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Type of Grapefruit Classification Using Deep Learning

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Abstract: *Fruit has been recognized as a good source of vitamins and minerals, and for their role in preventing vitamin C and vitamin A deficiencies. People who eat fruit as part of an overall healthy diet generally have a reduced risk of chronic diseases.*
Fruit are important sources of many nutrients, including potassium, fiber, vitamin C and folate (folic acid).
One of important types of fruit is Grapefruit . Grapefruit is a tropical citrus fruit known its sweet and somewhat sour taste. It's rich in nutrients, antioxidants and fiber, making it one of the healthiest citrus fruits you can eat. Research shows that it may have some powerful health benefits, including weight loss and a reduced risk of heart disease.
In this paper we presented a system that recognize the two types of Grapefruit Pink and white based on deep learning using python on colab editor .
This system may help people to automate their factories , restaurants or anything else need to classify these two types for different use .

Keywords: *Grapefruit ,Deep Learning, Classification, colab , python.*

INTRODUCTION

Grapefruit is a citrus fruit with a flavor that can range from bittersweet to sour. It contains a range of essential vitamins and minerals. People can consume the fruit whole or as a juice or pulp.

The grapefruit first appeared in the 18th century, as a result of crossing a pomelo and an orange. People called it "grapefruit" because it grows in clusters, similar to grapes.

The nutrients grapefruit contains may help promote healthy skin and protect against various conditions. They may also play a role in weight maintenance.

Figure 1: Samples of Grapefruit

DEEP LEARNING

Deep Learning (DL) or more commonly known as deep structured learning or hierarchical learning is a division of Machine Learning (ML) which is based on a set of algorithms that attempt to model high-level abstractions in data, [1, 2]. Such algorithms develop a layered, hierarchical architecture of learning and representing data. This hierarchical learning architecture is inspired by artificial intelligence emulating the deep, layered learning process of the primary sensorial areas of the neocortex in human brain, which automatically extracts features and abstractions from underlying data [3, 4, 5]. Based on [6, 7], DL algorithms are useful when it comes to dealing with large amounts of unsupervised data and naturally learn data representations in a greedy layer-wise method.

