Pattern recognition algorithm to identify marine animals

PS NUMBER:GR915

Abstract

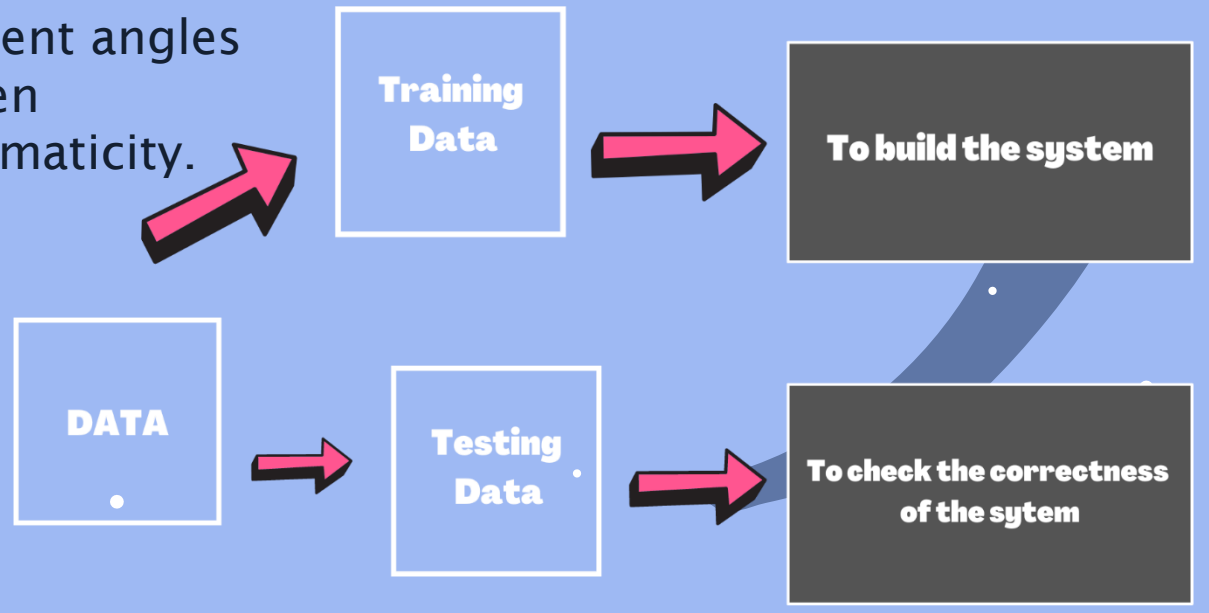
In our vast blue world, there are several harmful and dangerous species. Thermal cameras are available to track warm-blooded animals. However, in the water, the majority of the species are cold-blooded. People who swim in the sea along the coast are at risk of being attacked by dangerous marine animals. Hence we have developed a **pattern recognition algorithm** to detect marine species using **high-resolution** cameras and alert swimmers when such sea creatures are in that area.

Introduction

Pattern is everything around in this digital world. A pattern can either be seen physically or it can be observed mathematically by applying algorithms.

Little bit more about Pattern recognition

- ✓ System should recognize familiar patterns quickly and accurate
- ✓ Recognize and classify unfamiliar objects
- ✓ Accurately recognize shapes and objects from different angles
- ✓ Identify patterns and objects even when partly hidden
- ✓ Recognize patterns quickly with ease, and with automaticity.



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In pattern recognition system, for recognizing the pattern or structure two basic approaches are used which can be implemented in different techniques. These are:

