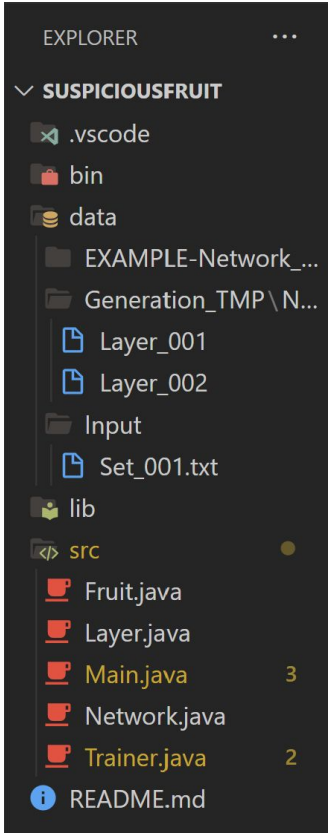
- 2 weeks of heavy research + light curiosity in the prior 2 months.
- Sourced many scholarly articles, blogs, and videos.
- Created a general structural layout for the neural network.
- This all allowed the foundations for the neural network to be coded within a few days.

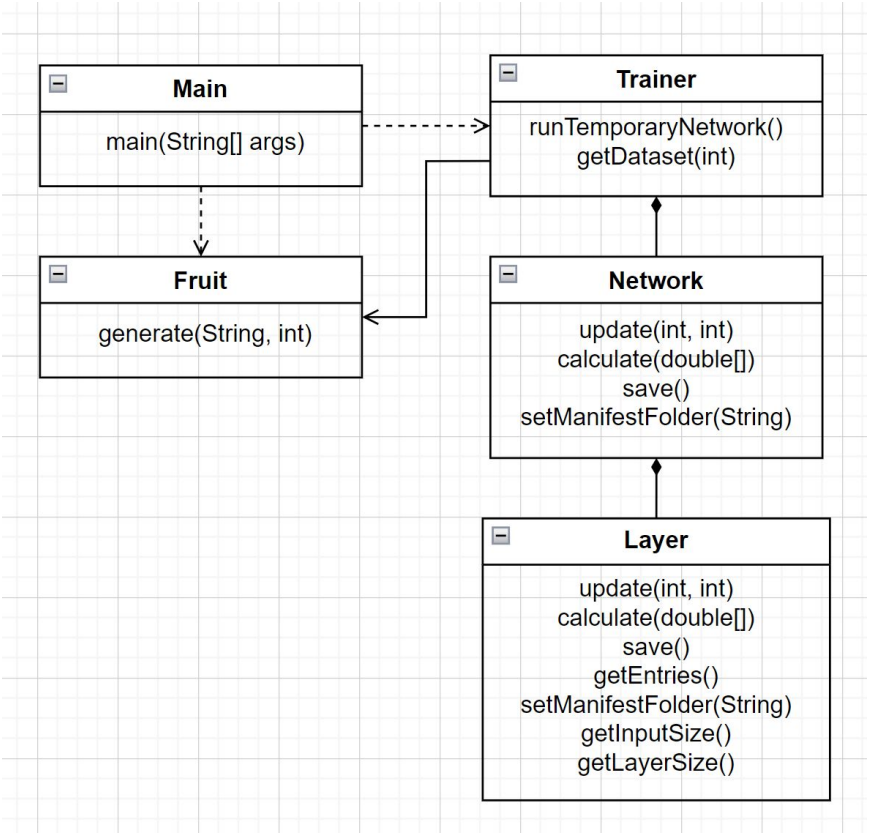
# POISONOUS FRUIT

- The task: determine whether a fruit was poisonous or not.
- The fruit has three characteristics that act as inputs to the network:
  - one (1): Length of the spikes;
  - two (2): Density of the spots;
  - three (3): The size of the fruit itself.
- This was solved in the matter of a minute at max by the AI.

