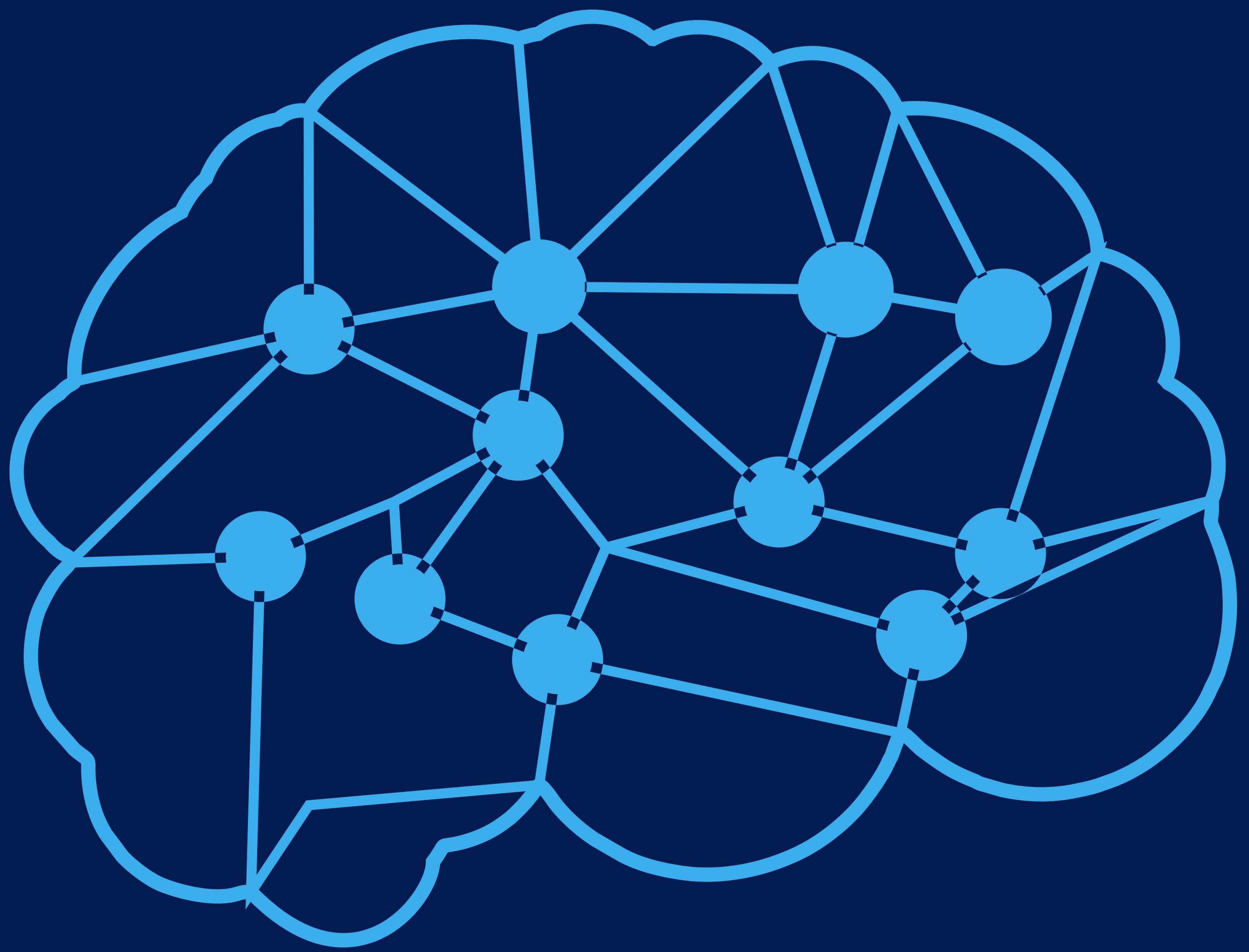
DEEP LEARNING

CONTENTS



What is DEEPLEARNING ?

- Deep learning is a subset of machine learning, which is essentially a neural network with three or more layers.

- These neural networks attempt to simulate the behavior of the human brain—albeit far from matching its ability—allowing it to “learn” from large amounts of data.