Statistical Approach / Structural Approach

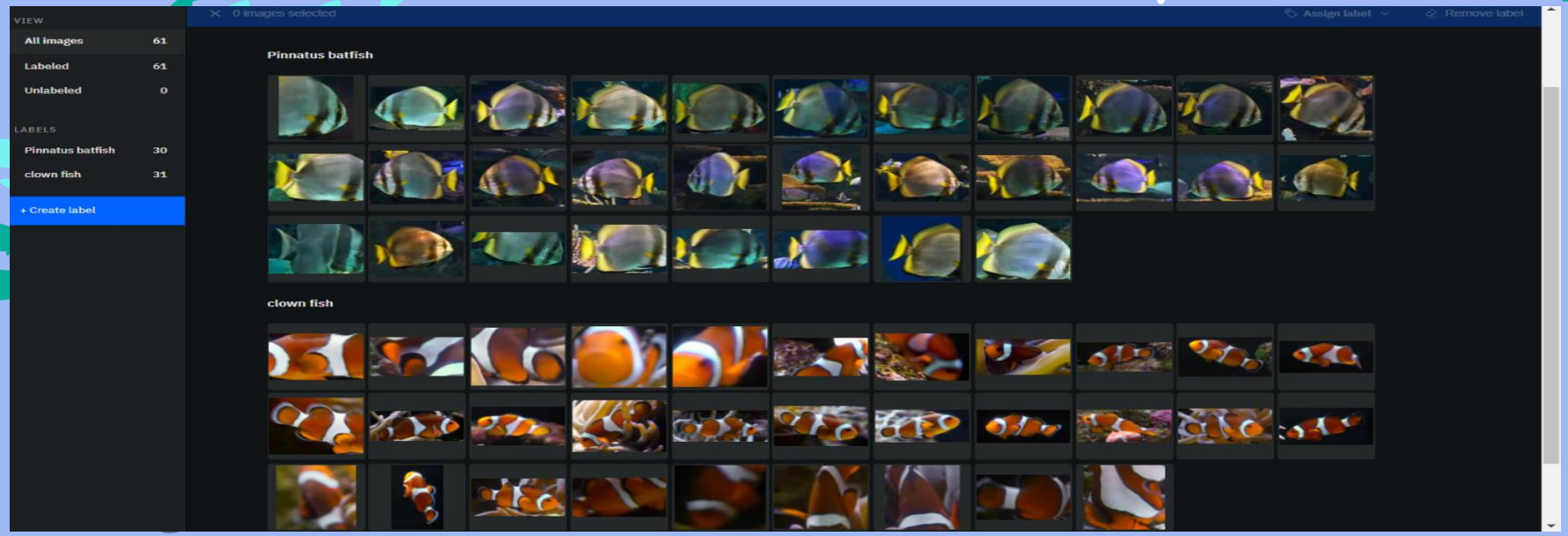
For our algorithm we are going to use both these two techniques.
Why? You may ask. Because a fish comes in many shapes and colors, so we need both the statistical data and structural data.
With the exception of some primitive species, most fish have common characteristics that include **gills, scales, fins and bony skeletons**. Some characteristics that differentiate fish include the shape of their heads, where their mouths are located, fin type and location, and average adult size. Here is where data comes into play, we're going to collect all these common characteristics and compile them first. Then we're going to compare the new data with the old data which we compiled before