# CODE STRUCTURE

892 Lines of Code

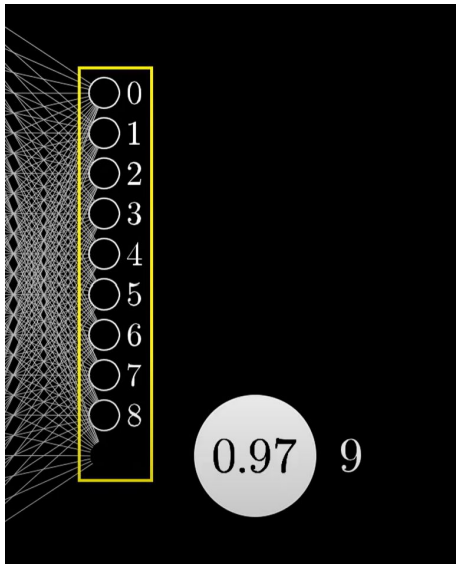


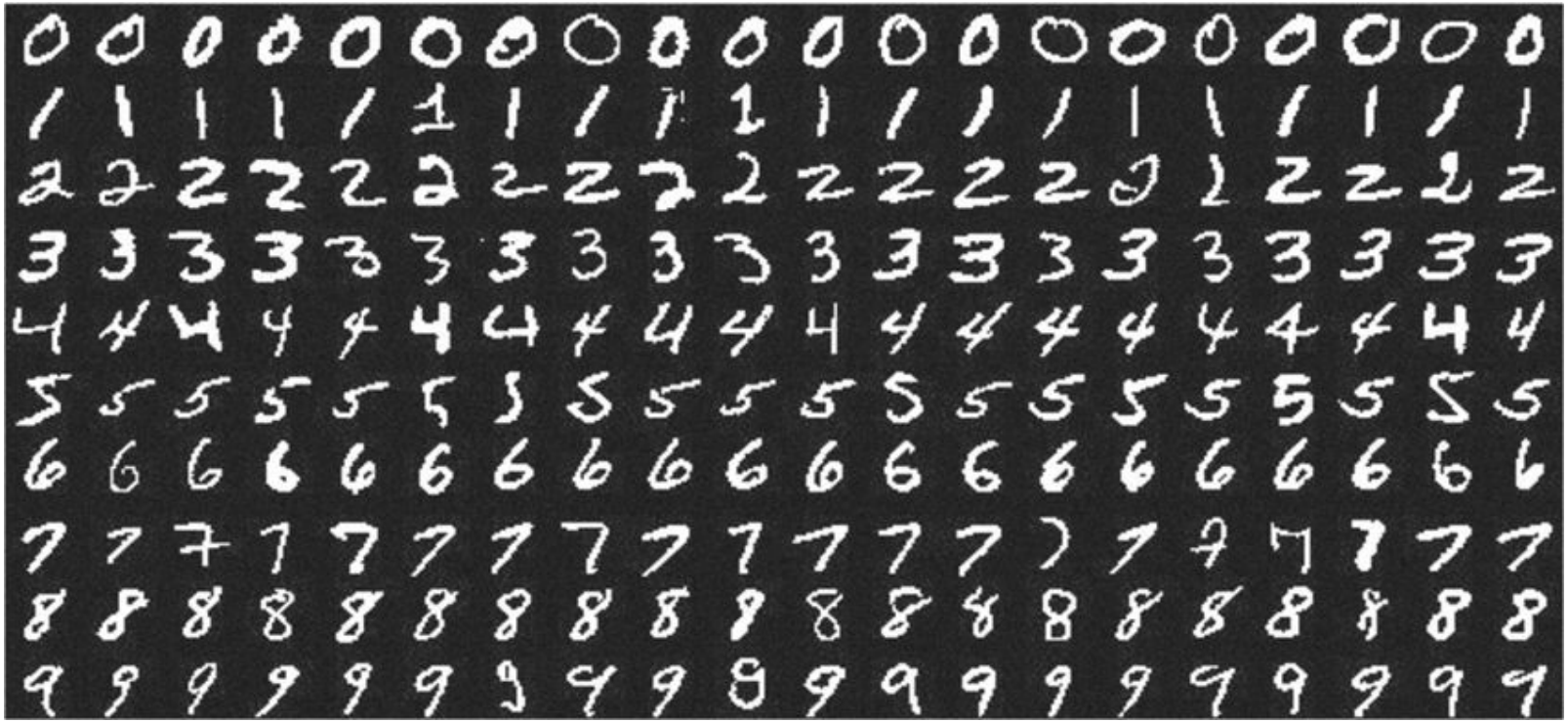
# MNIST DATABASE

# "HELLO WORLD"

- The MNIST database is considered the "hello world" of machine learning.
- The task: determine the number (0 - 9) represented by a handwritten digit.