OBJECTIVE

1. The objective of this project is to recognize the images of the fruits and classify them into the correct type.
2. To build an Image Classifier using CNN model which classifies 131 different types taken from dataset

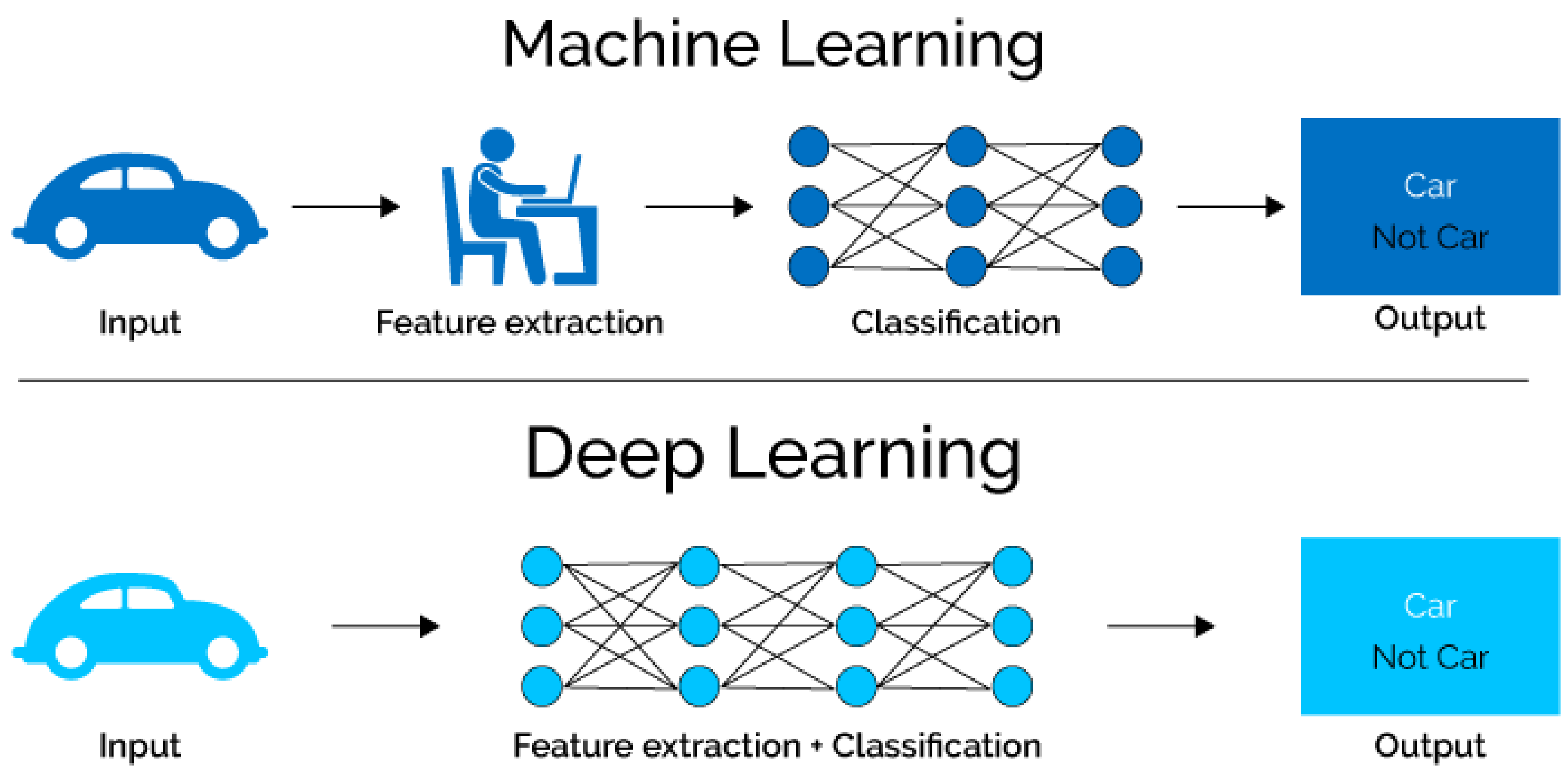
IMPORTANCE

We have trained a deep neural network that is capable of identifying fruits from images