Existing survey

LABELS

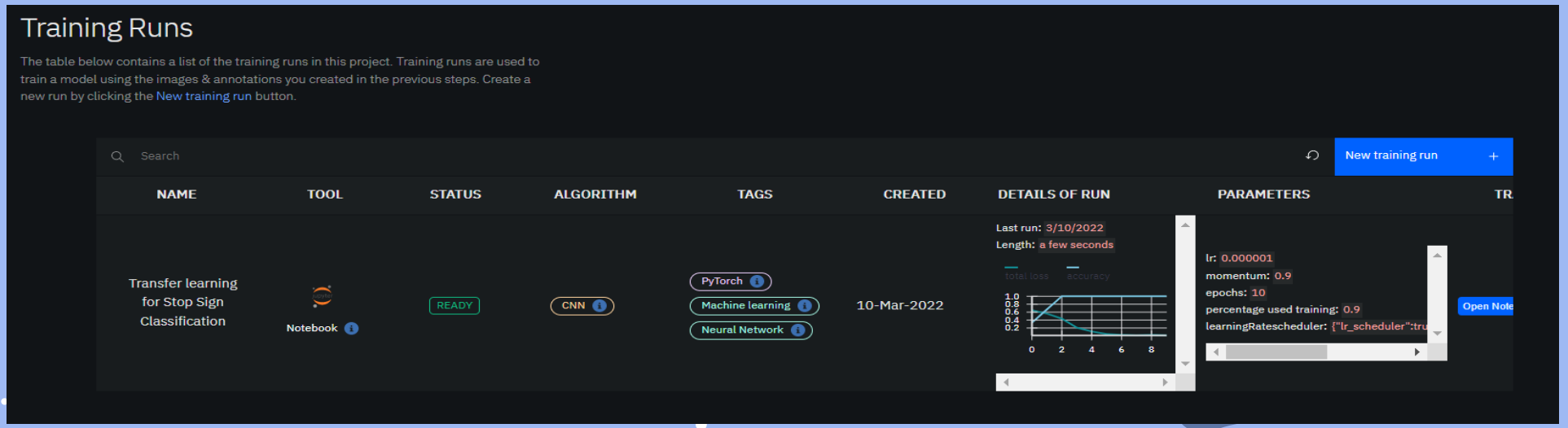
Pinnatus batfish	30
clown fish	31

First thing's first, we have collected 100s of photos of the same fish as seen above now we put them all under the same folder/label (for e.g.. Clownfish)
Then we train those photos. Training is an array that will contain image pixel values and the index at which the image in the FOLDERS list.



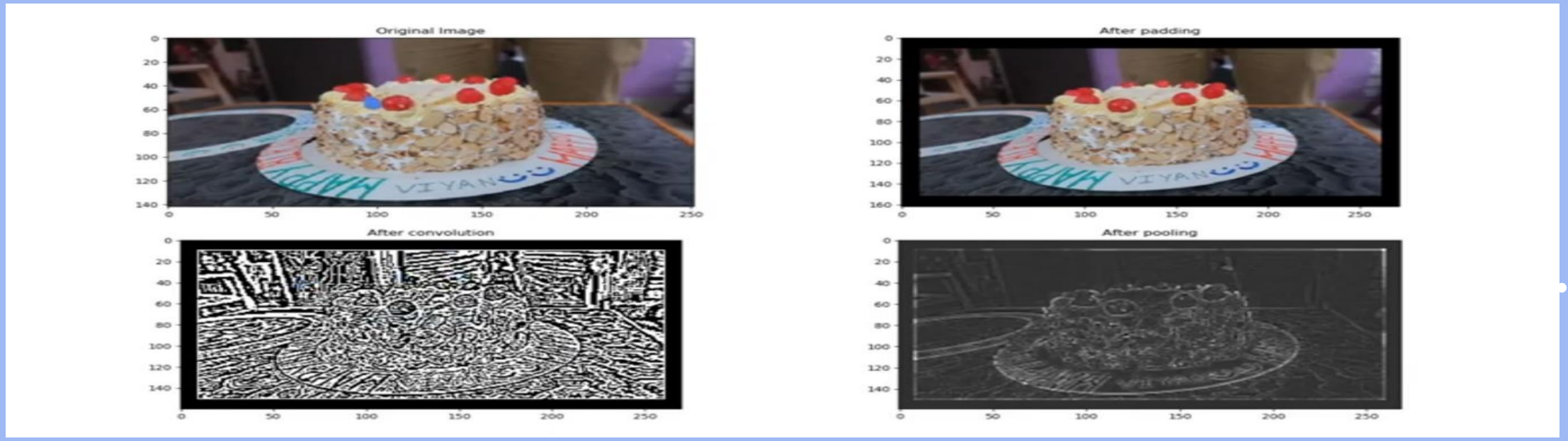
done using

CV Studio



Proposed System

The most commonly applied technique is machine learning. Machine learning is a set of algorithms that learn from an environment containing data such as images.
Among the most popular and widely used AI algorithms are the family of artificial neural networks. A neural network is a set of human brain-inspired networks with artificial neurons and synapses that are trained to approximate an external function, typically mapping from input data (e.g., images) to labeled values or categories (e.g., classes).



