

Banana Classification Using Deep Learning

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Abstract: *Banana, fruit of the genus Musa, of the family Musaceae, one of the most important fruit crops of the world. The banana is grown in the tropics, and, though it is most widely consumed in those regions, it is valued worldwide for its flavour, nutritional value, and availability throughout the year. Cavendish, or dessert, bananas are most commonly eaten fresh, though they may be fried or mashed and chilled in pies or puddings. They may also be used to flavour muffins, cakes, or breads. Cooking varieties, or plantains, are starchy rather than sweet and are grown extensively as a staple food source in tropical regions; they are cooked when ripe or immature. A ripe fruit contains as much as 22 percent of carbohydrate and is high in dietary fibre, potassium, manganese, and vitamins B6 and C.. In this paper, machine learning based approach is presented for identifying type Apple with a dataset that contains 8,554 images use 4,488 images for training, 1,928 images for validation and 2,138 images for testing. A deep learning technique that extensively applied to image recognition was used. use 70% from image for training and 30% from image for validation. Our trained model achieved an accuracy of 100% on a held-out test set, demonstrating the feasibility of this approach.*

Keywords: *Type Banana, Deep Learning, Classification, Detection*

INTRODUCTION

Banana Benefits:

1. High Fibre Content

Banana is loaded with fibre, both soluble and insoluble. The soluble fiber has the tendency to slow down digestion and keep you feeling full for a longer time. Which is why bananas are often included in a breakfast meal so that you can start about your day without having to worry about the next meal.

2. Heart Health

High fibre foods are said to be good for the heart. According to a study done by University of Leeds in UK, increasing the consumption of fibre-rich foods such as bananas can lower the risk of both cardiovascular disease (CVD) and coronary heart disease (CHD).

3. Ease in Digestion

According to Ayurveda, banana has a sweet and sour taste. The sweet taste is said to bring about a sense of heaviness but the sour taste is known to stimulate *agni* (the digestive juices), thereby supporting digestion and helping in building up metabolism.

4. Powerhouse of Nutrients

Banana is a heavyweight when it comes to nutrition. It is loaded with essential vitamins and minerals such as potassium, calcium, manganese, magnesium, iron, folate, niacin, riboflavin, and B6. These all contribute to the proper functioning of the body and keeping you healthy.

5. High Source Of Potassium

The high content of potassium in bananas makes it a super fruit. This mineral is known for its numerous health benefiting properties - it helps in regulating heartbeat, blood pressure, and keeps the brain alert. So make sure you add bananas to your daily to keep your heart and brain healthy, plus for more stabled blood pressure.

6. Blood Pressure

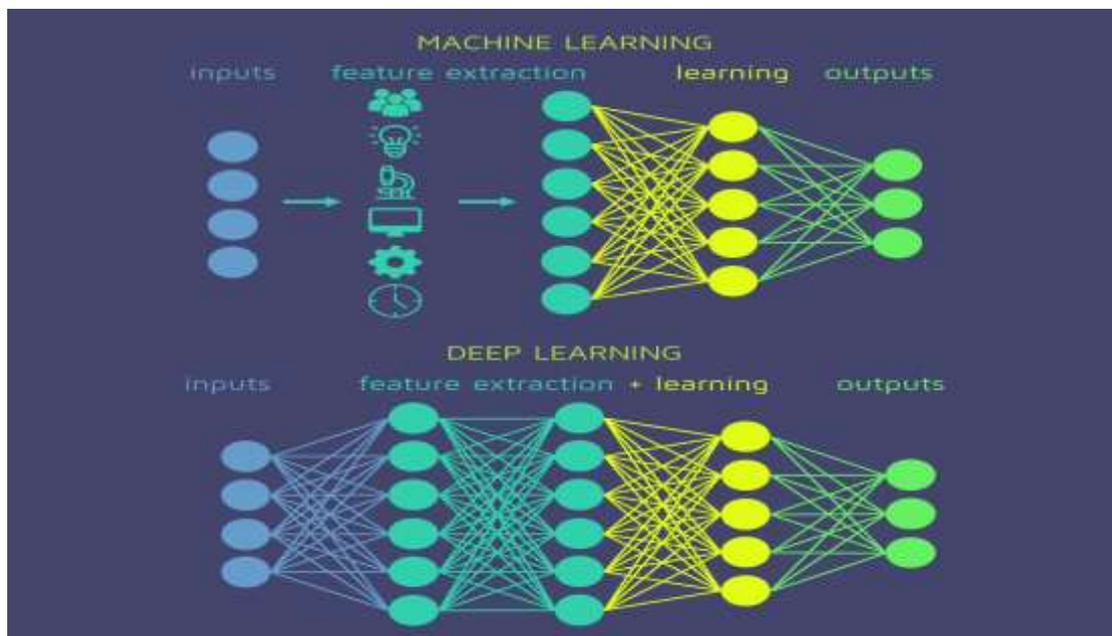
It is a known fact that salt is the culprit when it comes to high blood pressure. Bananas have low salt content and high potassium content, and these properties contribute to making it an ideal for those undergoing this condition. But make sure you consult your nutritionist or doctor before you add it to your diet.