PROPOSED SOLUTION

Proposing an efficient framework for fruit classification using deep learning

- Use of Convolutional Neural Network to classify fruits based on their images

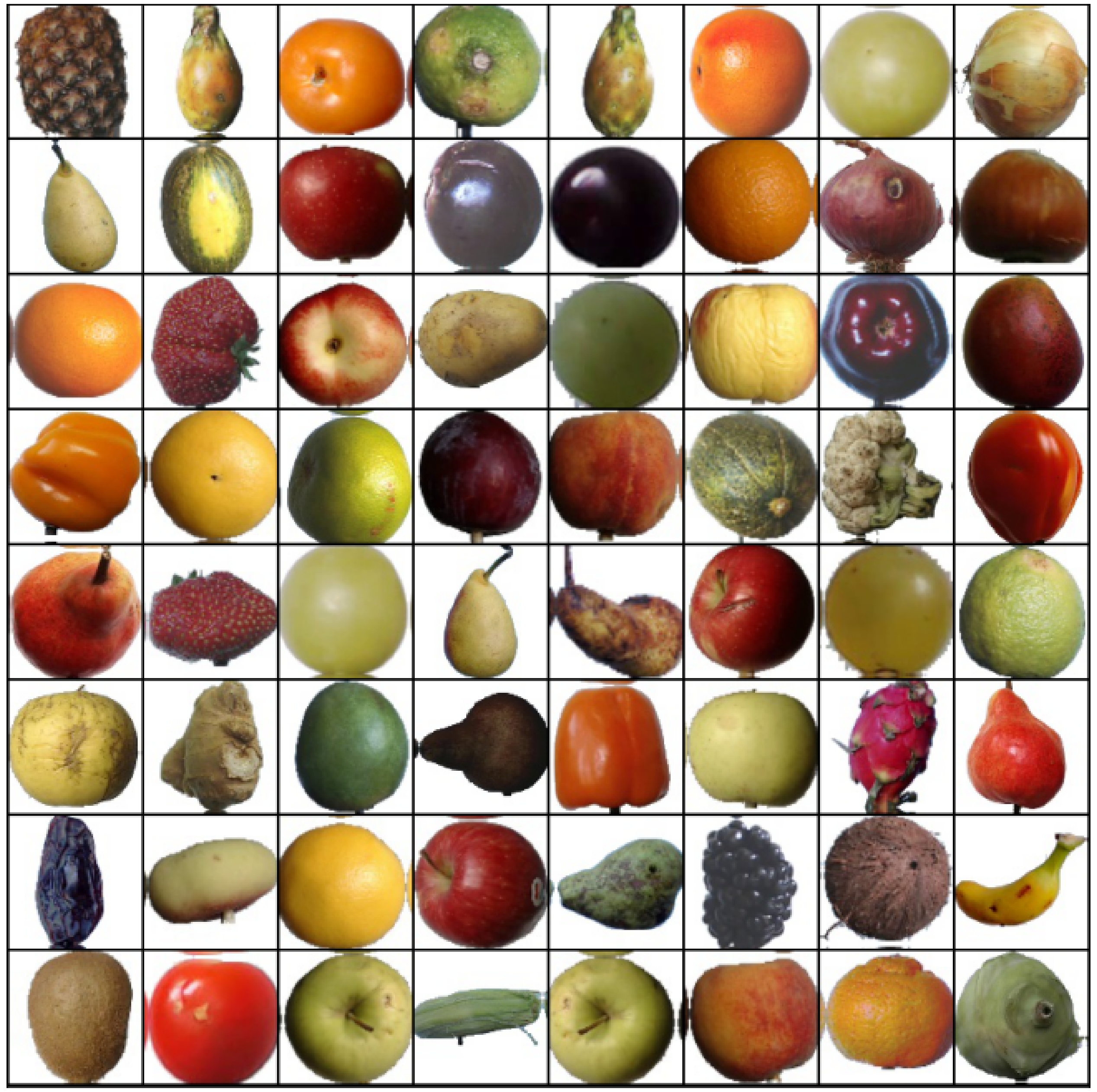


ABOUT THE DATASET

1. The dataset was named Fruits-360
2. some fruits which are included are Apples Apricot, Avocado, Avocado ripe, Banana Cherry etc.

DATASET PROPERTIES:-

- The total number of images: 90483.
- Training set size: 67692 images (one fruit or vegetable per image).
- Test set size: 22688 images (one fruit or vegetable per image).
- The number of classes: 131 (fruits and vegetables).
- Image size: 100x100 pixels.