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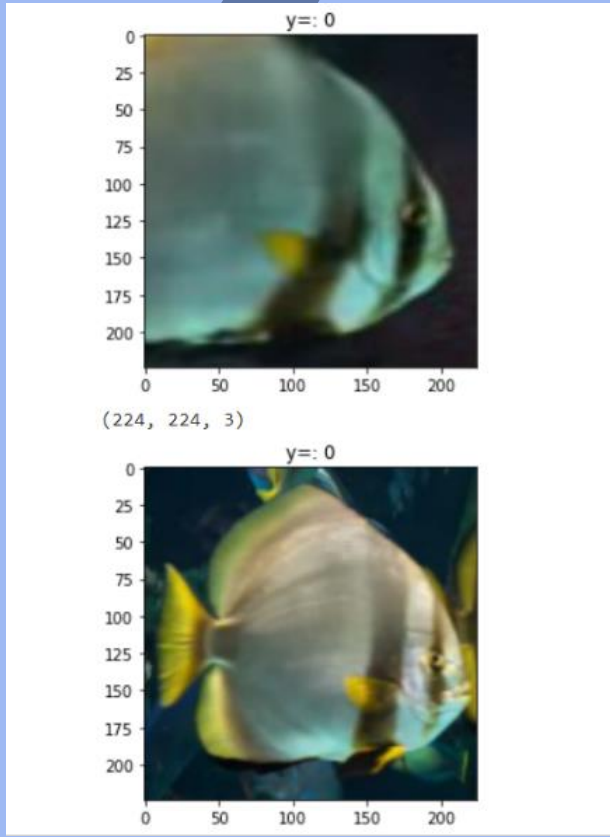
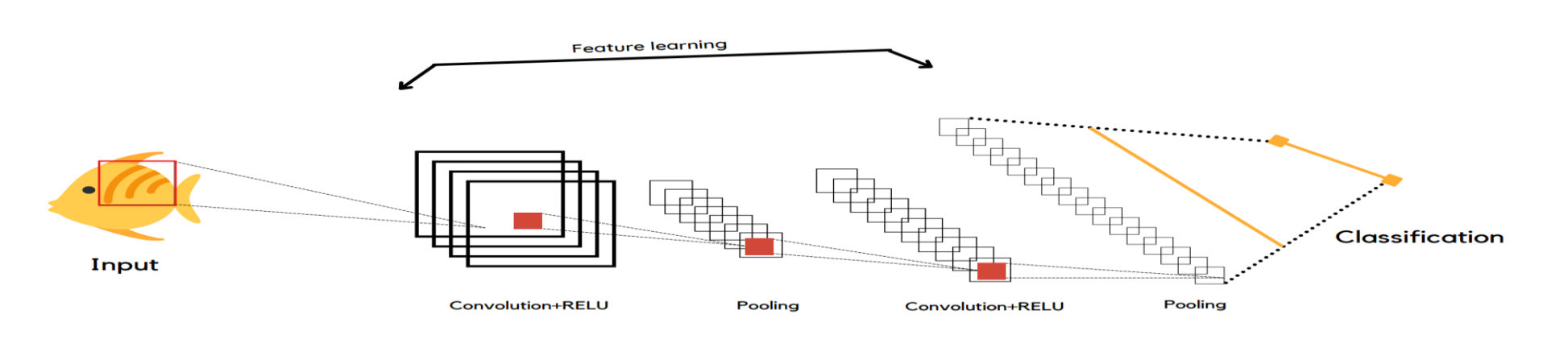
In addition to classification, a network trained for object detection can output the x- and y-location, width, and height of the object of interest. This information is then used to draw a boundary box around the object to be classified, e.g. a fish.



1.In practice, this means that we can detect and count objects in an image or a video, e.g. the number of fish. The approach has been extended even further by pixel-wise detection and classification of the entire image. This approach scales down the image with convolutions and pooling operations, followed by reverse order scaling-up of the same image.
2.In this way, a single image can be divided into multiple regions by generating several boundary boxes, allowing for many classes to be classified within a single image.

The typical approach is to first train with an available, sizeable dataset and subsequently train with a smaller but more relevant dataset. In this way, the learning algorithms find the general image patterns from a big dataset (e.g., shapes, species patterns, face patterns) and the individual differences from the smaller dataset
Collecting and labelling relevant image and video data is therefore central to building a high-performance and robust fish detector

Working



1 **Convolution** preserves the relationship between pixels by learning image features using small squares of input data. Convolution of an image with different filters can perform operations such as edge detection, blur and sharpen by applying filters.

2 **Pooling** layers section would reduce the number of parameters when the images are too large. Max pooling take the largest element from the rectified feature map. The objective is to down-sample an input representation (image, hidden-layer output matrix, etc.), reducing its dimensionality.

3 **Flattening** is the process of converting all the resultant 2 dimensional arrays into a single long continuous linear vector. It gets the output of the convolutional layers, flattens all its structure to create a single long feature vector to be used by the dense layer for the final classification.

