

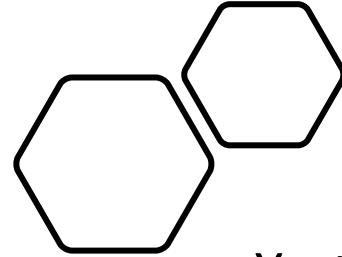


Automated Object Detection

FCAI-HU

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Contents

1. Project idea in detail.
2. The main functions.
3. similar applications in the market.
4. Primary literature review of academic publications (papers) relevant to the idea (at least two papers).
5. The data set used (a publicly available data set is preferred).
6. Details of the algorithm(s)/approach(s) to be used.

Project Description

- introduction to object detection and provide an overview of the state-of-the-art computer vision object detection algorithms. Object detection is a key field in artificial intelligence, allowing computer systems to “see” their environments by detecting objects in visual images or videos.
- Object detection is an important computer vision task used to detect instances of visual objects of certain classes (for example, humans, animals, cars, or buildings) in digital images such as photos or video frames. The goal of object detection is to develop computational models that provide the most fundamental information needed by computer vision applications

1. Idea of project

The goal of object detection is to develop computational models that provide the most fundamental information needed by Deep Learning is a specialized form of machine learning which involves learning in different stages. To learn more about the technological background

we made this by made preprocessing for images (resized all images height and width to make all images the same size and the make label hot encoding by taking value for each category then made all images to RGB) and then find features for each image belongs to category and split dataset for train and test then we use random forests and decision tree algorithms and out the accuracy



Main functionalities:



2. Main functionalities:

- ❖ Get Data

First, we get data from dataset to detect on it to review the output.

- ❖ OS library

Python OS module allows us to use the operating system dependent functionalities and to interact with the underlying operating system in several different ways.

- ❖ CV2 OpenCV

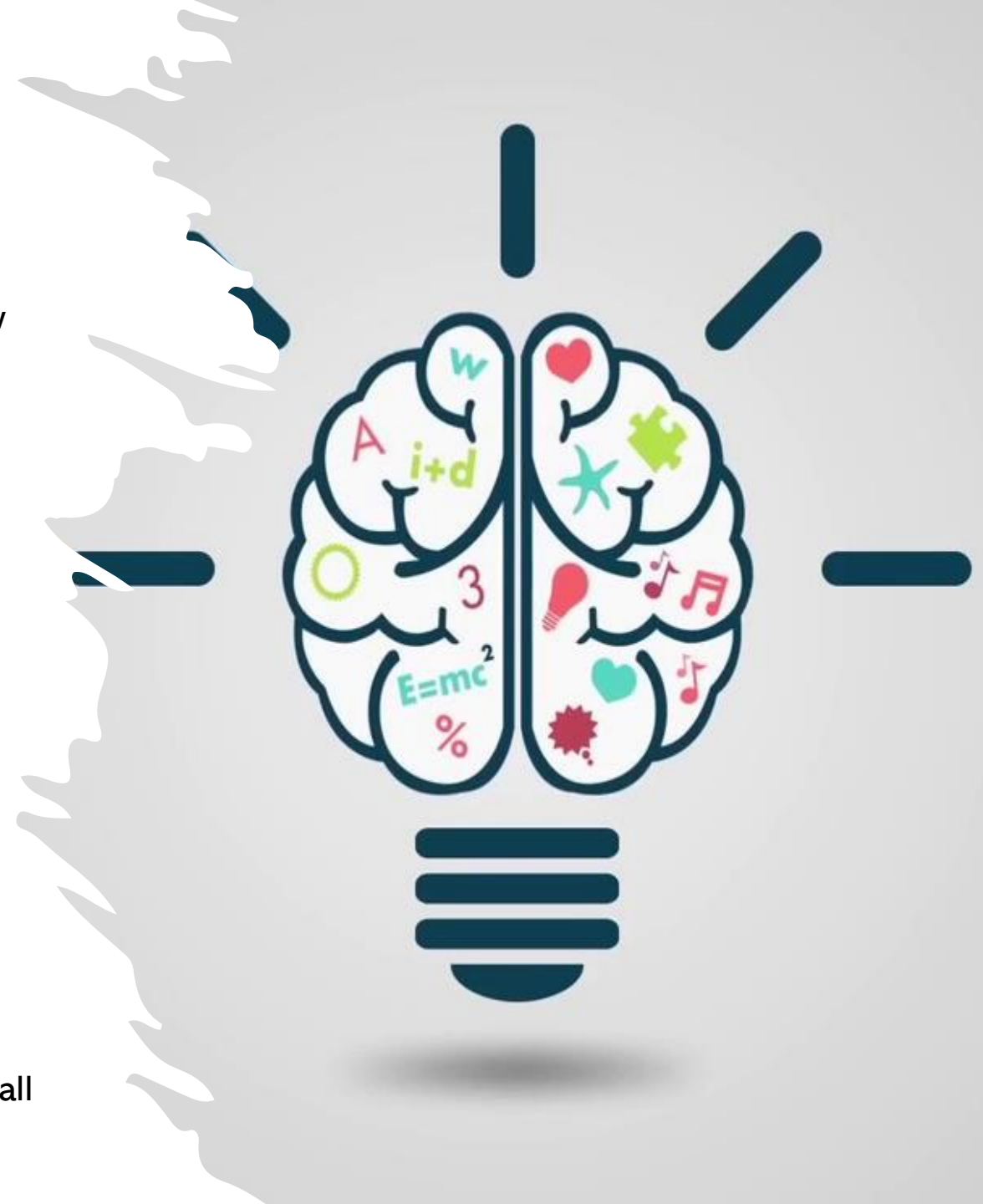
is an open-source Python library, which used to understand the content of the digital image.

- ❖ Preprocessing

Then we get image from dataset we are doing some processing on it to simulate the algorithm.

- ❖ Resize

now we resize image like (144,144) to make sure that all images will get the same size to provide the algorithm.