7. Helps Fight Anaemia

Due to the high iron content in bananas, they are good for those suffering from anaemia. Anaemia is a condition where there is a decrease in the number of red blood cells or haemoglobin in the blood. This leads to fatigue, shortness of breath, and paleness. But, as we always say that moderation is the key.

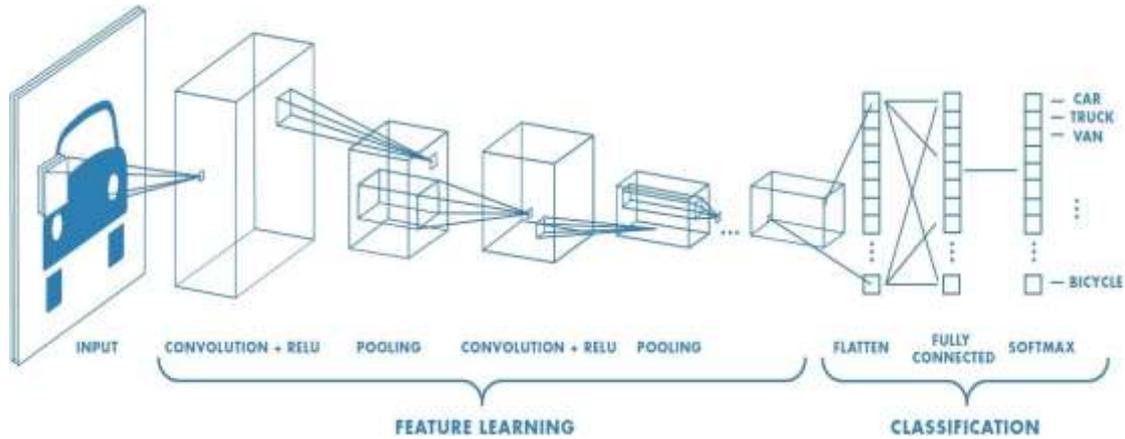
DEEP LEARNING

Deep learning is an artificial intelligence function that imitates the workings of the human brain in processing data and creating patterns for use in decision making. Deep learning is a subset of machine learning in artificial intelligence (AI) that has networks capable of learning unsupervised from data that is unstructured or unlabeled. Also known as deep neural learning or deep neural network.



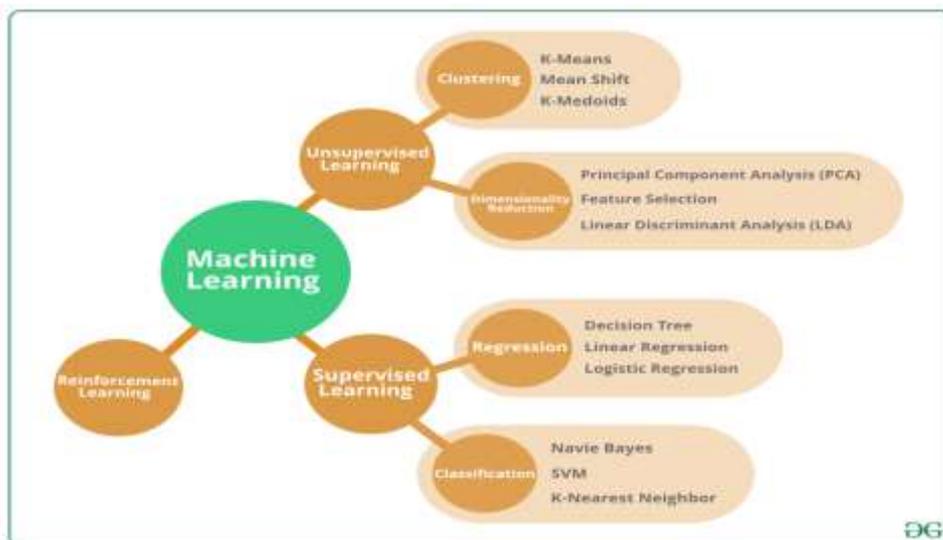
CONVOLUTIONAL NEURAL NETWORK

A Convolutional Neural Network (ConvNet/CNN) 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. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics.



TYPES OF MACHINE LEARNING ALGORITHMS

There some variations of how to define the types of Machine Learning Algorithms but commonly they can be divided into categories according to their purpose and the main categories are the following:



Supervised Learning

How it works: This algorithm consist of a target / outcome variable (or dependent variable) which is to be predicted from a given set of predictors (independent variables). Using these set of variables, we generate a function that map inputs to desired outputs. The training process continues until the model achieves a desired level of accuracy on the training data. Examples of Supervised Learning: Regression, Decision Tree, Random Forest, KNN, Logistic Regression etc.

