National Defense Education Program
ARTIFICIAL INTELLIGENCE

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OVERVIEW

01 **Intro to AI**
Definition & explanation
Applications

02 **Our Project**
What we are aiming to do
MNIST databases
Image/Pixel analysis

03 **Neural Networks**
What they are
Layers, nodes, & weights
Application to our project

04 **Current Progress**
Where we've gotten
Code & graphs

05 **Sneak Peek**
What we will be doing
Improve the network
Clothing database

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01

Intro To Artificial Intelligence

Manas Agrawal & Kevin Comaduran

What is an AI?

AI stands for “Artificial Intelligence”. This is the way that scientists answer the question “How can a machine think?” AIs use pattern recognition known as “machine learning” to determine relationships between pieces of data. With these relationships figured out, they can analyse inputs and determine the output accurately.

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Machine Learning

Machine Learning is how computer scientists train an AI. This process involves two major factors: training data and testing data.

Trainers

Training data is the information fed into pattern recognition

After the artificial intelligence is done training, testing data is used to ensure that it has a high accuracy

Testers

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The point is, the computer has no way to know... unless you give it more trainers. Can anyone guess what the symbol might mean now?

solution, we have completed training

Example

1 ✤ 2 = 6

(1+2)*2 = 6

4 ✤ 7 = 22

(4+7)*2 = 22

12 ✤ 24 = 72

(12+24)*2 = 72

0.4 ✤ 2.6 = 6

(0.4+2.6)*2 = 6

3 ✤ 4 = 14

(3+4)*2 = 14

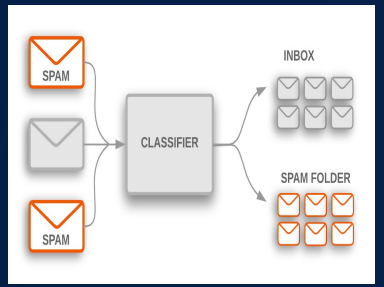
Applications

AI-based software to catch wrist fractures more quickly in the healthcare sector

Using AI to observe and identify potential investment market offenses in financial sector

Adopting AI to help find and detect new phenomena in astronomy

Employing AI to detect and filter spam mail or phishing emails



Source : https://www.ai.gov/strategic-pillars/applications/

02

OUR PROJECT

Kevin Comaduran & Tyler Hale

Image Recognition

Supervised Classification

In our project, our software will have the ability to recognize images. It will then “classify” these images into pre-specified groups.

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Modified National Institute of Standards and Technology (MNIST)

Definition

Large database of handwritten that is used for training different image processing system

Uses

Provides a baseline for testing images processing systems.

Source

Created by re-mixing different samples from NIST's database

Features

Databases can reach up to 70,000 pieces of data.

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MNIST Numbers Dataset

The Handwritten Numbers dataset contains over 70,000 images that contain the numbers 1-10. Our project will be to interpret these images, which are really an array of 784 pixels that contain a value from 0-255 that represents the amount of white that is present in the pixel.

With this image, you can see how many variations there are to handwritten numbers and how that makes it difficult to identify specific digits

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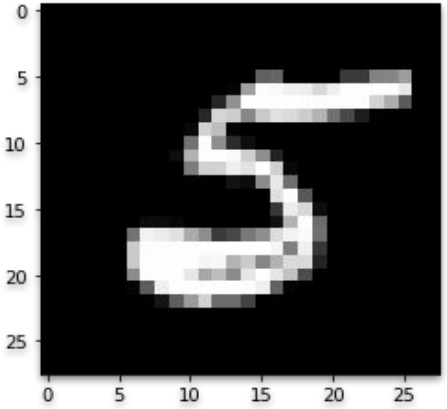
Examples

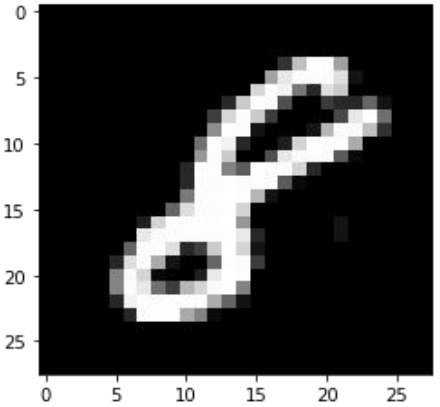
```
x = image_dictionary[5]
print(x.shape)
plt.imshow(x[100], cmap='gray')
```

(6313, 28, 28)




```
x = image_dictionary[8]
print(x.shape)
plt.imshow(x[6800], cmap='gray')
```

(6825, 28, 28)