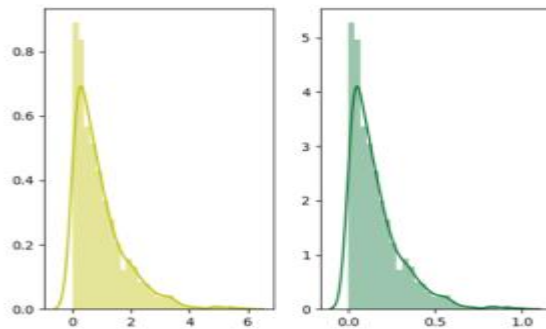
2. Main functionalities:

❖ Normalization

refers to rescaling real-valued numeric attributes into a $[0, 1]$ range. is used in machine learning to make model training less sensitive to the scale of features.

Data normalization

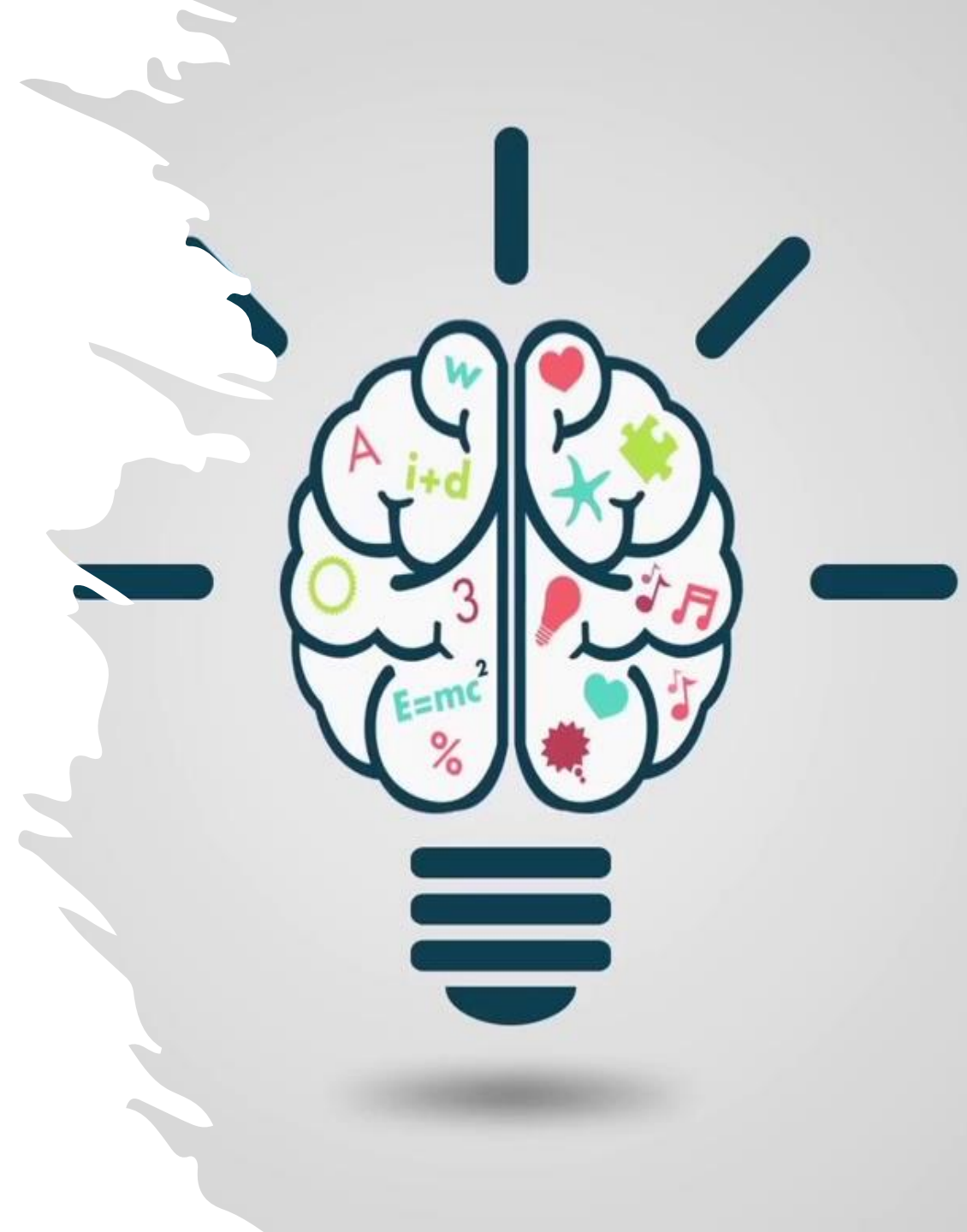
is used in machine learning to make model training less sensitive to the scale of features. This allows our model to converge to better weights and, in turn, leads to a more accurate model.



Left: Original Data, Right: Normalized Data

❖ Label encoding

Label Encoding refers to converting the labels into a numeric form so as to convert them into the machine-readable form. Machine learning algorithms can then decide in a better way how those labels must be operated. It is an important pre-processing step for the structured dataset in supervised learning