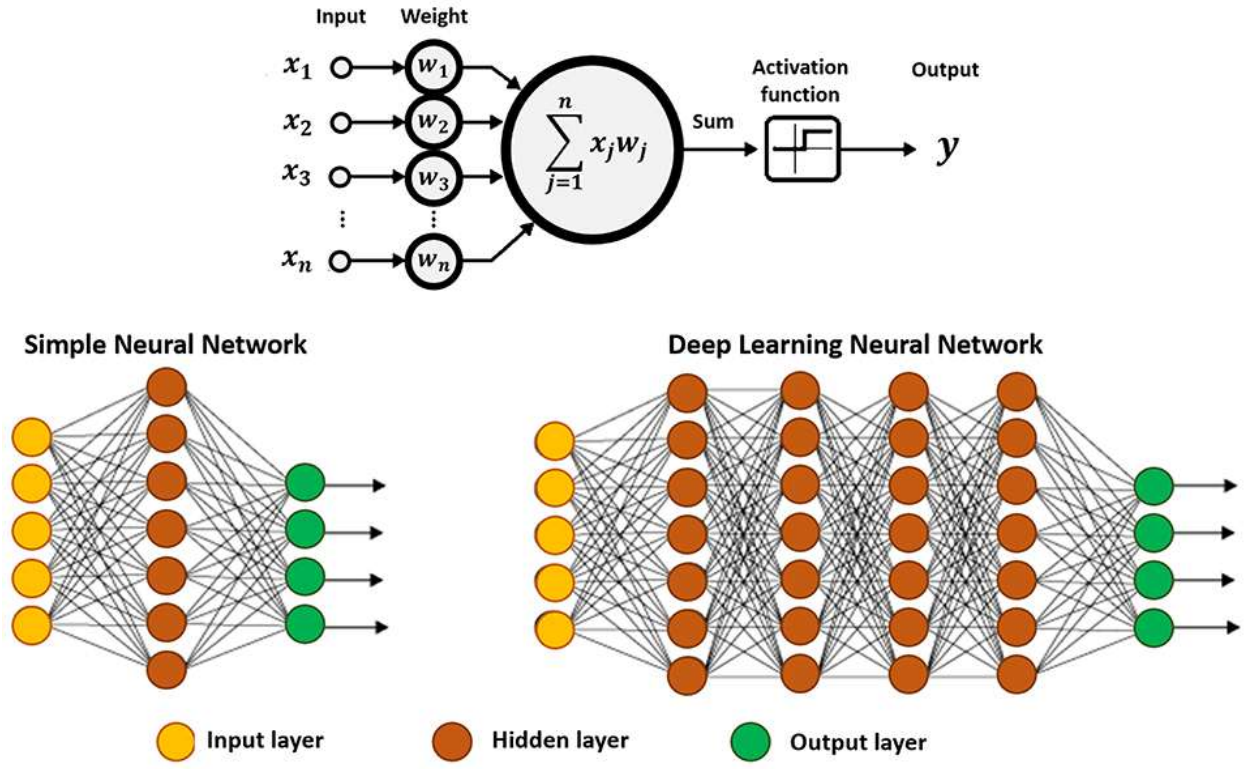


Figure 2

Deep learning has dramatically improved the state-of-the-art in many different artificial intelligent tasks like object detection, speech recognition, machine translation . Its deep architecture nature grants deep learning the possibility of solving many more complicated AI tasks . As a result, researchers are extending deep learning to a variety of different modern domains and tasks in additional to traditional tasks like object detection, face recognition, or language models.

TYPES OF MACHINE LEARNING ALGORITHMS

Machine learning algorithms are organized into taxonomy, based on the desired outcome of the algorithm. Common algorithm types include:

- **Supervised learning** --- where the algorithm generates a function that maps inputs to desired outputs. One standard formulation of the supervised learning task is the classification problem: the learner is required to learn (to approximate the behavior of) a function which maps a vector into one of several classes by looking at several input-output examples of the function.

- **Unsupervised learning** --- which models a set of inputs: labeled examples are not available.

•**Semi-supervised learning** --- which combines both labeled and unlabeled examples to generate an appropriate function or classifier.

•**Reinforcement learning** --- where the algorithm learns a policy of how to act given an observation of the world. Every action has some impact in the environment, and the environment provides feedback that guides the learning algorithm.

•**Transduction** --- similar to supervised learning, but does not explicitly construct a function: instead, tries to predict new outputs based on training inputs, training outputs, and new inputs.

•**Learning to learn** --- where the algorithm learns its own inductive bias based on previous experience. The performance and computational analysis of machine learning algorithms is a branch of statistics known as computational learning theory. Machine learning is about designing algorithms that allow a computer to learn. Learning is not necessarily involves consciousness but learning is a matter of finding statistical regularities or other patterns in the data. Thus, many machine learning algorithms will barely resemble how human might approach a learning task. However, learning algorithms can give insight into the relative difficulty of learning in different environments.

This paper organized as follow :in the first part we will talk about our objectives from this research , then we will talk about our dataset which we used to train our model and we will talk about it self then our system evaluation and result from testing our network .

Finally the conclusion and what we get from our system and it helpful for whom. .

STUDY OBJECTIVES

1. Demonstrating the feasibility of using deep convolutional neural networks to classify Type Apple or anything have many types and we want to classify it.
2. Crating a model that can be used by developer or someone to design and develop smartphones application or web site to detect the thing we need to classify.

DATASET

The dataset used, provided by Kaggle, contains a set of 1,312 images use 687 images for training, 295 images for validation and 330 images for testing belonging to 2 species from Grapefruit.

Figure 3: Samples of Grapefruit form dataset

The images was resized into 150×150 for faster computations but without losing the quality of the data.

METHODOLOGY

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

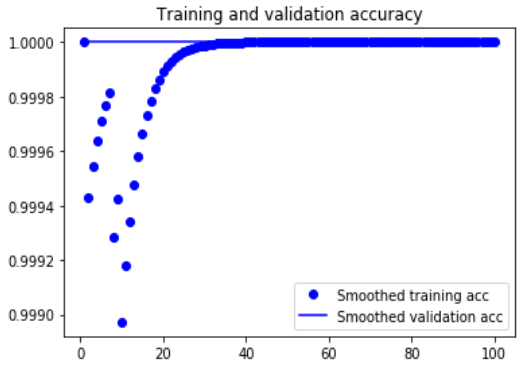
MODEL

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, 256)	1179904
dense_4 (Dense)	(None, 1)	257

SYSTEM EVALUATION

We used the original Grapefruit dataset that consists of 982 images after resizing the images to 150x150 pixels. We divided the data into training (70%), validation (30%). The training accuracy was 100% and the validation accuracy was 100%.



CONCLUSION

We proposed a system that help people to determine the type of Grapefruit with accuracy reached to 100% .we built a model using deep learning convolutional neural networks and used this model to predict the type of (previously unseen) images of Grapefruit with a network of 4 layers and a dropout of 0.2, this model and this system will help many users to automate their restaurants or factories or anything else when it comes to Grapefruit.

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