- 784 inputs (28x28 pixels) with each input ranging on a scale of 0.0 - 1.0, 0 being black, 1 being white.



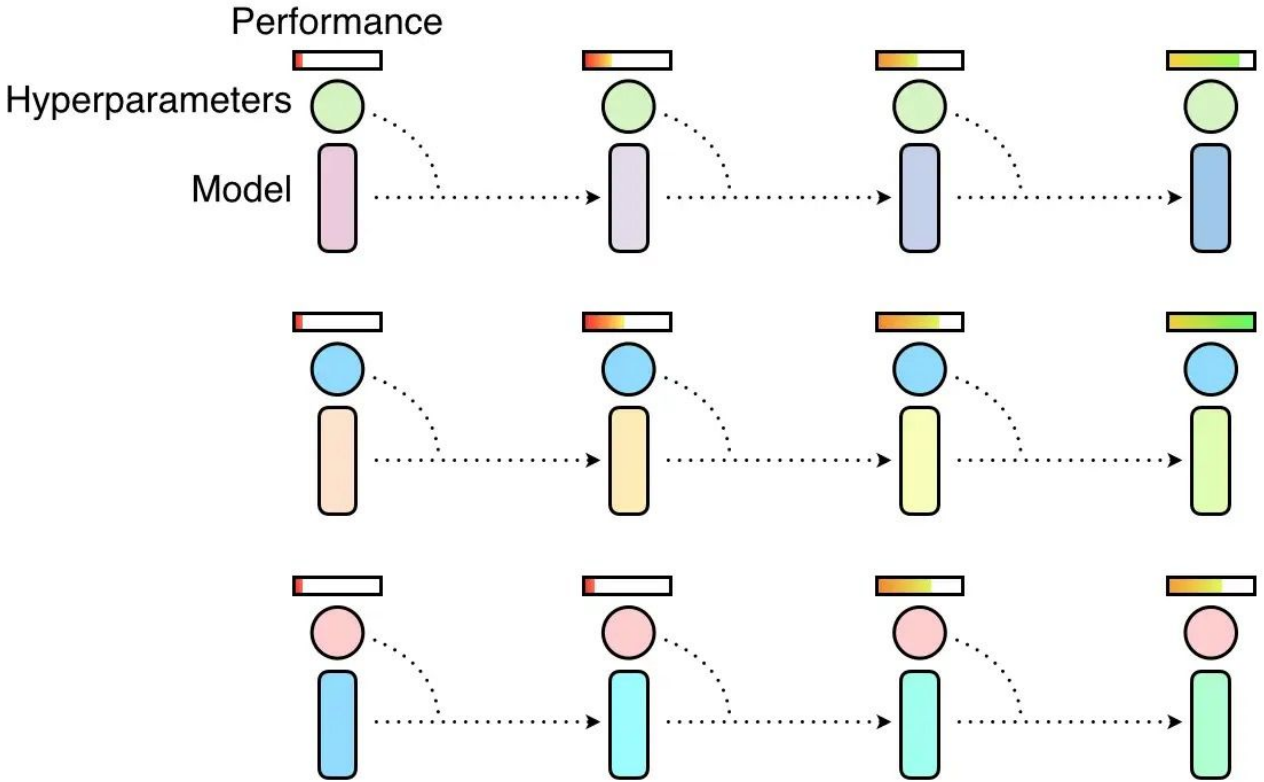
# EXAMPLES



# POPULATION-BASED TRAINING

A training method developed by Google DeepMind.