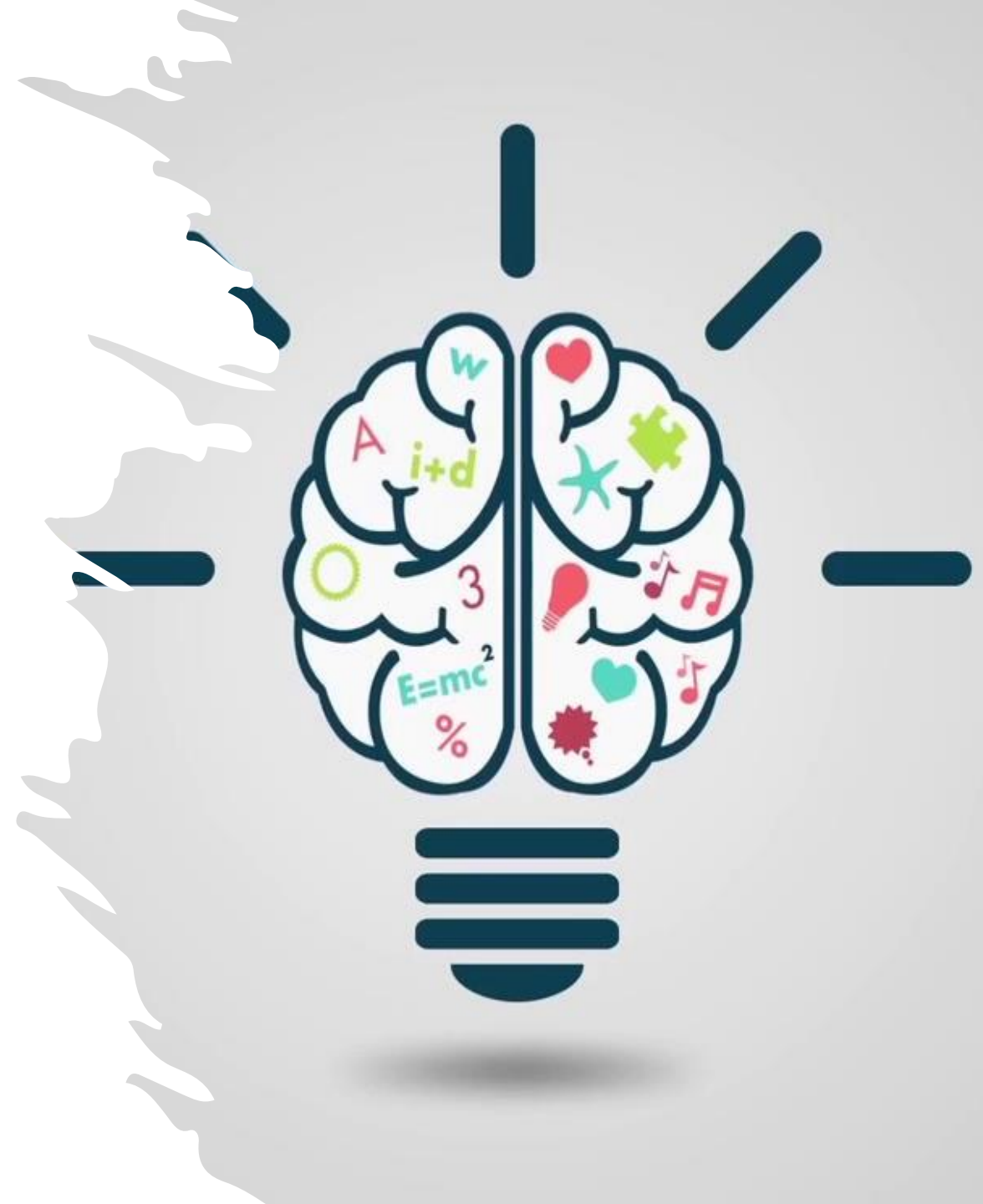


2. Main functionalities:

- ❖ Test and split (Train_Test_Split)
That we get the dataset and divide it in two part like 70 % training and 30 % testing.
- ❖ Label one hot encoding
One hot encoding is a process by which categorical variables are converted into a form that could be provided to ML algorithms to do a better job in prediction.

Feature extract

- ❖ VGG16
VGG16 is a convolution neural net which was used to win ILSVR(Imagenet) One very important area of application is image processing, in which algorithms are used to detect and isolate various desired portions or shapes (features) of a digitized image or video stream. It is particularly important in the area of optical character recognition



2. Main functionalities:

❖ Fit

Given a Dataset comprising of a group of points, find the best fit representing the Data. We often have a dataset comprising of data following a general path, but each data has a standard deviation which makes them scattered across the line of best fit.