THE 131 Classes in the DATASET

'Apple Braeburn', 'Apple Crimson Snow', 'Apple Golden 1', 'Apple Golden 2', 'Apple Golden 3', 'Apple Granny Smith', 'Apple Pink Lady', 'Apple Red 1', 'Apple Red 2', 'Apple Red 3', 'Apple Red Delicious', 'Apple Red Yellow 1', 'Apple Red Yellow 2', 'Apricot', 'Avocado', 'Avocado ripe', 'Banana', 'Banana Lady Finger', 'Banana Red', 'Beetroot', 'Blueberry', 'Cactus fruit', 'Cantaloupe 1', 'Cantaloupe 2', 'Carambula', 'Cauliflower', 'Cherry 1', 'Cherry 2', 'Cherry Rainier', 'Cherry Wax Black', 'Cherry Wax Red', 'Cherry Wax Yellow', 'Chestnut', 'Clementine', 'Cocos', 'Corn', 'Corn Husk', 'Cucumber Ripe', 'Cucumber Ripe 2', 'Dates', 'Eggplant', 'Fig', 'Ginger Root', 'Granadilla', 'Grape Blue', 'Grape Pink', 'Grape White', 'Grape White 2', 'Grape White 3', 'Grape White 4', 'Grapefruit Pink', 'Grapefruit White', 'Guava', 'Hazelnut', 'Huckleberry', 'Kaki', 'Kiwi', 'Kohlrabi', 'Kumquats', 'Lemon', 'Lemon Meyer', 'Limes', 'Lychee', 'Mandarine', 'Mango', 'Mango Red', 'Mangostan', 'Maracuja', 'Melon Piel de Sapo', 'Mulberry', 'Nectarine', 'Nectarine Flat', 'Nut Forest', 'Nut Pecan', 'Onion Red', 'Onion Red Peeled', 'Onion White', 'Orange', 'Papaya', 'Passion Fruit', 'Peach', 'Peach 2', 'Peach Flat', 'Pear', 'Pear 2', 'Pear Abate', 'Pear Forelle', 'Pear Kaiser', 'Pear Monster', 'Pear Red', 'Pear Stone', 'Pear Williams', 'Pepino', 'Pepper Green', 'Pepper Orange', 'Pepper Red', 'Pepper Yellow', 'Physalis', 'Physalis with Husk', 'Pineapple', 'Pineapple Mini', 'Pitahaya Red', 'Plum', 'Plum 2', 'Plum 3', 'Pomegranate', 'Pomelo Sweetie', 'Potato Red', 'Potato Red Washed', 'Potato Sweet', 'Potato White', 'Quince', 'Rambutan', 'Raspberry', 'Redcurrant', 'Salak', 'Strawberry', 'Strawberry Wedge', 'Tamarillo', 'Tangelo', 'Tomato 1', 'Tomato 2', 'Tomato 3', 'Tomato 4', 'Tomato Cherry Red', 'Tomato Heart', 'Tomato Maroon', 'Tomato Yellow', 'Tomato not Ripened', 'Walnut', 'Watermelon'

