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Deep Learning Classification of Peach Fruits

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Abstract: *Peach, (Prunus persica), fruit tree of the rose family (Rosaceae), grown throughout the warmer temperate regions of both the Northern and Southern hemispheres. Peaches are widely eaten fresh and are also baked in pies and cobblers; canned peaches are a staple commodity in many regions. Yellow-fleshed varieties are especially rich in vitamin A. Peach trees are relatively short-lived as compared with some other fruit trees. In some regions orchards are replanted after 8 to 10 years, while in others trees may produce satisfactorily for 20 to 25 years or more, depending upon their resistance to diseases, pests, and winter damage. in the body.[1] In this paper, machine learning based approach is presented for identifying type peach with a dataset that contains 2,306 images use 1,212 images for training, 520 images for validation and 574 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 Peach, Deep Learning, Classification, Detection.*

INTRODUCTION

Peach is deciduous plant that belongs to the family Rosaceae. This plant is closely related to almonds, cherries and plums. Peach originate from China, but it can be found all around the world today. It has been part of human diet at least couple of thousand years. People cultivate peaches mainly because of their aromatic fruit. Some varieties are cultivated only for decorative purposes. Peach tree usually grows in temperate climate because it requires low temperature during the winter for successful development of flowers. This plant also requires fertilizers rich in nitrogen and constant water supply during the growth. Peaches are often targeted by insects or insect larvae which affect amount and quality of produced fruit.[2]

INTERESTING PEACH FACTS : [3]

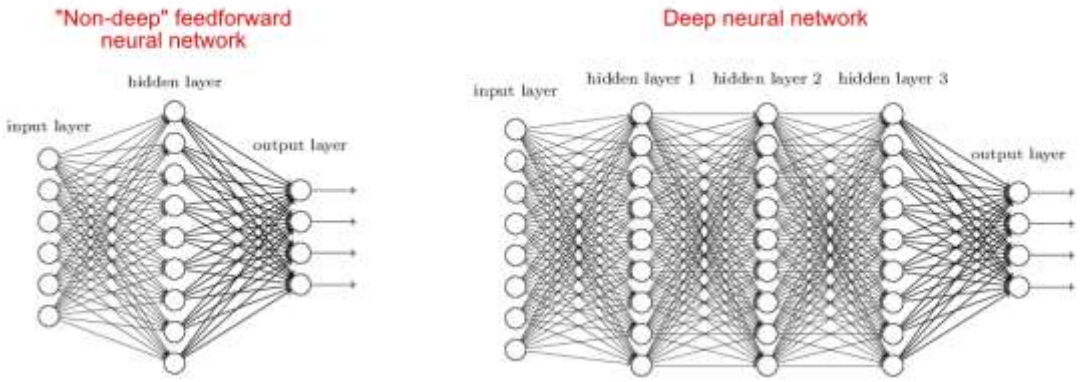
- Size of peach tree depends on the variety. It can reach 13 to 33 feet in height.
- Peach develops green, elongated leaves. They are lanceolate in shape and have pinnate veins.
- Flowers appear on the tree before leaves. They consist of 5 pink petals. Flowers are located individually or grouped in pairs. They contain both male (stamens) and female (pistil) reproductive organs.
- Honeybees are main pollinators of flowers.
- Fruit of peach is botanically known as drupe (stone fruit). It consists of white or yellow flesh that is covered with yellowish-red velvety skin. Varieties of peach with white flesh are sweeter compared to the peaches that have yellow flesh.
- Seed is large, oval in shape and protected with woody husk. Even though seed can be consumed, large doses are not recommended because it contains hydrocyanic acid which is poisonous.
- All varieties of peaches can be divided in two groups: clingstone and freestone peaches. In a clingstone type, flesh is tightly attached to the stone. This type of peach is mainly used for canning. Flesh of freestone types can be easily removed from the stone. This type of peach is mainly sold as fresh fruit.
- Nectarine is a type of peach that has smooth skin instead of velvety (which is typical for peaches).
- Peach was known as “Persian apple” because ancient Romans believed that peach originates from Persia.
- Peaches are rich source of vitamin C, A and E. They also contain high amount of potassium, magnesium, zinc and phosphorus. Peach of an average size contains only 37 calories.
- People consume peaches raw or in the form of juices and various desserts.
- Peaches are used in the cosmetic industry for the production of various lotions, creams and shampoos. Peaches are also used in the industry of perfumes.
- Peach symbolizes immortality and unity in Chinese culture. Brides use flowers of peach to decorate their hairs during wedding ceremony in China.
- China is the greatest manufacturer of peaches in the world.
- First fruit will appear on the peach tree after 3 years. This plant usually lives around 12 years.