# POPULATION BASED TRAINING



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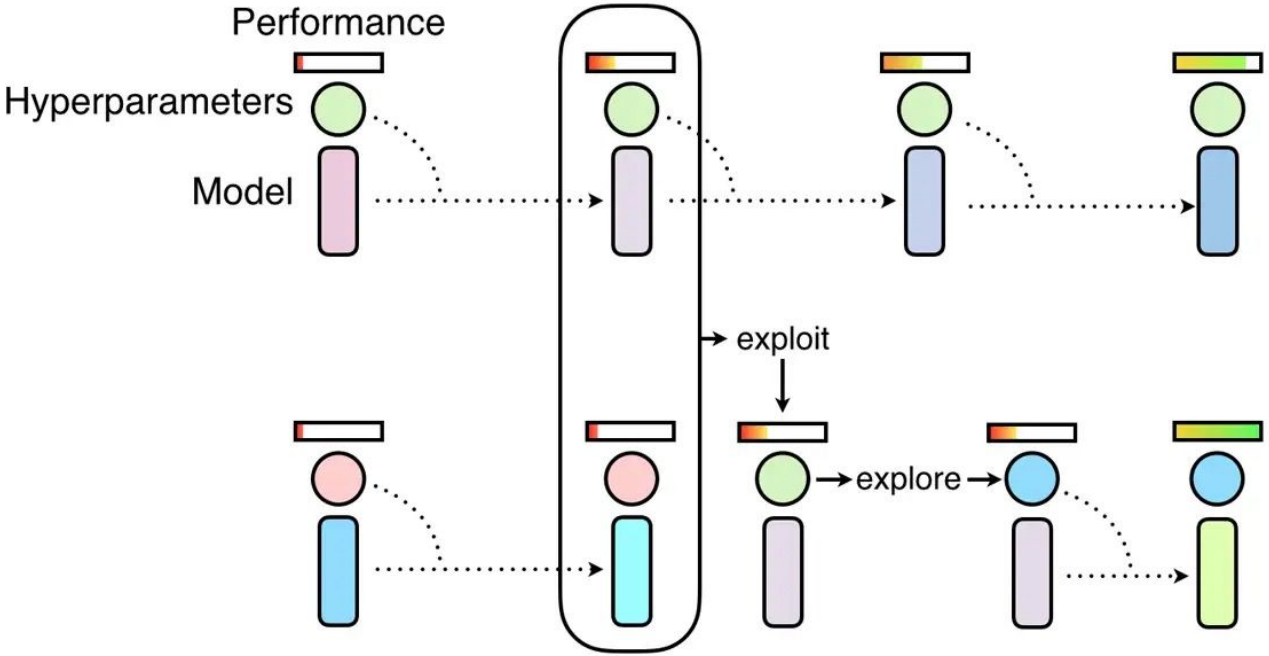