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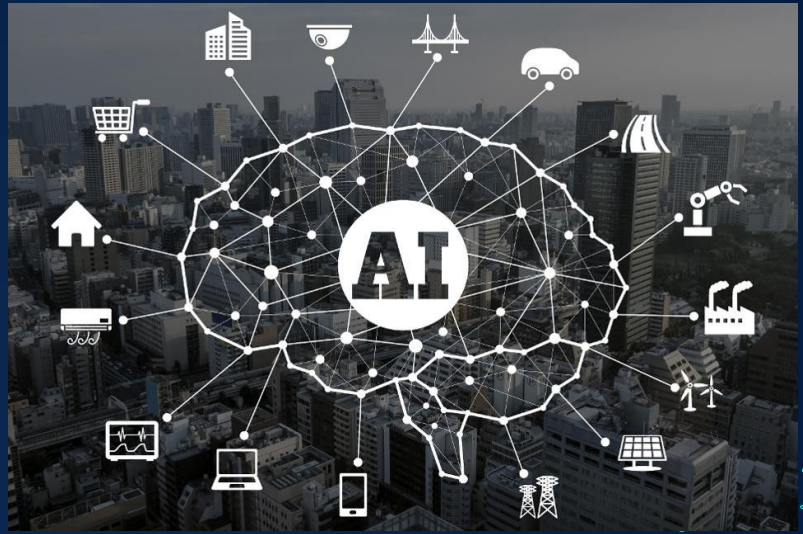
Real World Relevance

It is important for AI to read hand-written numbers because businesses use it to read postal addresses, bank check amounts, and other paper documents.



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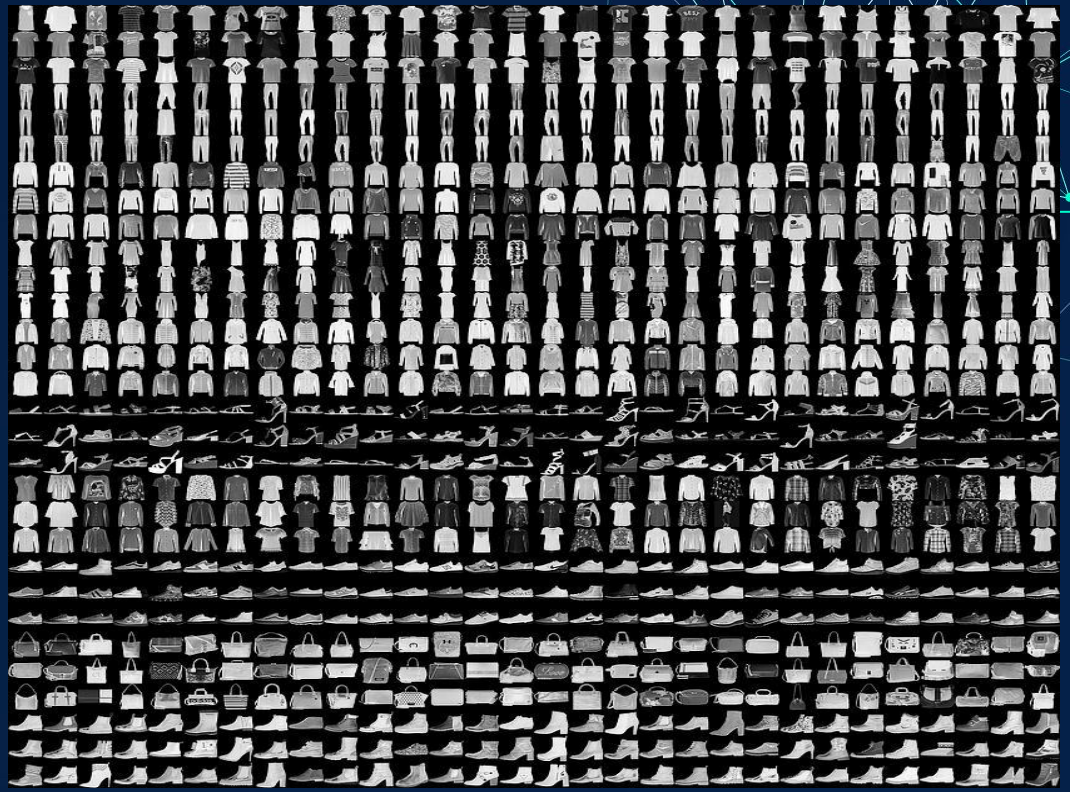
MNIST Clothing Dataset

Instead of digits, this dataset contains many different items of clothing (Shirts, Trousers, Sneakers, Bags, etc.). There is a total of 70,000 pieces of data. Each group contains ~7000 each



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Source :.https://emerj.com/ai-sector-overviews/artificial-intelligence-for-clothing-and-apparel/

Real World Applications

- Clothing recognition can be use to characterize people such as life style, age, and gender. Fashion brands around the globe use AI for their design process; regarding personal style to fit body shape.

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03

NEURAL NETWORKS

Prativa Regmi & Sanchit Singhal

What are Neural Networks?