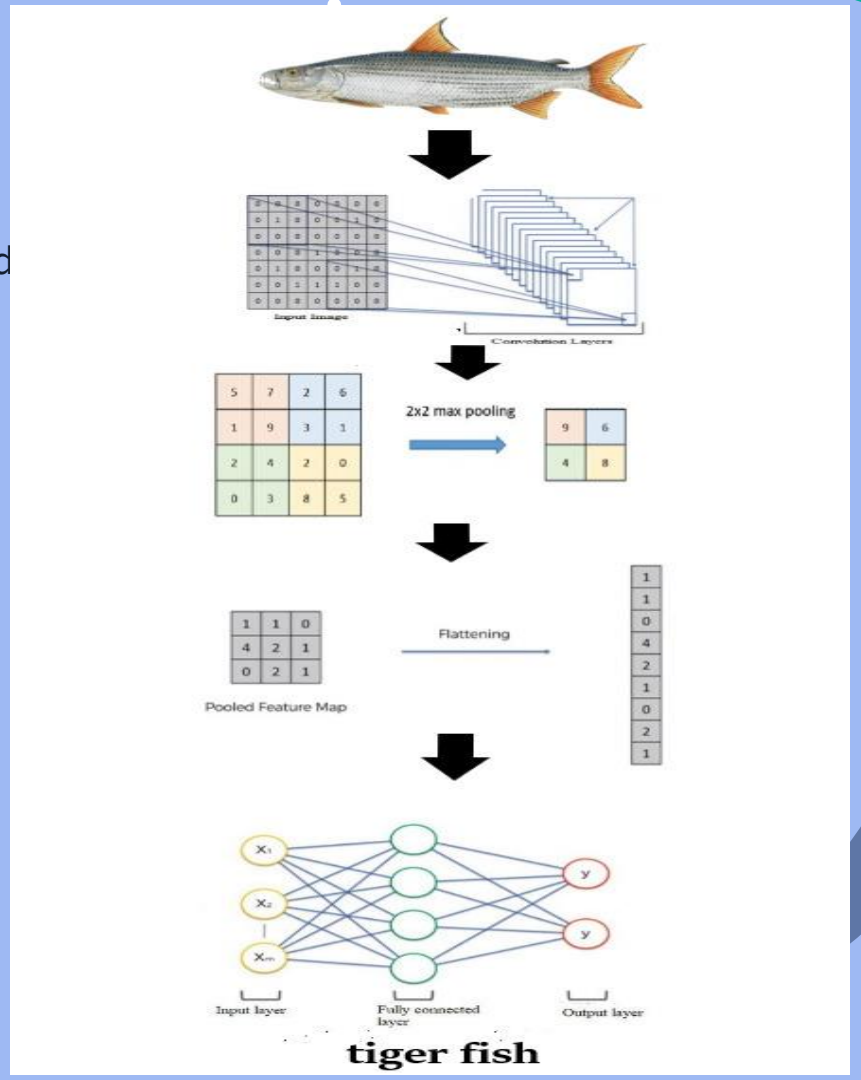
4 **Fully connected:** These are a specific type of hidden layer which must be used within the CNN. This is used to combine the features into more attributes that predict the outputs more accurately.

Working architecture

Convolutional Neural Network

A convolutional neural network (CNN) is a specific type of artificial neural network that uses perceptron's, machine learning unit algorithm, for supervised learning, to analyse data. CNNs apply to image processing, natural language processing and other kind of cognitive tasks.

- Input will hold the raw pixel values of the image and with three colour channels R, G, B.
- CONV layer will compute the output of neurons that are connected to local regions in the input, each computing a dot product between their weights and a small region they are connected to in the input volume.
- RELU layer will apply an element wise activation function. This leaves the size of the volume unchanged.
- POOL layer will perform a down sampling operation along the spatial dimensions (width, height), resulting in volume such as [16x16x12].



System requirements

RAM: 16gb , Less than 16 GB can cause problems while Multitasking.

CPU: Processors above **Intel Core i7, 7th Generation** is advised as it is more powerful and delivers High Performance.

GPU: GeForce 10 series , AMD Radeon , RTX 20 series.

Storage: A minimum of **1TB HDD** is required as the datasets tend to get larger and larger by the day. If you have a system with **SSD** a minimum of **256 GB** is advised. Then again if you have less storage you can opt for Cloud Storage Options.

Operating System: Linux is recommended due to its robust nature (or) Windows and Mac OS can both run Virtual Linux Environment and you can work on those systems too.

THANK YOU

TEAM AFK