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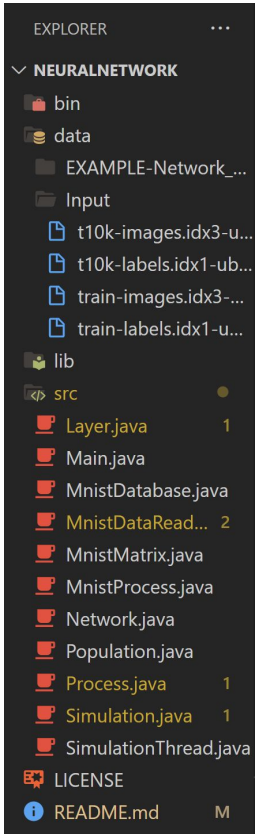
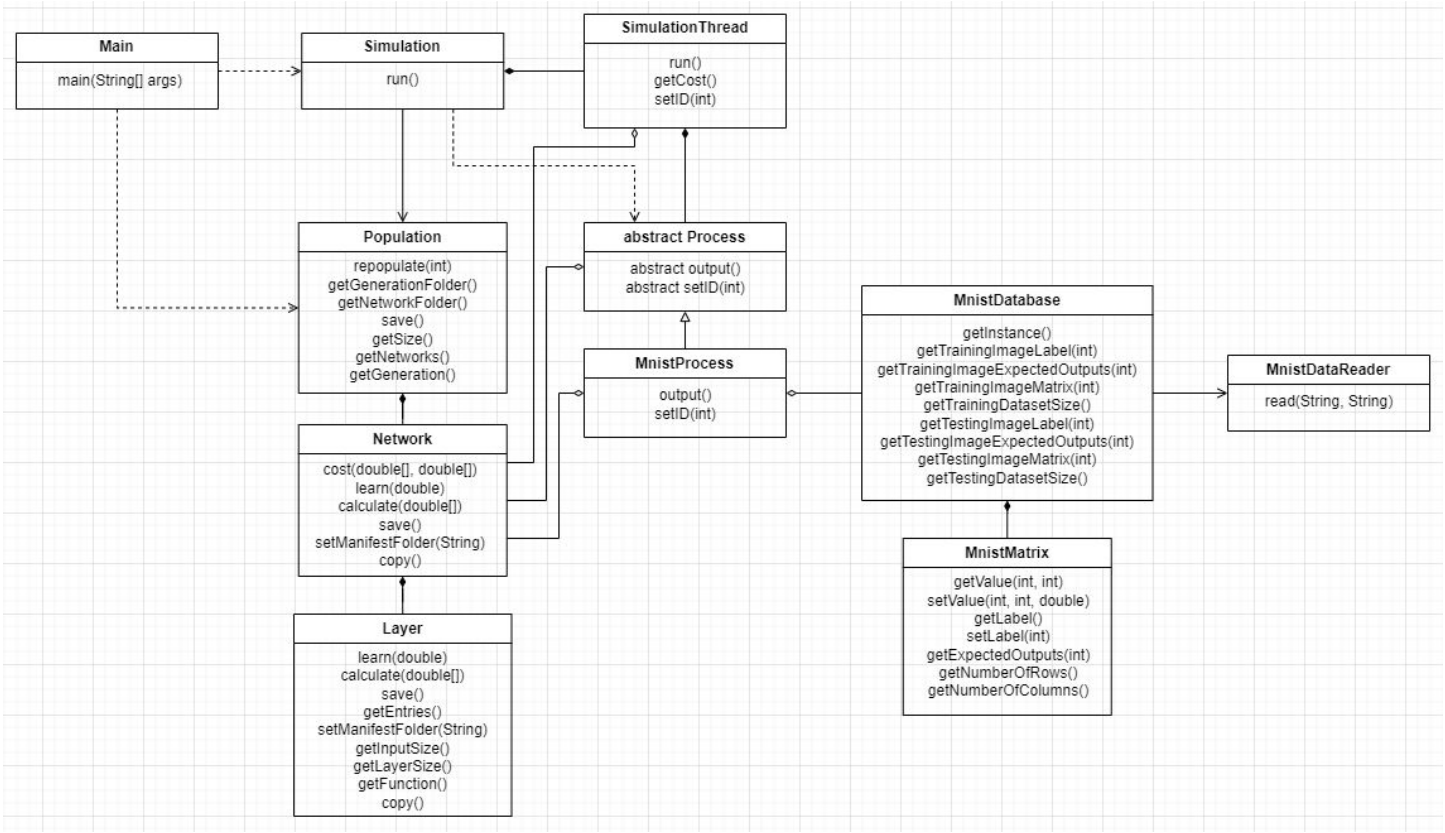