Deep Learning is an Artificial Intelligence (AI) subfield that imitates the works of a human brain in processing data and producing patterns for use in decision making. Deep learning is a subset of machine learning in artificial intelligence that has networks the skills of learning from data that is unlabeled or unstructured.

In this work, we show that a Deep Convolutional Neural Network (CNN) does well in classifying peach type. In computer vision, CNNs have been known to be powerful visual models that yield hierarchies of features enabling accurate segmentation. They are also known to perform predictions relatively faster than other algorithms while maintaining competitive performance at the same time [4].

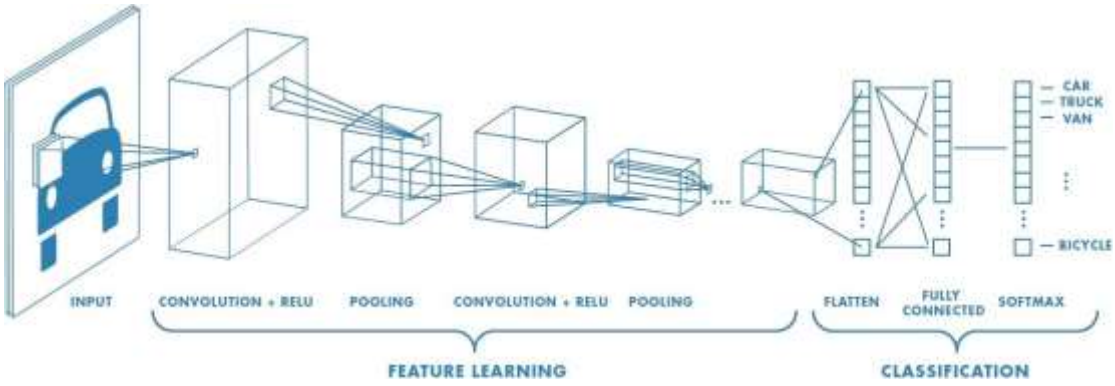
DEEP LEARNING

Deep learning (also known as deep structured learning or hierarchical learning) is part of a broader family of machine learning methods based on learning data representations, as opposed to task-specific algorithms. Learning can be supervised, semi-supervised or unsupervised [5]-[6]. In deep learning, each level learns to transform its input data into a slightly more abstract and composite representation. In an image recognition application, the raw input may be a matrix of pixels; the first representational layer may abstract the pixels and encode edges; the second layer may compose and encode arrangements of edges; the third layer may encode a nose and eyes; and the fourth layer may recognize that the image contains a face. Importantly, a deep learning process can learn which features to optimally place in which level on its own. (Of course, this does not completely obviate the need for hand-tuning; for example, varying numbers of layers and layer sizes can provide different degrees of abstraction) [5],[7].



CONVOLUTIONAL NEURAL NETWORK

In deep learning, a convolutional neural network (CNN, or ConvNet) is a class of deep neural networks, most commonly applied to analyzing visual imagery. CNNs use a variation of multilayer perceptron's designed to require minimal preprocessing. They are also known as shift invariant or space invariant artificial neural networks (SIANN), based on their shared-weights architecture and translation invariance characteristics [8].