Neural networks, also known as artificial neural networks, are a series of algorithms that recognize the underlying relationships in a set of data through a process that mimics the way the human brain operates. Neural nets are the means by which computer learns to perform some tasks by analyzing training examples.

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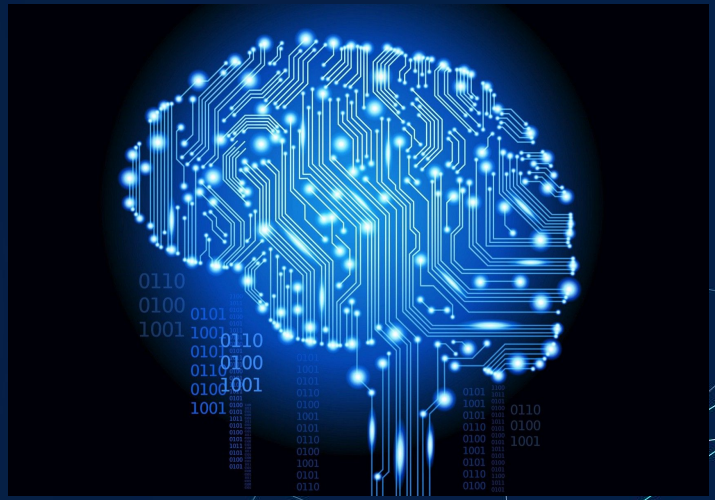
Relation to Human Brain

- Consists of millions of processing nodes interconnected like human brain
- Nodes = Neurons
- Sends and analyzes data send through layers
- Makes decisions based on the data



Source: https://www.bmc.com/blogs/neural-network-introduction/

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Breakdown of Parts

What is a Layer?

- Part of the structure
- Input, Hidden, & Output
- Order of computation; steps for the model
- Symbolic of a group of neurons activated at the same time
- Connections between layers are like axons

What is a Node?

- Computational unit
- Information travels from node to node
- Symbolic of a neuron

What is a Weight?

- Number from 0-1 representing connection strength
- Changes as the model learns
- Symbolic of the threshold potential

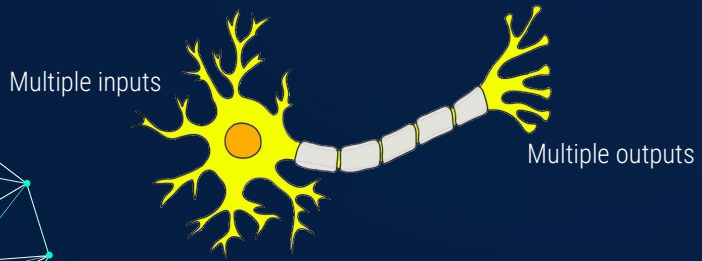

Image: https://neuroscientificallychallenged.com/glossary/neuron

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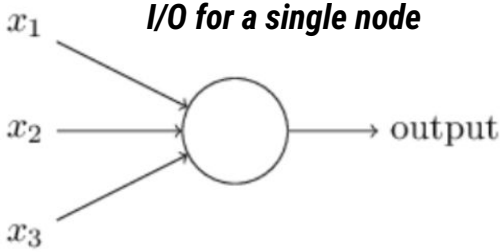
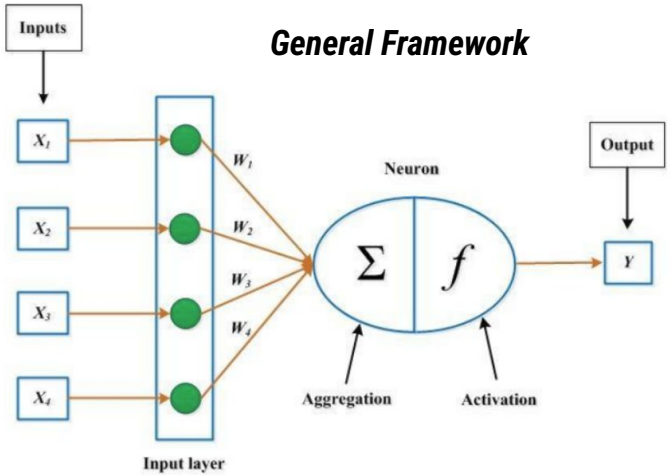
How does it work?