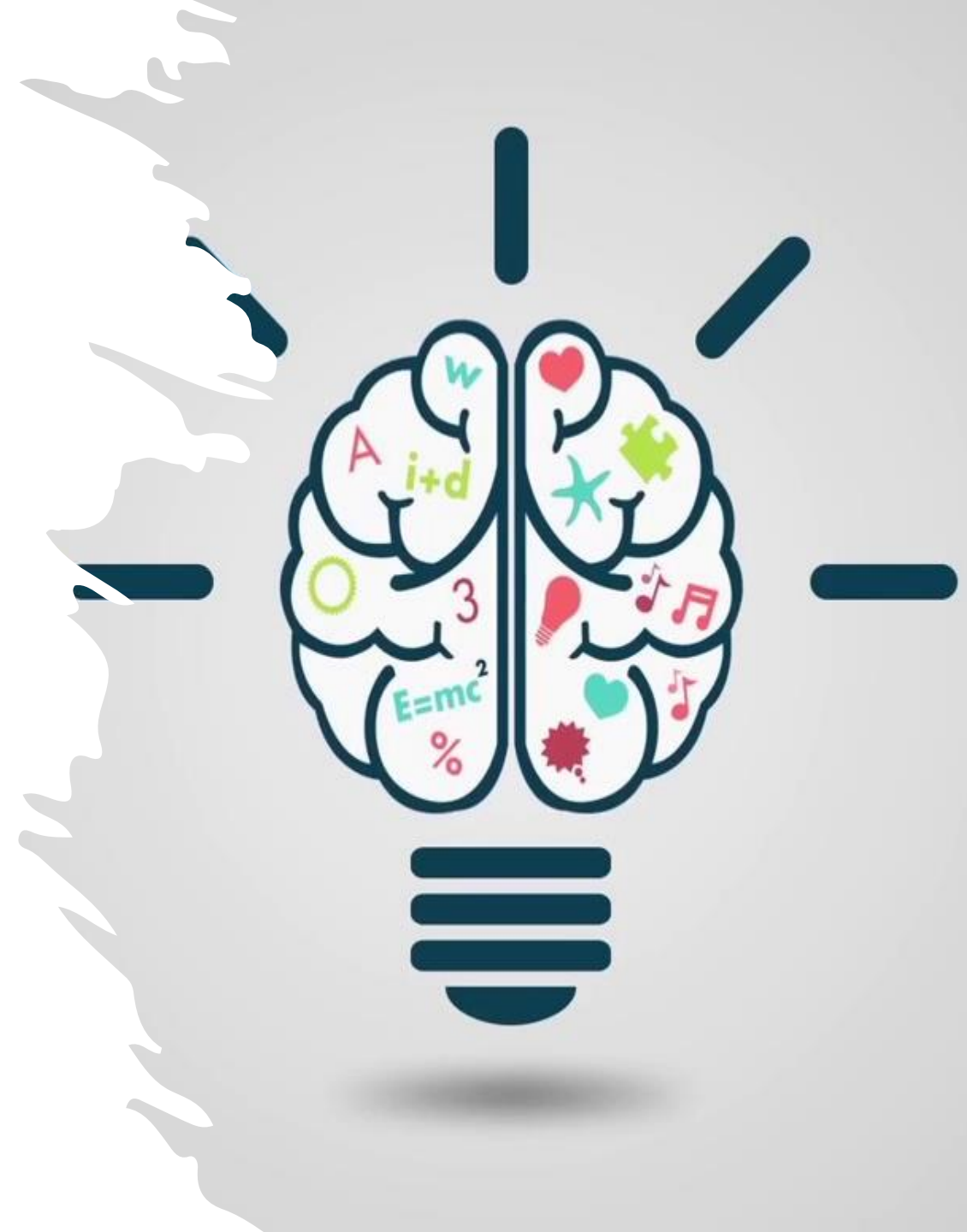
❖ Predict

When you get the image and get the Feature extraction from testing images, we predict the image

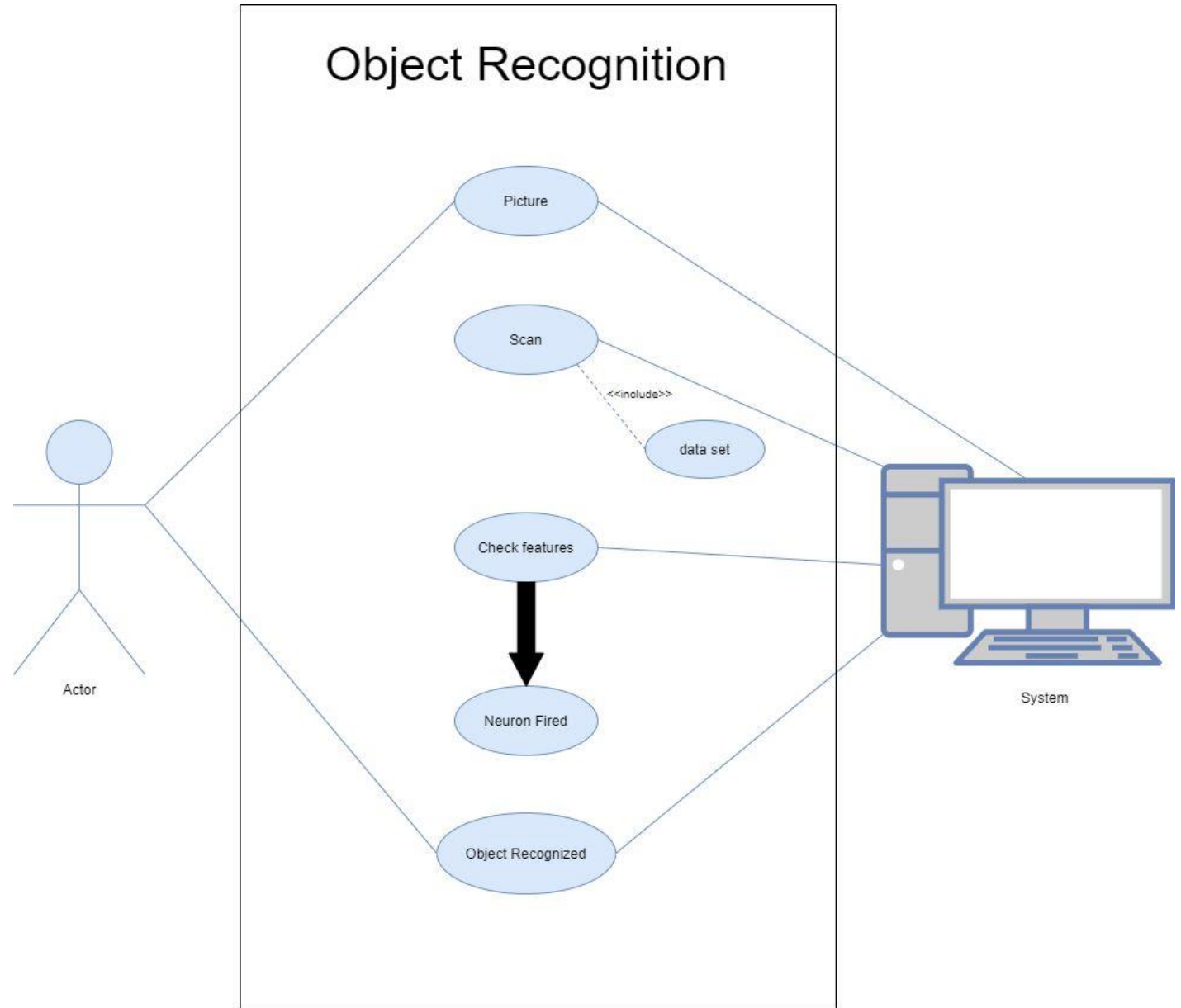
❖ Get accuracy

Accuracy is a measure for the closeness of the measurements to a specific value, while precision is the closeness of the measurements to each other, i.e. not necessarily to a specific value. For example: how many times that the program is doing the algorithm will as percentage.

#Decoding



UseCase



**similar
applications in
the market**



3. similar applications in the market.