METHODOLOGY

CLEANING DATASET

Preprocessing the Dataset

Building the CNN

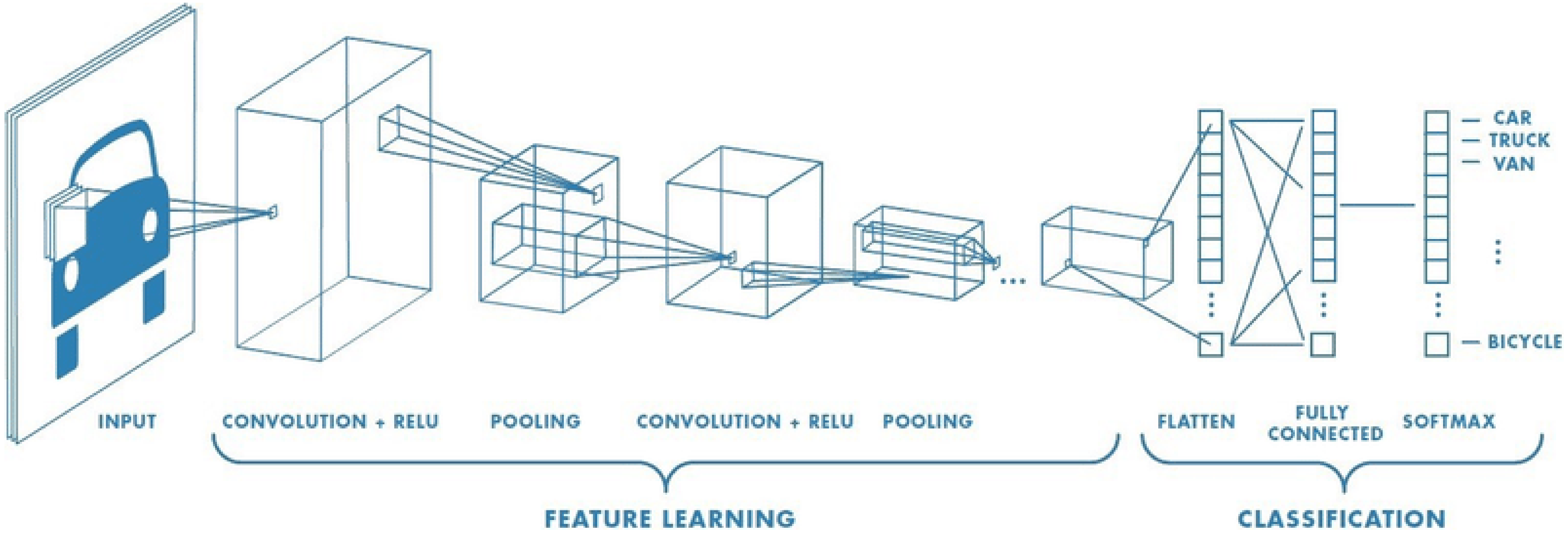
Training the CNN

Testing

MAKING A SINGLE PREDICTION

CONVOLUTIONAL NEURAL NETWORK

- A Convolutional Neural Network is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms.



SNAPSHOTS OF THE CODE

Part 2: Building the CNN

Initialising the CNN

```
In [5]: cnn = tf.keras.models.Sequential()

In [6]: # Step 1 - Convolution
        cnn.add(tf.keras.layers.Conv2D(filters=32, kernel_size=3, activation='relu', input_shape=[256,256,3]))

In [7]: # Step 2 - Pooling
        cnn.add(tf.keras.layers.MaxPool2D(pool_size=2, strides=2))

In [8]: # Adding a Second Convolutional Layer
        cnn.add(tf.keras.layers.Conv2D(filters=32, kernel_size=3, activation='relu'))
        cnn.add(tf.keras.layers.MaxPool2D(pool_size=2, strides=2))

In [9]: # Step 3 - Flattening
        cnn.add(tf.keras.layers.Flatten())

In [10]: # Step 4 - Full Connection
         cnn.add(tf.keras.layers.Dense(units=128, activation='relu'))

In [11]: # Step 5 - Output Layer
         cnn.add(tf.keras.layers.Dense(units=131, activation='softmax'))
```



```
In [14]: cnn.fit( x= training_data, validation_data= testing_data, epochs= 4)

Epoch 1/4
2116/2116 [==============================] - 8482s 4s/step - loss: 4.1480 - accuracy: 0.8256 - val_loss: 1.4861 - val_accuracy:
0.7838
Epoch 2/4
2116/2116 [==============================] - 6176s 3s/step - loss: 0.6750 - accuracy: 0.8593 - val_loss: 3.1759 - val_accuracy:
0.7038
Epoch 3/4
2116/2116 [==============================] - 5166s 2s/step - loss: 0.3625 - accuracy: 0.9149 - val_loss: 5.1771 - val_accuracy:
0.6088
Epoch 4/4
2116/2116 [==============================] - 5737s 3s/step - loss: 0.2919 - accuracy: 0.9459 - val_loss: 4.6571 - val_accuracy:
0.6634
```

COMPARISON WITH EXISTING MODELS

- In papers for references we can see an approach to detecting fruits based on color, shape and texture. They highlight the difficulty of correctly classifying similar fruits of different species. They propose combining existing methods using the texture, shape and color of fruits to detect regions of interest from 5 images.

- Similarly, a method combining shape, size and color, texture of the fruits together with a k nearest neighbor algorithm is used to increase the accuracy of recognition.

CONCLUSION

From our point of view, one of the main objectives for the future is to improve the accuracy of the neural network. This involves further experimenting with the structure of the network. Various tweaks and changes to any layers as well as the introduction of new layers can provide completely different results. Another option is to replace all layers with convolutional layers. This has been shown to provide some improvement over the networks that have fully connected layers in their structure.

In the near future, we plan to create a mobile application that takes pictures of fruits and labels them accordingly. Another objective is to expand the data set to include more fruits. This is a more time-consuming process since we want to include items that were not used in most other related papers.

REFERENCES

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