- Neural networks are comprised of interconnected layers and nodes
- Each node receives inputs and computes the data to make a decision
- Once a node is activated, it sends data to the next node through it's connections
- Eventually it reaches the output layer, where the most prominent node is chosen as the 'solution' and outputted
- They can adapt to changing input and use the training data to learn and improve accuracy over time

I/O for a single node



General Framework



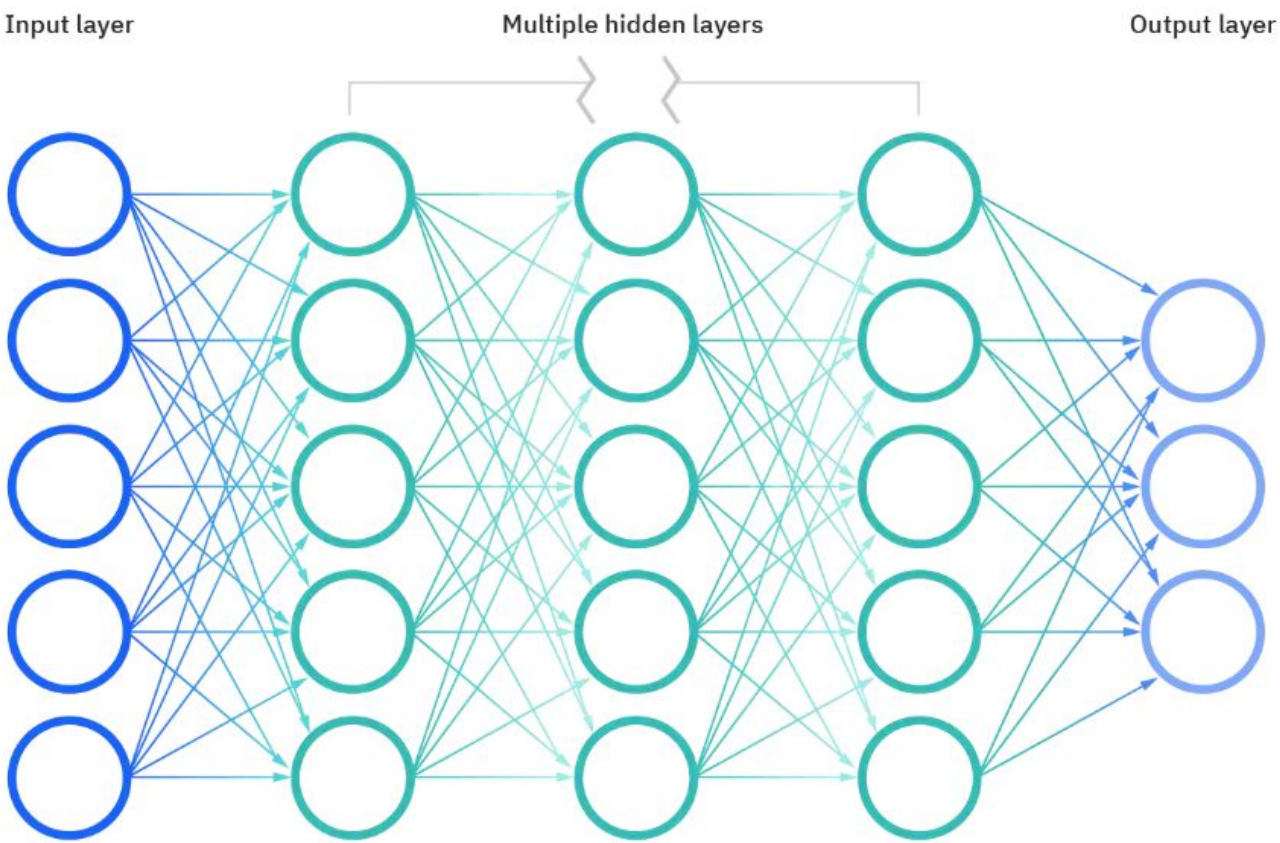


Image: https://www.ibm.com/cloud/learn/neural-networks

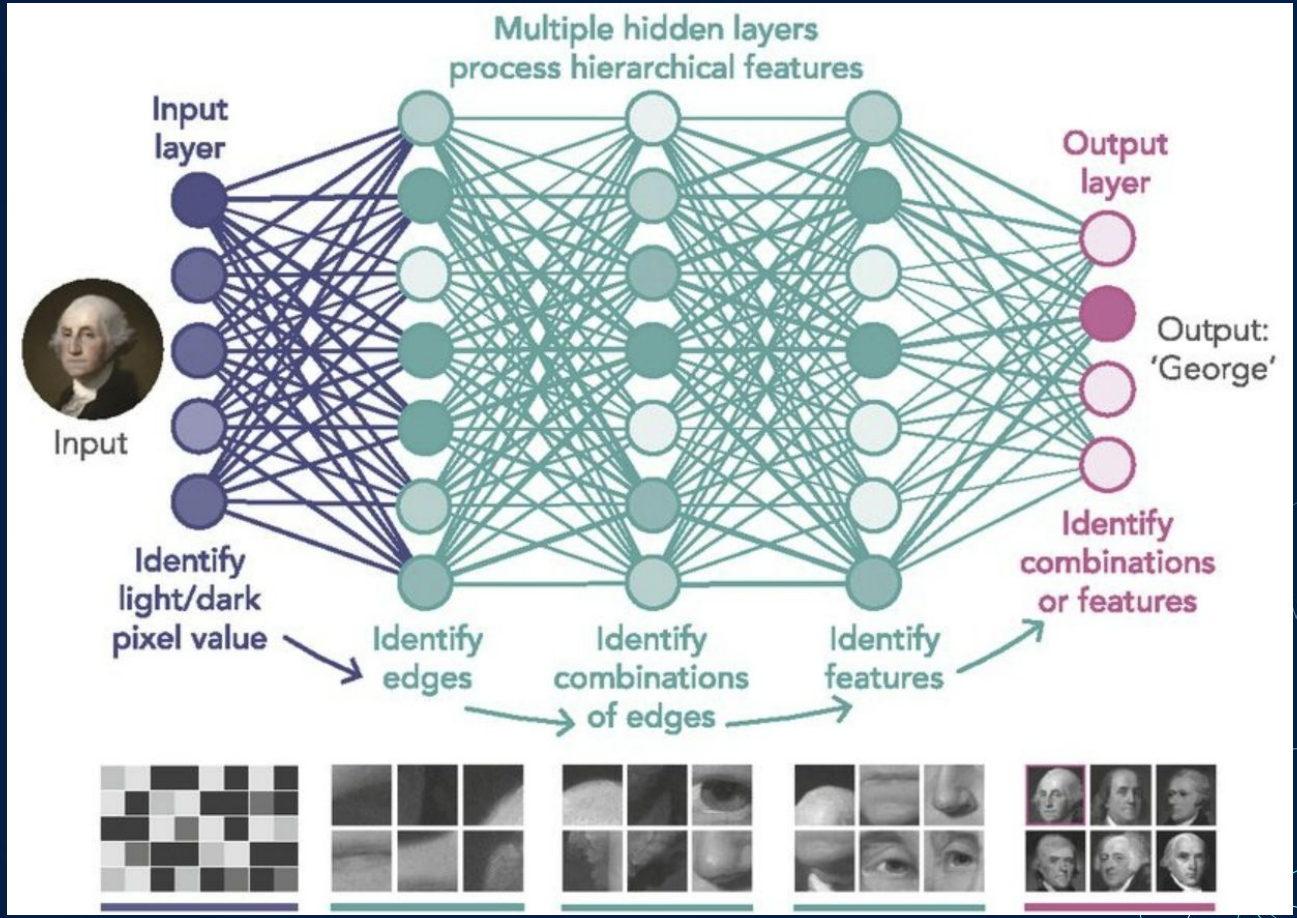
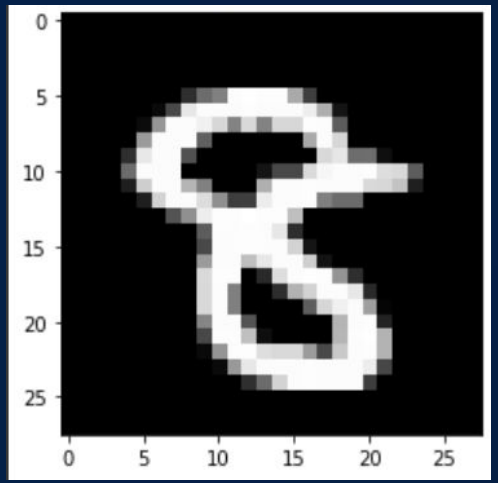
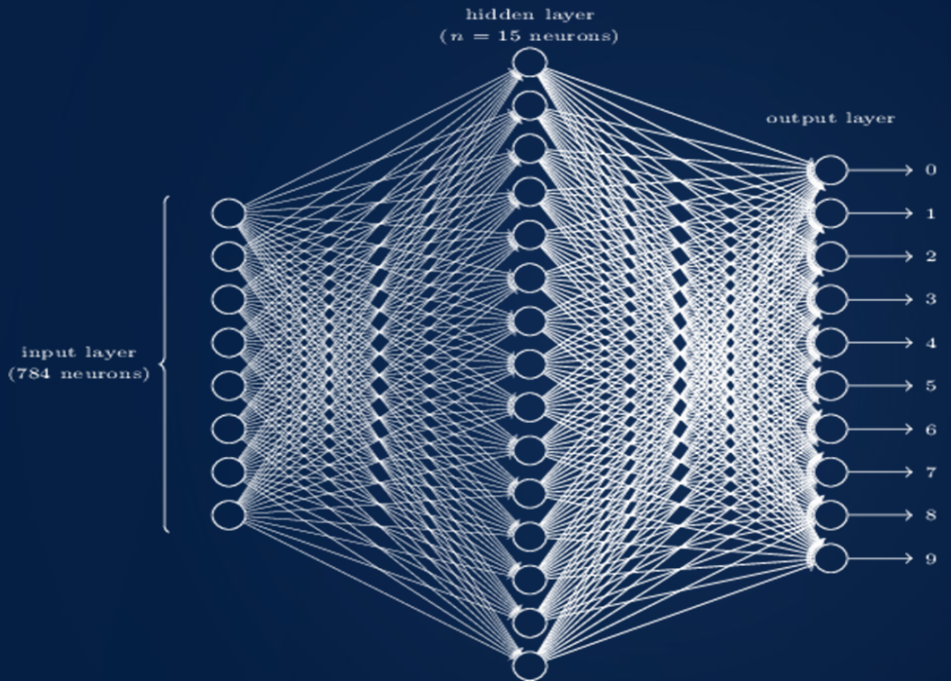