❖ alwaysAI:

Computer Vision with Object Detection

Link : [Computer Vision with Object Detection \(alwaysai.co\)](https://alwaysai.co)

❖ Pixel Solutionz:

Application of Object Detection in Real life

Link : [Application of Object Detection in Real life - Pixel Solutionz](#)

❖ TensorsFlow:

Application of Object Detection

Link : [Object detection | TensorFlow Lite](#)



Primary literature review



4. Primary literature review :

❑ OBJECT DETECTION AND IDENTIFICATION A Project Report

Computer Vision is the branch of the science of computers and software systems which can recognize as well as understand images and scenes. Computer Vision consists of various aspects such as image recognition, object detection, image generation, image super-resolution and many more. Object detection is widely used for face detection, vehicle detection, pedestrian counting, web images, security systems and self-driving cars. In this project, we are using highly accurate object detection-algorithms and methods such as R-CNN, Fast-RCNN, Faster-RCNN, Retina Net and fast yet highly accurate ones like SSD and YOLO. Using these methods and algorithms, based on deep learning which is also based on machine learning require lots of mathematical and deep learning frameworks understanding by using dependencies such as TensorFlow, OpenCV, imageai etc, we can detect each and every object in image by the area object in an highlighted rectangular boxes and identify each and every object and assign its tag to the object. This also includes the accuracy of each method for identifying objects.

Paper Link : [\(PDF\) OBJECT DETECTION AND IDENTIFICATION A Project Report \(researchgate.net\)](#)

4. Primary literature review :

□ Detecting People in Artwork with CNNs

Abstract. CNNs have massively improved performance in object detection in photographs. However research into object detection in artwork remains limited. We show state-of-the-art performance on a challenging dataset, People-Art, which contains people from photos, cartoons and 41 different artwork movements. We achieve this high performance by fine-tuning a CNN for this task, thus also demonstrating that training CNNs on photos results in overfitting for photos: only the first three or four layers transfer from photos to artwork. Although the CNN's performance is the highest yet, it remains less than 60% AP, suggesting further work is needed for the cross-depiction problem.

Keywords: CNNs, cross-depiction problem, object recognition

Paper link : [1610.08871v1.pdf \(arxiv.org\)](#)

4. Primary literature review :

□ Single-Shot Refinement Neural Network for Object Detection

For object detection, the two-stage approach (e.g., Faster R-CNN) has been achieving the highest accuracy, whereas the one-stage approach (e.g., SSD) has the advantage of high efficiency. To inherit the merits of both while overcoming their disadvantages, in this paper, we propose a novel single-shot based detector, called RefineDet, that achieves better accuracy than two-stage methods and maintains comparable efficiency of one-stage methods.

RefineDet consists of two inter-connected modules, namely, the anchor refinement module and the object detection module. Specifically, the former aims to (1) filter out negative anchors to reduce search space for the classifier, and (2) coarsely adjust the locations and sizes of anchors to provide better initialization for the subsequent regressor. The latter module takes the refined anchors as the input from the former to further improve the regression and predict multi-class label. Meanwhile, we design a transfer connection block to transfer the features in the anchor refinement module to predict locations, sizes and class labels of objects in the object detection module. The multitask loss function enables us to train the whole network in an end-to-end way. Extensive experiments on PASCAL VOC 2007, PASCAL VOC 2012, and MS COCO demonstrate that RefineDet achieves state-of-the-art detection accuracy with high efficiency

Paper Link : [1711.06897v3.pdf \(arxiv.org\)](#)

4. Primary literature review :

□ Driving Datasets Literature Review

For the last decade, the progress made in the autonomous driving scientific community and industry has been exceptional. With the rise of deep-learning and better hardware, algorithms embodying the different aspects of driving, such as lane following, obstacle detection, semantic segmentation, tracking, and motion estimation have reached unprecedented performance. Although there are still no SAE Level-4 self-driving vehicles as of yet, recent developments in robotics and machine learning could soon make this aspiration a reality

Paper Link : [\(PDF\) Driving Datasets Literature Review \(researchgate.net\)](#)

