# Welcome to AI Club!


Scan me!
(attendance)

# Club Announcements

- Next meeting on 3/27 (more details to follow)
- E-Board Intern Application closes this Sunday 3/9 (at 11:59 pm)
- $15 Amazon Gift card Challenge - Facial Recognition Workshop
- Launching a club github https://github.com/Rutgers-Artificial-Intelligence-Club/Workshops


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# Facial Recognition with Neural Networks

# What are Neural Networks?

Neural Networks are a type of machine learning program that is not only designed but also trained to conduct a specific task.

Called Neural Network because it is meant to mimic the functions of a neuron.

(Almost) every Neural Network has one of the following in each layer:

1. Weights: value from the network that adds sensitivity to an input
2. Bias: value that allows the layer to still activate when the sum is not enough

This workshop will only cover one layer Neural Networks called Perceptrons

# More on Neural Networks

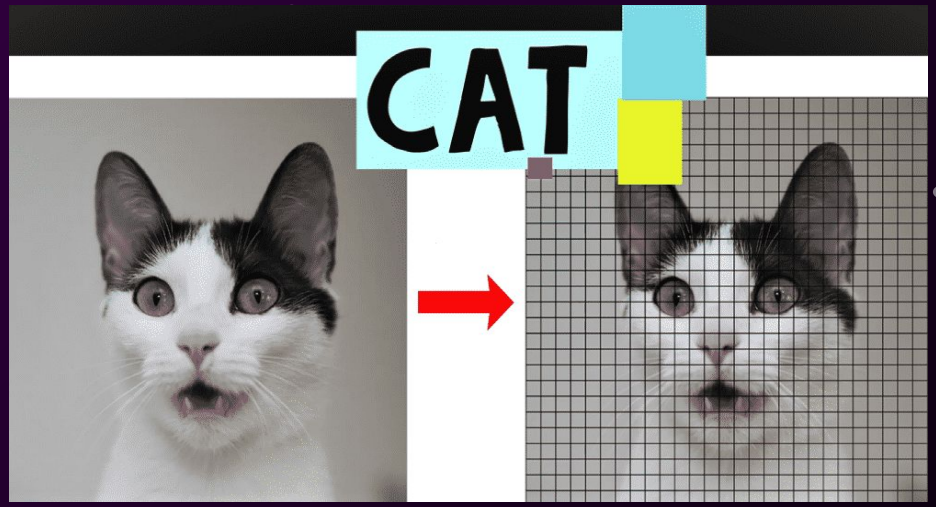
In each part of the Neural Network prediction process there can be at least one the following:

1. Input Layer
2. Middle Layer (AKA Hidden layer, Black Box, etc.)
3. Output Layer

# Input Layer

The first part of the Neural Network, uses a number of indices in an array with float values to quantify data we receive.

Ex. can be the total number of pixels in the case for image/facial recognition



# Middle Layer

- The middle layer is where more of the computation is delegated to give a more precise reading.
- Having a middle layer in most cases increases the accuracy of the overall prediction.
    - This also increases the computational cost of the program.