Image: https://www.positronic.ai/consulting/deep-learning/

How Our Project Uses a Neural Network

- 28x28 pixelated image of a handwritten number
- Stored as a group of 784 individual pixels
- Pixels are a value 0-255 (Black to White)
- The nodes in the hidden layers analyze the pixels and produce an output based on what the weights were set to after training





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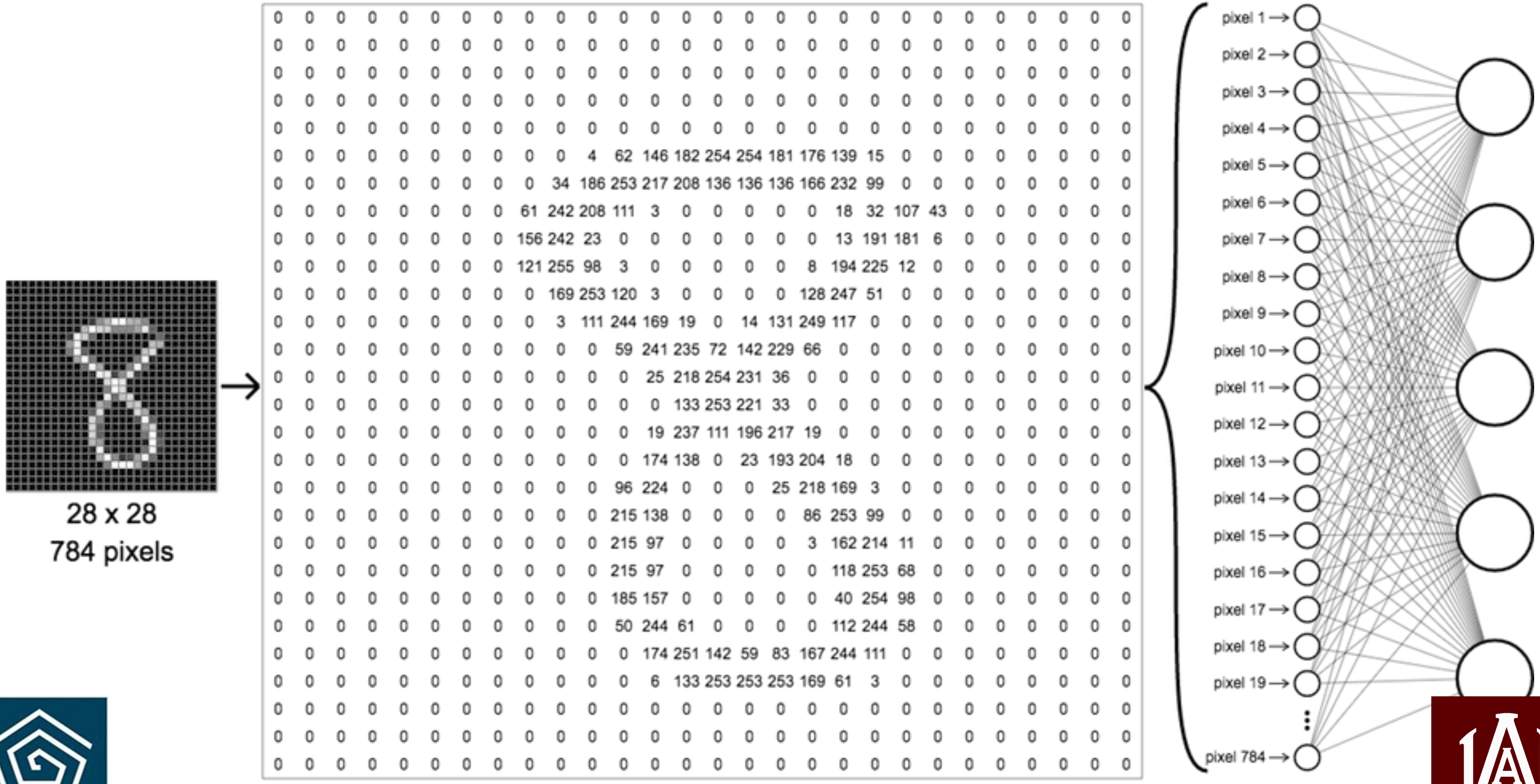