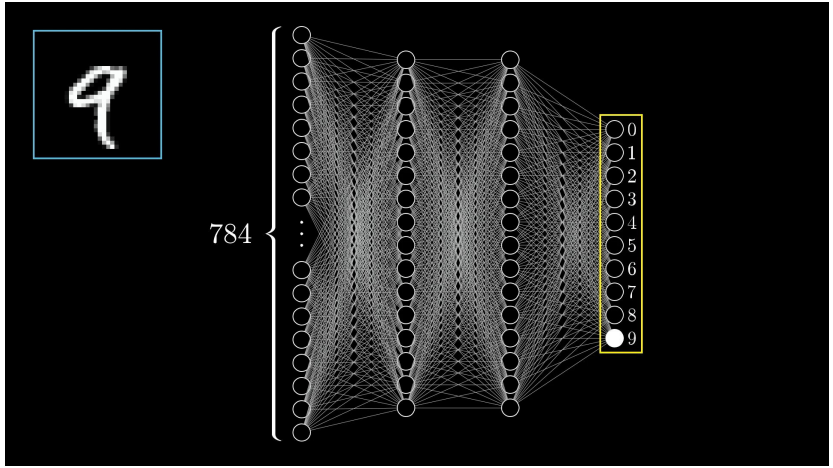



# DEMO

# RECAP

# NEURAL NETWORK

- A neural network is composed of many layers with many nodes.
- A node is more "activated" as its value approaches 1.
- Population-Based Training (PBT) provides an efficient way to train a successful neural network model.



# CODE STRUCTURE: FROM THIS

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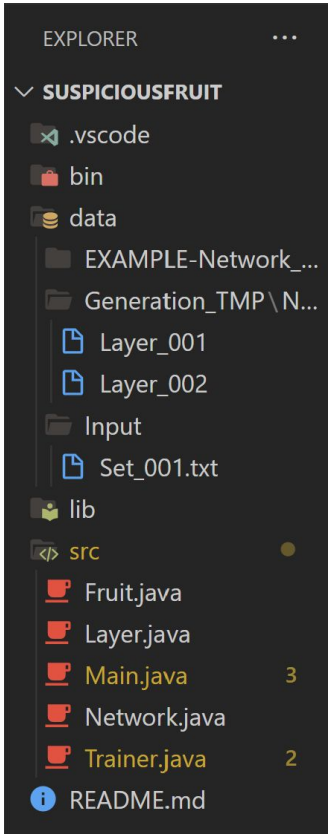