Unsupervised Learning

How it works: In this algorithm, we do not have any target or outcome variable to predict / estimate. It is used for clustering population in different groups, which is widely used for segmenting customers in different groups for specific intervention. Examples of Unsupervised Learning: Apriori algorithm, K-means.

Reinforcement Learning

How it works: Using this algorithm, the machine is trained to make specific decisions. It works this way: the machine is exposed to an environment where it trains itself continually using trial and error. This machine learns from past experience and tries to capture the best possible knowledge to make accurate business decisions.

STUDY OBJECTIVES

- 1- Demonstrating the feasibility of using deep convolutional neural networks to classify Type Banana.
- 2- Developing a model that can be used by developer to create smartphones application or web site to detect Type Banana.

DATASET

The dataset used, provided by Kaggle, contains a set of 1,914 images use 1,001 images for training, 429 images for validation and 484 images for testing belonging to 3 species from banana. See Fig. 1 for types Banana.



Figure 1: Dataset Samples

The output 3 classes as follow:

- class (0): Banana.
- class (1): Banana Lady Finger.
- class (2): Banana Red.

The images were resized into 128×128 for faster computations but without compromising the quality of the data.

METHODOLOGY

In this section we describe the proposed solution as selected convolutional network (ConvNet) architecture and discuss associated design choices and implementation aspects.

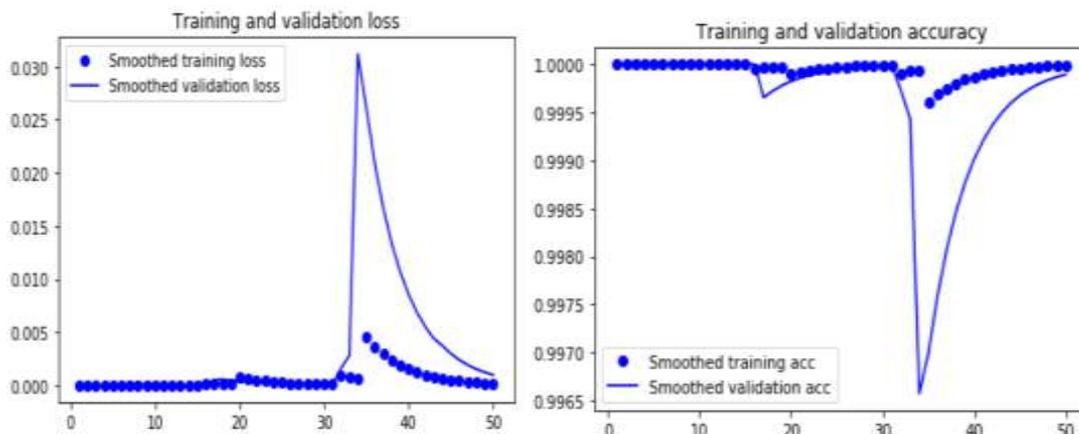
MODEL

Our model takes raw images as an input, so we used Convolutional Neural Networks (CNNs) to extract features, in result the model would consist from (features extraction), which was the same for full-color approach and gray-scale approach, it consist of 4 Convolutional layers with Relu activation function, each followed by Max Pooling layer.

Layer (type)	Output Shape	Param #
conv2d_5 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_5 (MaxPooling2)	(None, 63, 63, 32)	0
conv2d_6 (Conv2D)	(None, 61, 61, 64)	18496
max_pooling2d_6 (MaxPooling2)	(None, 30, 30, 64)	0
conv2d_7 (Conv2D)	(None, 28, 28, 128)	73856
max_pooling2d_7 (MaxPooling2)	(None, 14, 14, 128)	0
conv2d_8 (Conv2D)	(None, 12, 12, 128)	147584
max_pooling2d_8 (MaxPooling2)	(None, 6, 6, 128)	0
flatten_2 (Flatten)	(None, 4608)	0
dropout_2 (Dropout)	(None, 4608)	0
dense_3 (Dense)	(None, 512)	2359808
dense_4 (Dense)	(None, 3)	1539

SYSTEM EVALUATION

We used the original apples dataset that consists of 1,914 images after resizing the images to 128x128 pixels. We divided the data into training (70%), validation (30%). The training accuracy was 99.99% and the validation accuracy was 100%.



CONCLUSION

We proposed a solution to help people determine the type of bananas more accurately, 100% accurately for your best model, builds a model using deep learning convolutional neural networks and uses this model to predict the type of (previously

unseen) images of banana with a network from 4 layers and a dropout of 0.2 , that takes banana images with 3 different species an input.

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