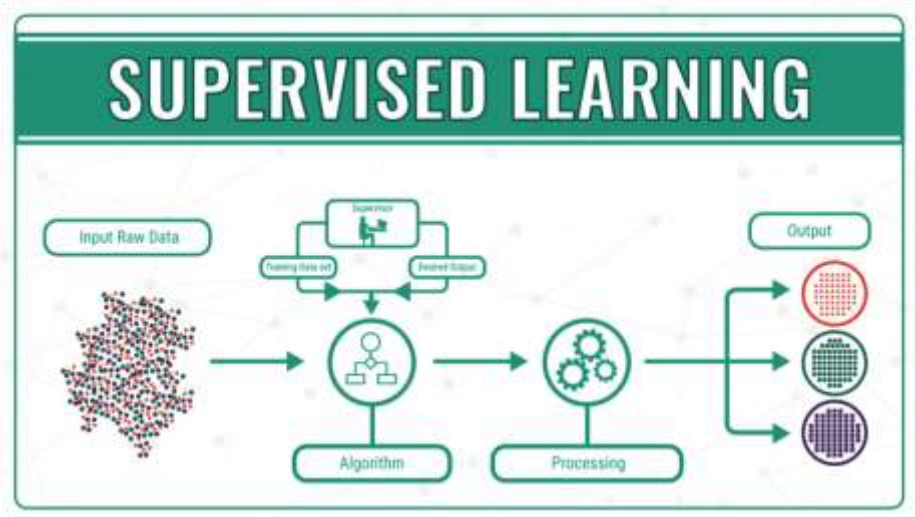


TYPES OF MACHINE LEARNING ALGORITHMS

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 [9]:

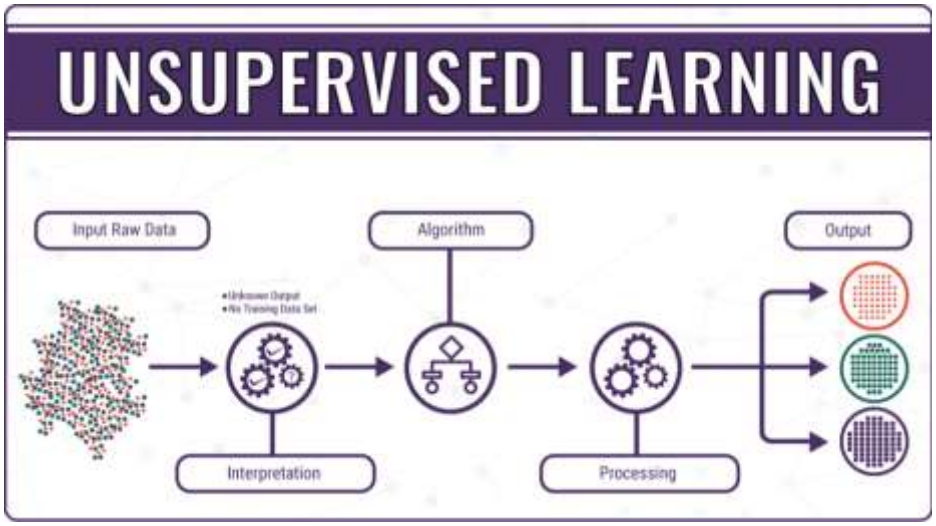
Supervised learning

Supervised learning is a learning model built to make prediction, given an unforeseen input instance. A supervised learning algorithm takes a known set of input dataset and its known responses to the data (output) to learn the regression/classification model. A learning algorithm then trains a model to generate a prediction for the response to new data or the test dataset [10].



Unsupervised Learning

Unsupervised learning is the training of an artificial intelligence (AI) algorithm using information that is neither classified nor labeled and allowing the algorithm to act on that information without guidance, An AI system may group unsorted information according to similarities and differences even though there are no categories provided. AI systems capable of unsupervised learning are often associated with generative learning models, although they may also use a retrieval-based approach (which is most often associated with supervised learning). Chatbots, self-driving cars, facial recognition programs, expert systems and robots are among the systems that may use either supervised or unsupervised learning approaches. [11].



STUDY OBJECTIVES

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

DATASET

The dataset used, provided by Kaggle, contains a set of 8,554 images use 4,488 images for training, 1,928 images for validation and 2,138 images for testing belonging to 13 species from peach. See Fig. 1 for types peach.

Figure 1: Dataset Samples

The output 3 classes as follow:

- class (0): peach Red.
- class (1): peach Gold
- class (2): peach Flat

The images were resized into 150×150 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.