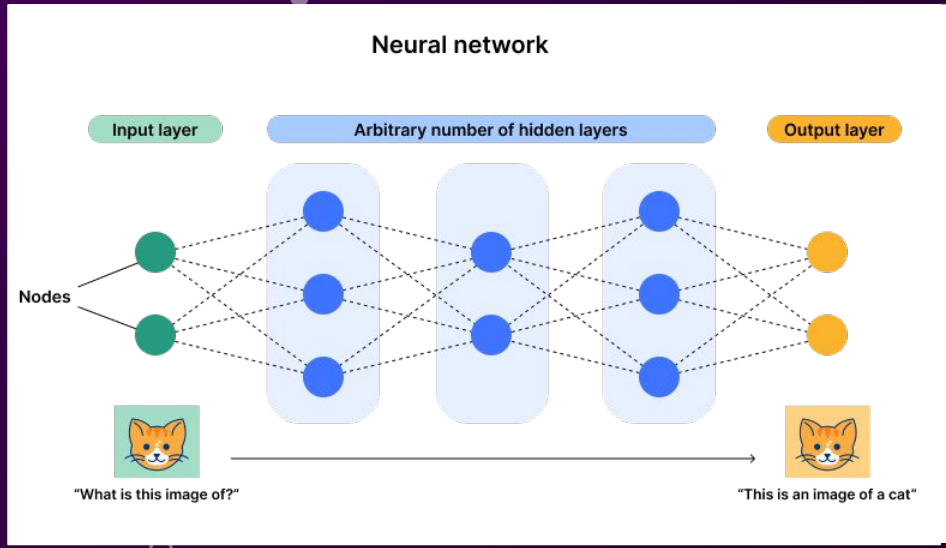
# Output layer

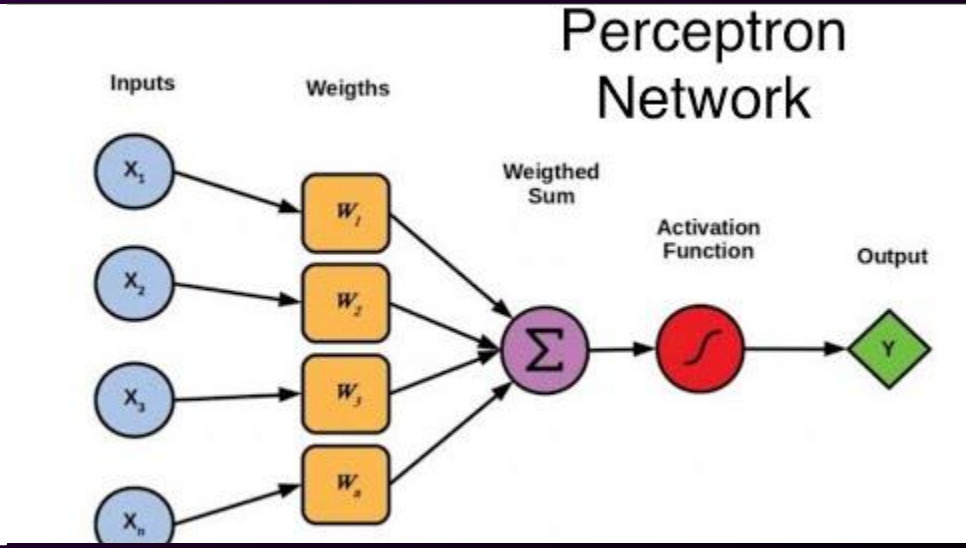
Finally, the output layer is the final part of the Neural Network that gives us its prediction

There are different types of outputs depending on the type of Neural Network:

1. Binary classifications: True or False
2. Multiclass classifications: Multiple Binary classifications

# Types of Neural Networks



# The Meat and Potatoes

Now that you know what makes up a NN, what makes all of this work?

What we know so far:

> Weights of a Neural Network are what we train and the processes (input -> output) are used for prediction and training.

# Types of Trainings

When we first build a NN, we have to first conduct trainings, and there a variety of options to train a NN, but they tend to fall into any one of these categories:

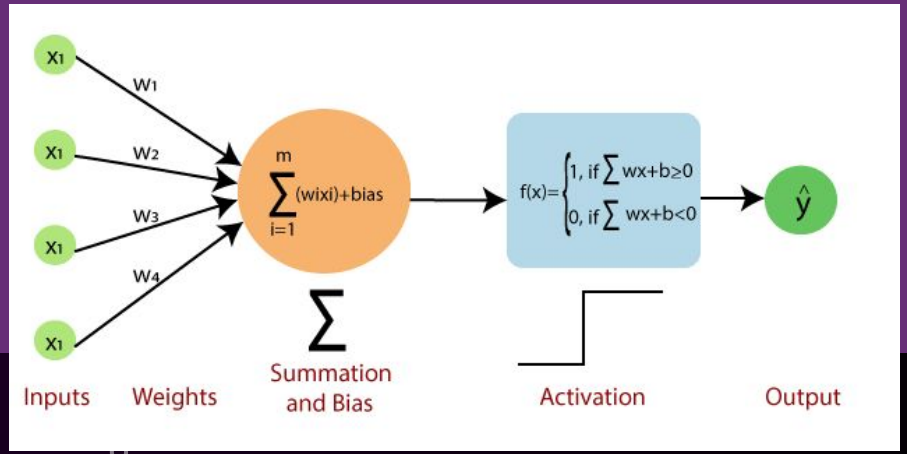
1. Supervised Learning: Developer actively tracks training procedure
2. Semi-supervised Learning: Developer is tracks training but allows the NN to do the work
3. Unsupervised Learning: Developer allows the program to train itself

# Predictions

In the case of predictions, whether binary or multi-class, the NN will have its weights, and an activation function applied to each part of the layer before moving on to the next set of weights.