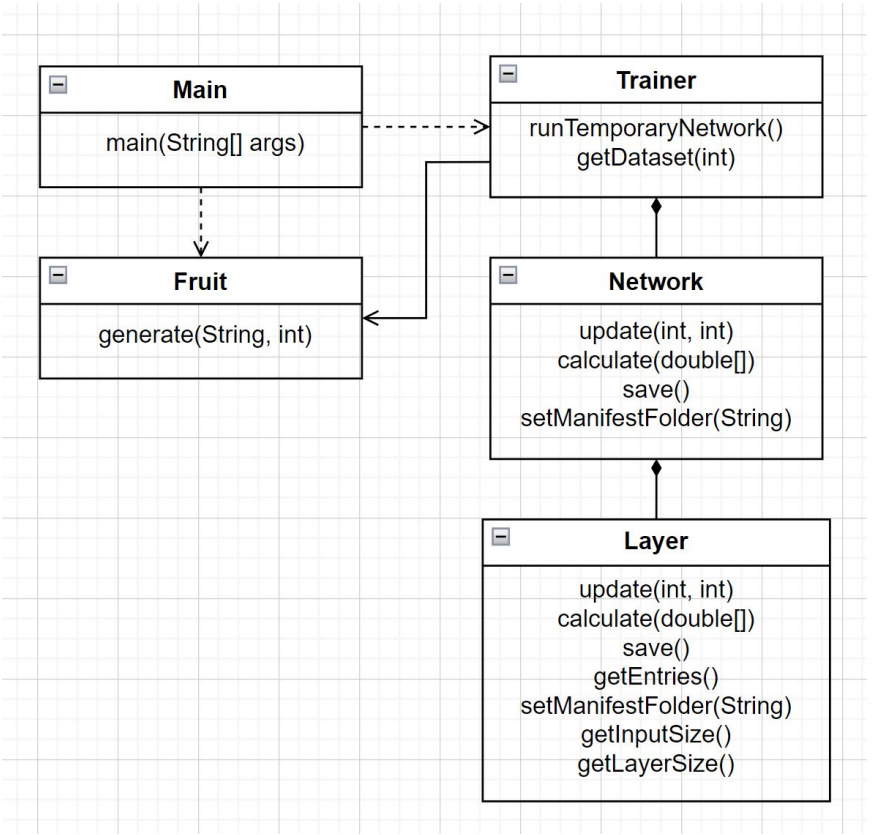

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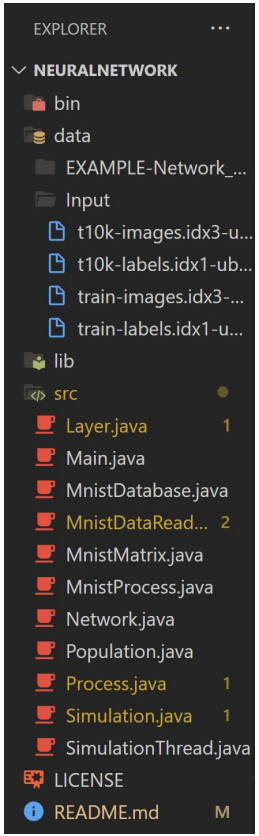
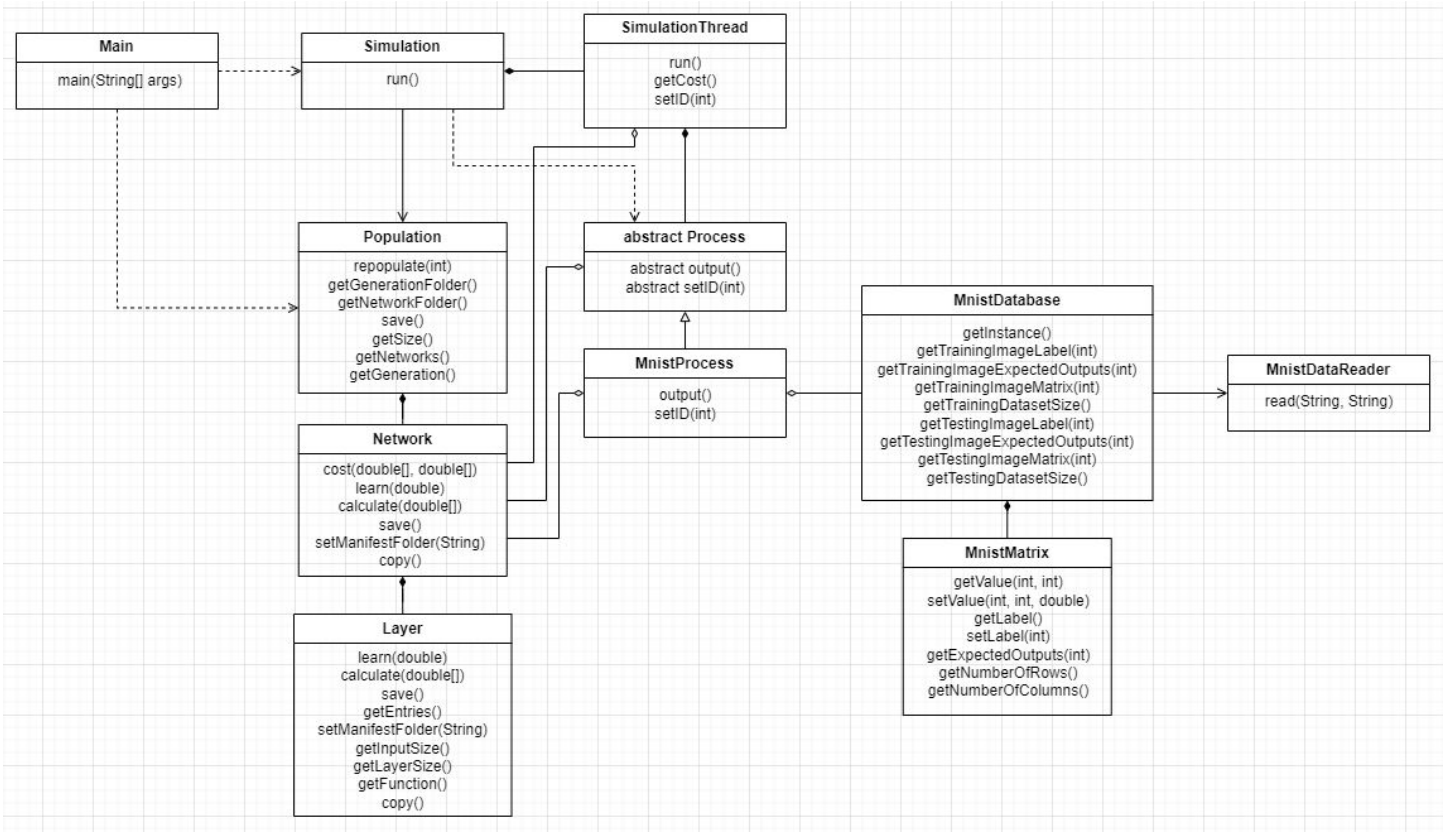
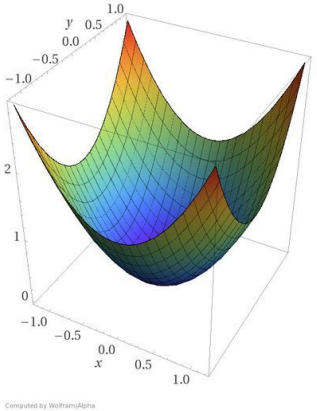