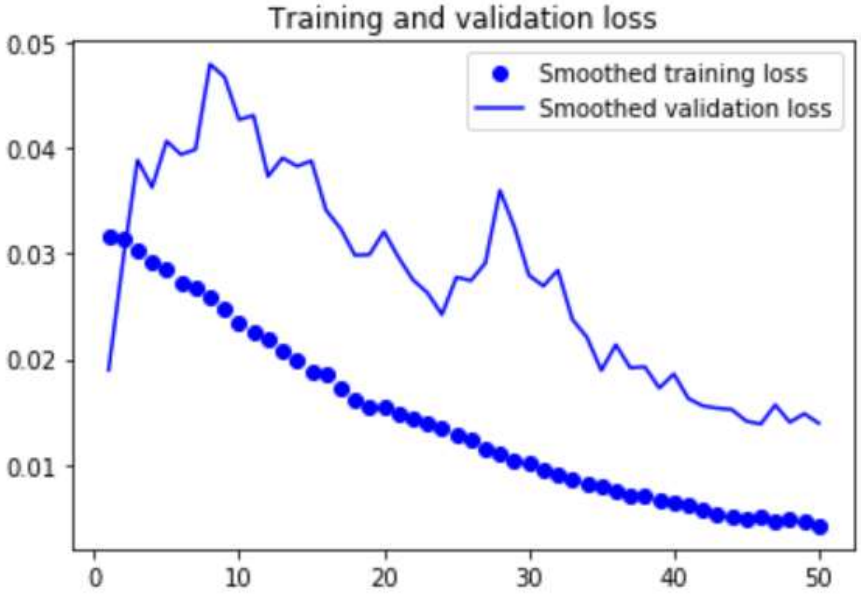
MODEL

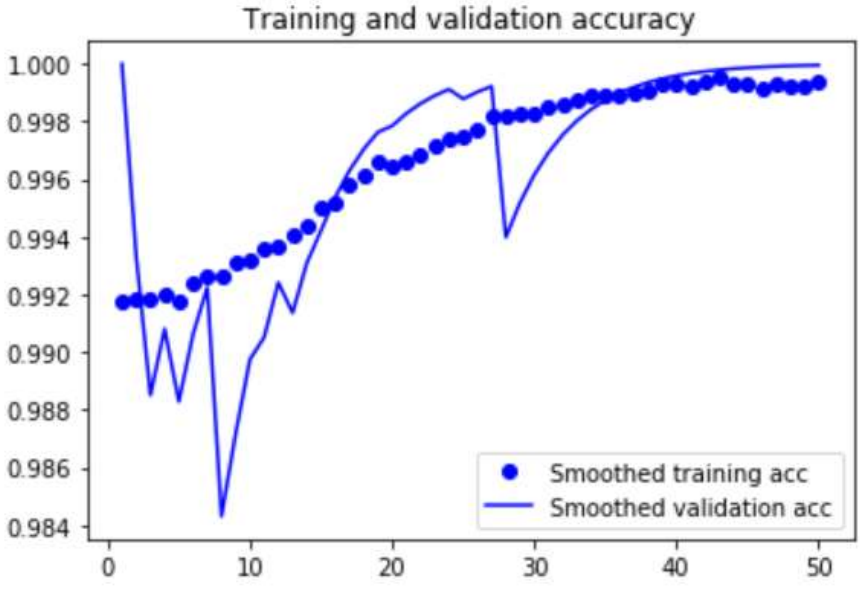
Our model takes raw images as an input, so we used Convolutional Nural Networks (CNNs) to extract features, in result the model would consist from (features extraction), which was the same for full-color approach and gray-scale approach, it consist of 4 Convolutional layers with Relu activation function,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

Layer (type)	Output Shape	Param #
conv2d_13 (Conv2D)	(None, 126, 126, 32)	896
max_pooling2d_13 (MaxPooling	(None, 63, 63, 32)	0
conv2d_14 (Conv2D)	(None, 61, 61, 64)	18496
max_pooling2d_14 (MaxPooling	(None, 30, 30, 64)	0
conv2d_15 (Conv2D)	(None, 28, 28, 128)	73856
max_pooling2d_15 (MaxPooling	(None, 14, 14, 128)	0
conv2d_16 (Conv2D)	(None, 12, 12, 128)	147584
max_pooling2d_16 (MaxPooling	(None, 6, 6, 128)	0
flatten_4 (Flatten)	(None, 4608)	0
dense_7 (Dense)	(None, 256)	1179904
dense_8 (Dense)	(None, 3)	771

SYSTEM EVALUATION

We used the original peach dataset and 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 peach more accurately, 100% accurately for the best model, builds a model using deep learning convolutional neural networks and uses this model to predict the type of (previously unseen) images of peach with a network from 4 layers and a dropout of 0.2 , that takes peach images with 3 different species an input.

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