The process of predictions is done by summing up the product of our weights and respective input values and then add our single bias in the layer.

$$L_j(x) = (w_1 i_1 + w_2 i_2 + \ldots + w_n i_n) + b$$

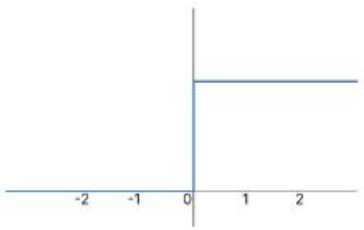


# Predictions Continued

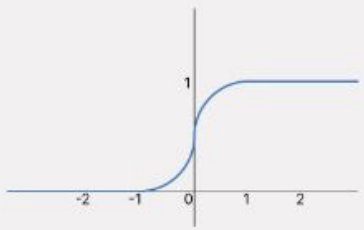
The sum that we find from the layer is then applied to an activation function that could be one of the following nonlinear functions:

1. Sigmoid: functions with a S shaped curve
2. Softmax: a function that separates outputs to discrete categories
3. Tanh: functions similar to sigmoid but boundaries are within y= -1 and y= 1
4. ReLu: Rectified Linear Unit, a function that explicitly determines the output based on threshold. Ex: if n>=0 1 else 0

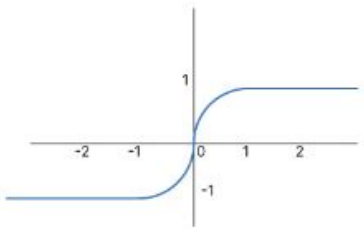
# Activation Functions



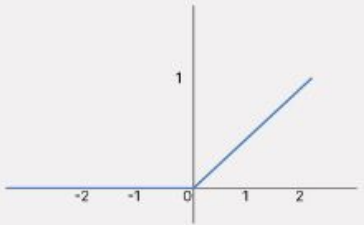

Step Function



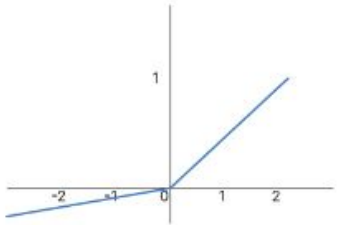

Sigmoid



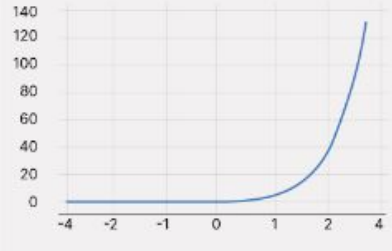

tanh




ReLU




Leaky ReLU




Softmax Function

# Face Recognition Project

- Objective: Creating a Neural Network to detect images of faces
- Modules:
  - Img_prep: prepares the text data and images (jpg and png only) into input values for NN
  - Neural_Net: you can modify the values of the Neural Network learning rate and loops
  - Directory_manager: Manages your files in the project space

# Facial Recognition Challenge - Win a $15 Amazon Gift Card

**Goal:** Improve the code to recognizing real faces.

**Deadline:** Submit your work by **3/9** for a chance to win a $15 Amazon Gift Card!

**Judging Criteria:** Accuracy, creativity, and program functionality.

**Submission:** Scan the QR code to access the submission form.

**Guidelines:**

- Build off of the provided code (will be in our github)
- Enhance preprocessing, feature extraction, or training methods.
- Document your improvements and results.

**Winner Announcement:** Results will be shared after evaluations!
Discord link: **https://discord.com/invite/6Ba6qYbj**

**Submission form**

**AI Club GitHub**

# Thank you for coming!

**To stay connected:**

**Instagram:** @Rutgers.ai

**Discord:** https://discord.gg/jeUTHkVNtM

**Groupme:** https://groupme.com/join_group/102980747/yver2JgJ