4. Primary literature review :

❑ A Small Object Detection Research Based on Dynamic Convolution Neural Network

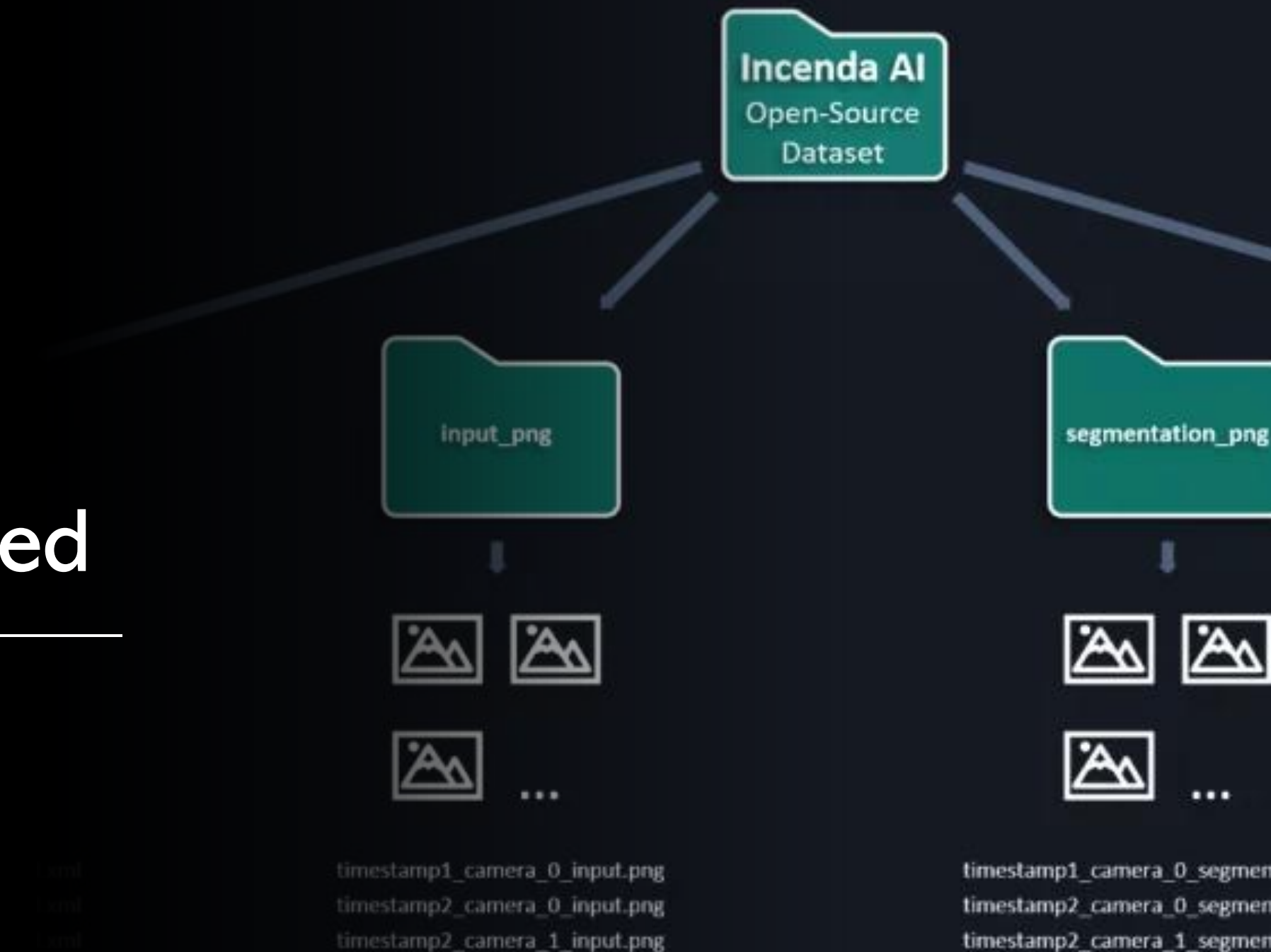
In view of the fact that the detection effect of EfficientNet-YOLOv3 object detection algorithm is not very good, this paper proposes a small object detection research based on dynamic convolution neural network. Firstly, the dynamic convolutional neural network is introduced to replace the traditional, which makes the algorithm model more robust; secondly, the optimization parameters are continuously adjusted in the training process to further strengthen the model structure; finally, the Learning Rate and Batch Size parameters are modified during the training process in order to prevent overfitting. In order to verify the effectiveness of the proposed algorithm, RSOD and TGRS-HRRSD remote sensing image data sets are used to test the effect. The results of the proposed algorithm on RSOD remote sensing image data sets show that compared with the original EfficientNet-YOLOv3 algorithm, the mean Average Precision (mAP) value is increased by 1.93% and the mean Log Average Miss Rate (mLAMR) value is reduced by 0.0500; The results of the proposed algorithm on TGRS-HRRSD remote sensing image data set show that compared with the original EfficientNet-YOLOv3 algorithm,

Keywords: dynamic convolution neural network; optimization parameters adjustment; Average Precision; Log Average Miss Rate

Paper Link : [small object detection Latest Research Papers | ScienceGate](#)