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	4	62	146	182	254	254	181	176	139	15	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	34	186	253	217	208	136	136	136	166	232	99	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	61	242	208	111	3	0	0	0	0	0	18	32	107	43	0	0	0	0	0	0
0	0	0	0	0	0	0	0	156	242	23	0	0	0	0	0	0	0	13	191	181	6	0	0	0	0	0	0
0	0	0	0	0	0	0	0	121	255	98	3	0	0	0	0	0	8	194	225	12	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	169	253	120	3	0	0	0	0	128	247	51	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	3	111	244	169	19	0	14	131	249	117	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	59	241	235	72	142	229	66	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	25	218	254	231	36	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	133	253	221	33	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	19	237	111	196	217	19	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	174	138	0	23	193	204	18	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	96	224	0	0	0	25	218	169	3	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	215	138	0	0	0	0	86	253	99	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	215	97	0	0	0	0	3	162	214	11	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	215	97	0	0	0	0	0	118	253	68	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	185	157	0	0	0	0	0	40	254	98	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	50	244	61	0	0	0	0	112	244	58	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	174	251	142	59	83	167	244	111	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	6	133	253	253	253	169	61	3	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Image: https://medium.com/algorithms-for-life/numbre-a-number-recognizer-neural-network-fff9e9a35ee4

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04

CURRENT PROGRESS

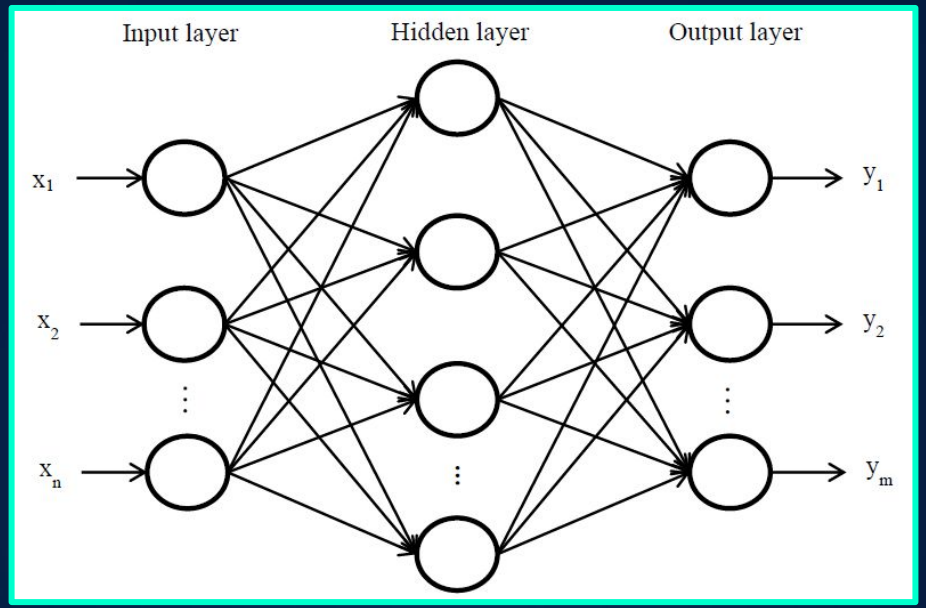
Amari Brassfield, John Brown, & Amanda Burns

Our Project

So far, we have been looking at the effect of different parameters on the performance of a simple feet-forward neural network (FFNN)

What is A FFNN?

- Type of neural network
- Layer by layer, one step at a time



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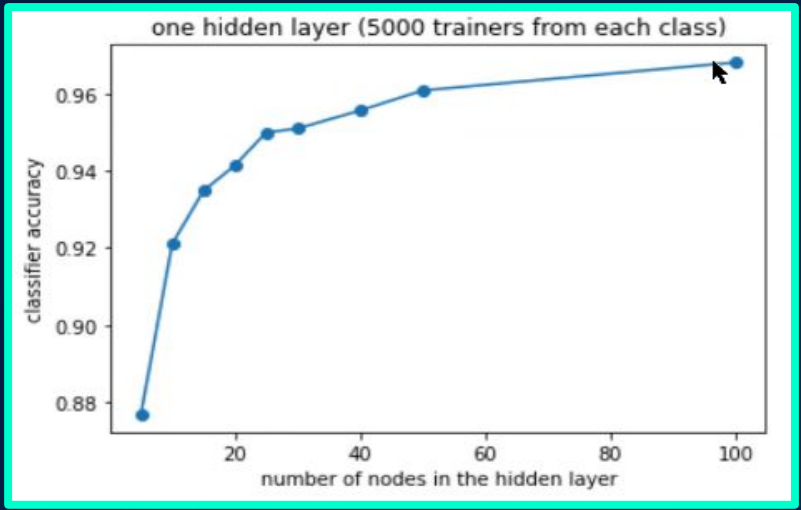
Increasing Accuracy with Nodes