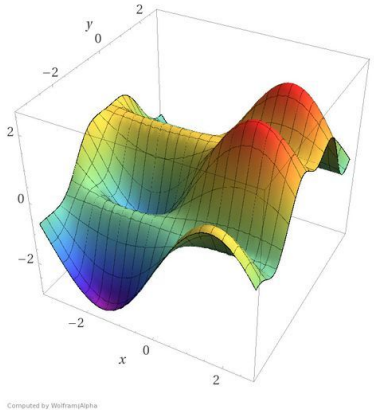



# GOING FORWARD

# THE AI IS SLOW

- Performing completely random changes to the AI is not very efficient…
  - I let my AI run overnight once and it made no progress at all.
- Solution: backpropagation and gradient descent.
  - Calculus concepts that will take at least a good couple weeks to get a grasp of with then another week to flesh out the new structure (not including the actual implementation of it in code).



# BEYOND FRUIT AND MNIST

- Face/object recognition
- Checkers

# THANK YOU

# POST-PRESENTATION

- All code with extensive documentation, links to helpful resources, and a pseudo-dev journal via GitHub commits are found at this repository:
  - https://github.com/savojosh/NeuralNetwork/tree/MNIST
  - Code from when I was seeing if a fruit was poisonous or not is not posted at this repository.
- Special thanks to:
  - 3Blue1Brown for the video used in this presentation;
  - Google DeepMind for Population-Based Training (PBT);
  - Sebastian Lague for an intro on how to actually code a neural network;
  - Dr. Cao for help with Java Reflections;
  - Jason Brownlee for extremely informational blog posts;
  - And to all other sources that helped me along the way.