Data Set Used





5. Data Set Used

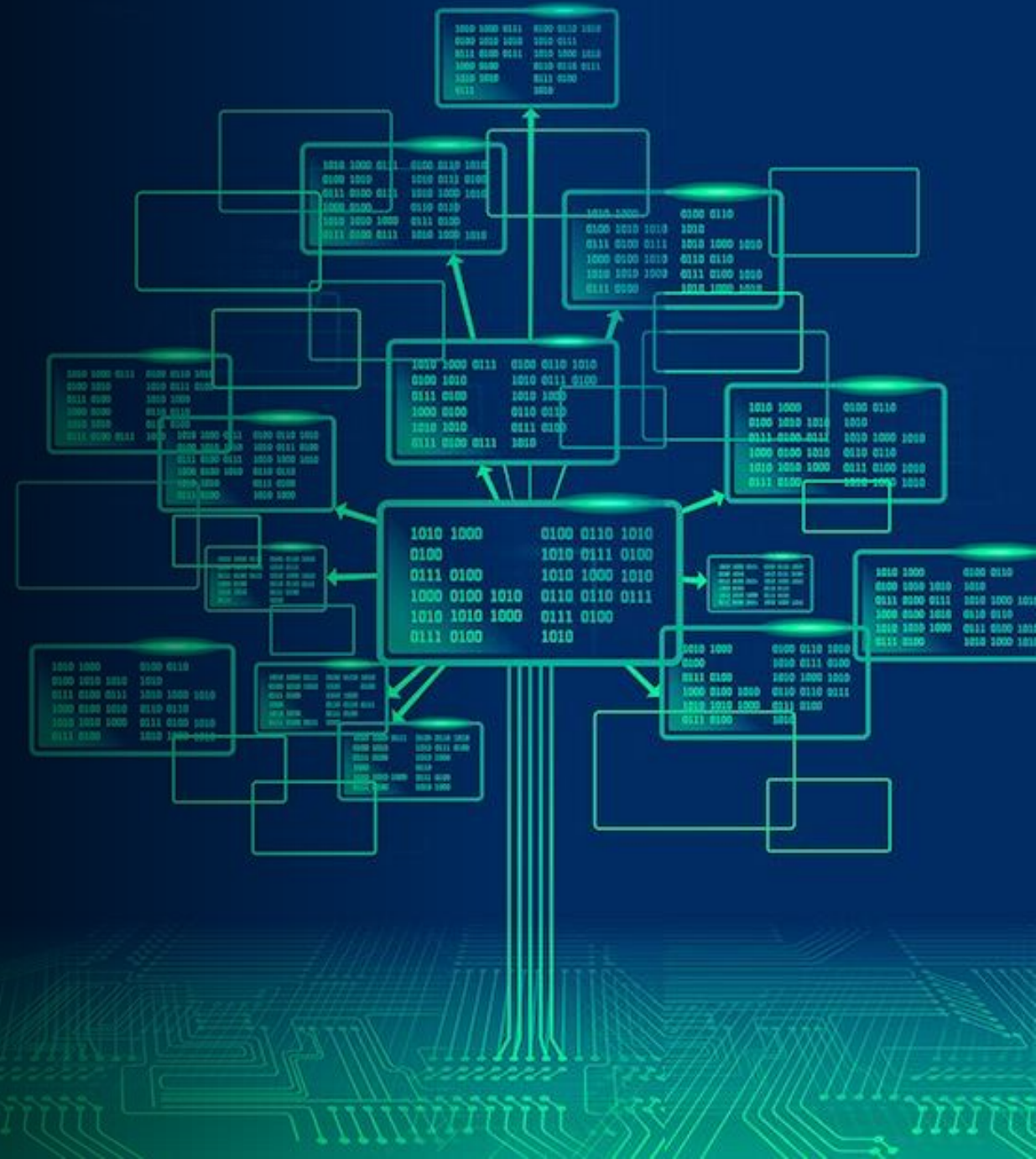
Our Dataset

Consists of 6 Categories

1. Category 1: Name: cars Number of images: 1000
2. Category 2: Name: flowers Number of images: 986
3. Category 3: Name: fruits Number of images: 990
4. Category 4: Name: men Number of images: 990
5. Category 5: Name: Traffic sign Number of images: 963
6. Category 6: Name: women Number of images: 990



Details of algorithms



Details of algorithms

❑ Artificial Neural Network (ANN) in Machine Learning

Artificial Neural networks (ANN) or neural networks are computational algorithms.

It intended to simulate the behavior of biological systems composed of “neurons”. ANNs are computational models inspired by an animal’s central nervous systems. It is capable of machine learning as well as pattern recognition. These presented as systems of interconnected “neurons” which can compute values from inputs.

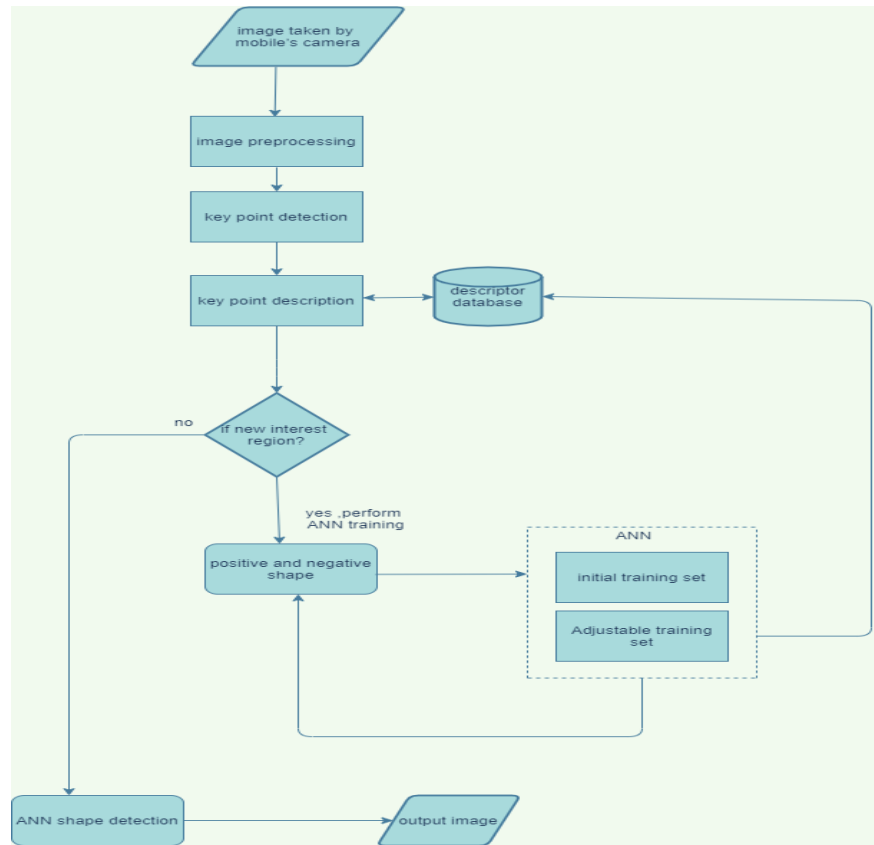
A neural network is an oriented graph. It consists of nodes which in the biological analogy represent neurons, connected by arcs. It corresponds to dendrites and synapses. Each arc associated with a weight while at each node. Apply the values received as input by the node and define Activation function along the incoming arcs, adjusted by the weights of the arcs.

A neural network is a machine learning algorithm based on the model of a human neuron. The human brain consists of millions of neurons. It sends and process signals in the form of electrical and chemical signals. These neurons are connected with a special structure known as synapses. Synapses allow neurons to pass signals. From large numbers of simulated neurons neural networks forms.