In this diagram, we were working with one hidden layer and 5000 training images to observe the effect that the number of nodes in that layer had on the performance of the model.

```
def nn_evaluator_1(image_dictionary):
  """evaluates the effect of the number of nodes in the hidden layer of a NN
   with a single hidden layer on the classifier performance.
   The classifier is trained to recognize hanwritten digits."""
  n_trainers = 5000 #number of trainers from each class
  epochs = 5
  # n_hiddenLayerNodes = [15, 30, 60, 120, 240]
  n_hiddenLayerNodes = [5, 10, 15, 20, 25, 30, 40, 50, 100]
  import numpy as np
  import tensorflow as tf
```

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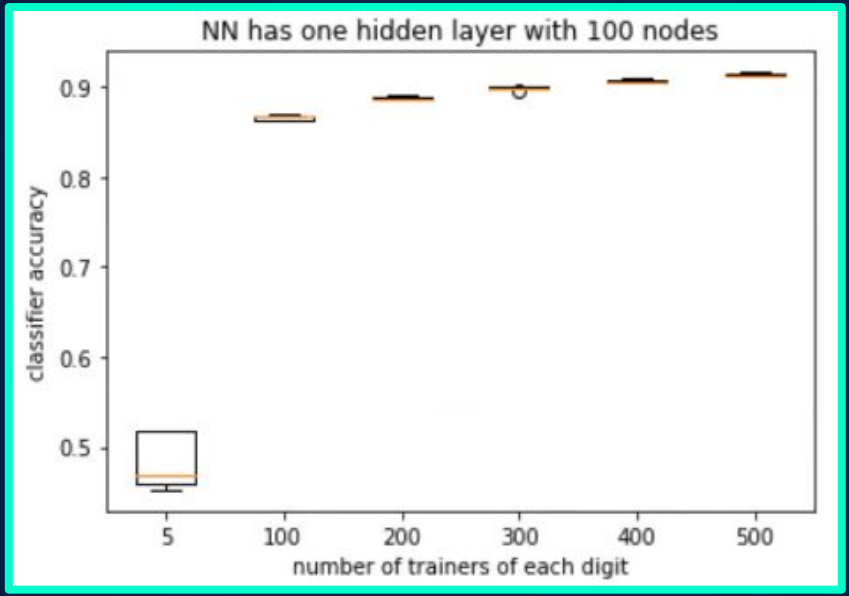
Increasing Accuracy with Trainers



- If you increase the number of trainers, the classifier's performance increases as well.
- Guessing the digit randomly results in a 10% accuracy, so you can see how much better the model does with just 5 trainers

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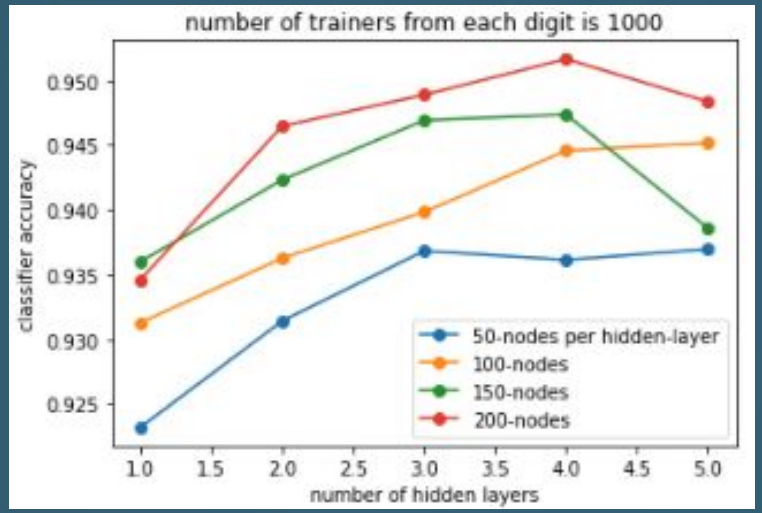
Increasing Accuracy with Layers



- To find out if we could increase the accuracy we investigated different arrangements of the hidden layers.
- Specifically, the number of hidden layers and the number of nodes in each layer on the oculus.

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Peak Accuracies from Our Data

98% → Single hidden layer with an increasing amount of nodes

95% → Single hidden layer with an increasing amount of trainers

97% → A fixed number of trainers (1000) with an increasing amount of hidden layers

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05

SNEAK PEEK

Destiny Dixon & Melvin Witten

Future Goals

- Investigate the effect of number of filters/layers on a convolutional network accuracy compared to a feet-forward network
- Creating new and improved features to improve the correct classification rate/accuracy
- Learn about practical applications for our projects

Future Plan

Week 5 Learn about Convolutional Neural Networks

Week 6 Look at Implementing Convolutional Neural Networks

Week 7 Image Classification and recognition using spatial features

Week 8 Image Classification and recognition using spectral features

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THANK YOU

Colab Notebook

(for reference)

https://colab.research.google.com/drive/1i9bIZjZFrUYAIG3ikjD1zT-HP-KVhpRE?usp=sharing

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