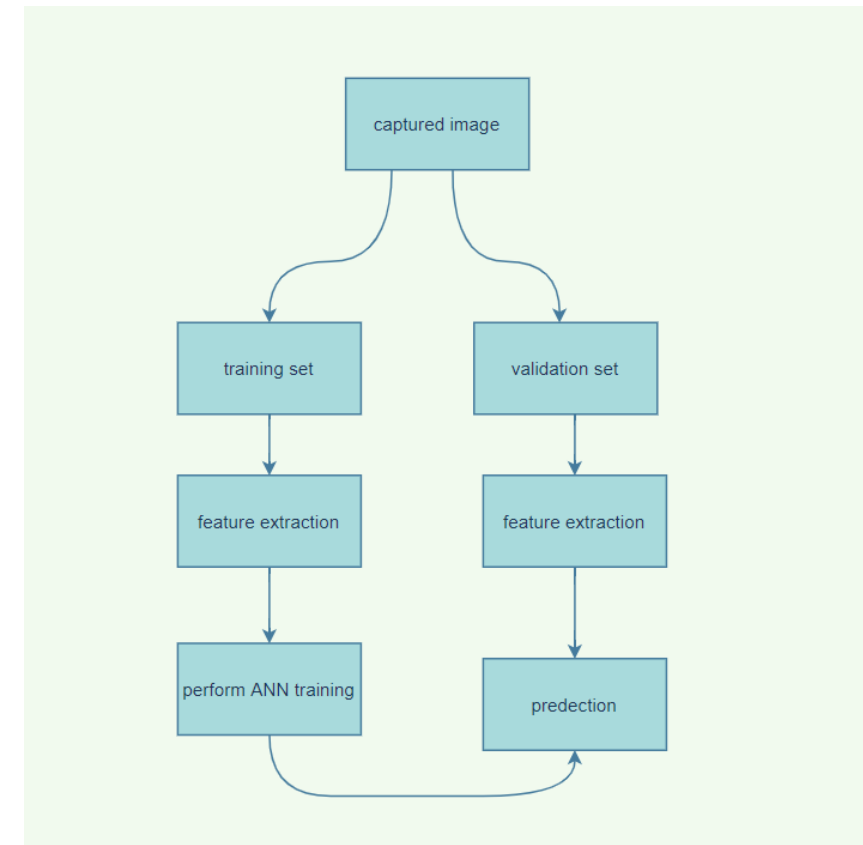
An Artificial Neural Network is an information processing technique. It works like the way human brain processes information. ANN includes a large number of connected processing units that work together to process information. They also generate meaningful results from it.

Details of algorithms

Flow Chart Diagram



Block Diagram



Development platform:

❑ Tools:

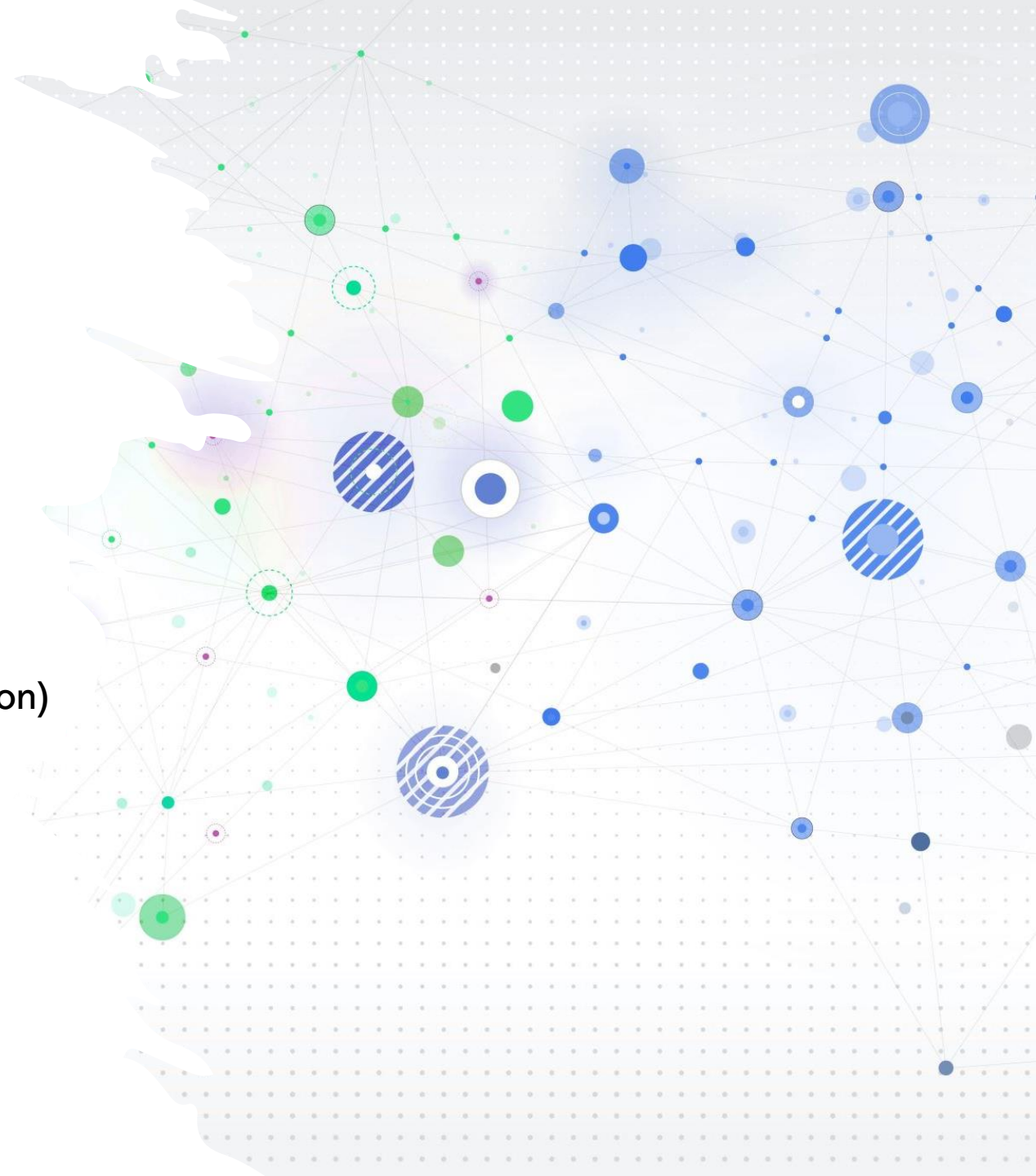
- Anaconda (Spyder, Jupyter)

❑ Libraries:

- OpenCV (cv2)
- os
- numpy
- sklearn(sklearn.ensemble.sklearn.model_selection)
- tensorflow (tensorflow.keras.utils)
- keras (keras.applications.vgg16)
- tkinter (tkinter.filedialog)
- PIL

❑ Programming Language:

- python





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The End