Moving object detection and tracking Using Convolutional Neural Networks

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***Abstract*— In this paper our goal is to compare transfer learning with CNN when we have limited data set. The CNN model requires large data set and it has more than 4 layers of computing hence it requires high computing power and GPU. Whereas in Transfer learning we provide it with a relatively small data set and low computing power and GPU. Hence in the availability of small data set, transfer learning is a more feasible option to obtain good accuracy.**

I. INTRODUCTION

A Convolution Neural Network (CNN) is a neural network that has one or more convolutional layers, and they are mainly used for segmentation, image classification and other auto correlated data. Usually, these layers of the CNN require high computing power and GPU as we increase the layers to get better accuracy. The main usage of CNN is to perform image classification, the convolution is basically sliding a filter over the image. In this instead of looking at the whole image, the layers help is concentrating on a particular feature of the image which will be more effective and useful to classify the image.

On the other hand, we have Transfer Learning which is a machine learning model. Transfer learning is using a pre trained machine learning model to develop a new model which is applied to solve a new but a similar problem. Using the pre trained machine learning model to build a new model helps when there is an availability of smaller data set and low computation power.

When we compare CNN with Transfer learning, the availability of data set is a main factor, both CNN and Transfer Learning give us optimal accuracy when there is an availability of data set, but when we have limited data set, Transfer learning is a more feasible option. The CNN model might take days or even weeks to train on a very large data set, whereas by using Transfer learning we cut short this long training process as we use a pretrained model.

Another factor that we are comparing between CNN and Transfer learning is the accuracy and effectiveness of the model in the presence of smaller dataset. Since the model used in Transfer learning is pretrained, the requirement of large data set to train the model is eliminated, whereas in CNN a relatively larger dataset is required to train the model from scratch and obtain good accuracy. Though both the models give us good accuracy, the availability of data set is a factor we must take into consideration, in such cases Transfer learning is more efficient.

In our implementation we will be using a machine learning model that is pretrained with 900-1000 classes, which contains the classes of the fruits that we will be taking into consideration. We will be using MobileNet1 model to perform image classification.

We will be Fine-Tuning our model, where we will be freezing the initial layers of the model and modifying the last 5 layers to classify the images and detect the quality of fruits and vegetables.

# II. LITERATURE SURVEY

There are different approaches had been presented by different researchers starting from background subtraction to CNN. Some of the human tracking methods have been presented in this section.

Human tracking consists of three basic steps for pedestrian tracking: Human detection from sequence of frame, tracking and analysis of the tracking for particular purpose. Deep learning-based low-cost machine vision system for grading the fruits based on their outer appearance or freshness. Various state-of-the-art deep learning models and stacking ensemble deep learning methods were applied to two data sets of fruits. The results of this study show that Efficient Net [CNN](https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/neural-networks) models and their stacked combinations have the highest accuracy in grading the test set and real samples as compared to the other deep learning models. [1]

A framework for learning and classifying bananas is developed first. It uses neural network technology to detect the fruit's ripening stage.

Due to the complexity of the banana fruit's ripening stages, it is necessary to develop image processing tools that can identify the various fresh incoming bunches.

The goal is to create an image processing system that can detect the different stages of the fruit's ripening process. This method would help determine the optimal eating quality and the price of bananas. [2]

Computer vision is a widely used technique for processing images. It has enormous potential in terms of image processing and farming.

In this paper, we study the various aspects of machine learning for the classification of fruits and vegetables. Through a variety of data sources, we found that SVM achieves better accuracy than other machine learning techniques.

In this paper, we perform the Recognition and classification of fruits and vegetables and detection of disease in fruits and vegetables among the horticulture products under the agriculture field using computer vision.[3].

This paper proposed a classification model for maturity status classification of papaya fruits in two approaches, machine learning and transfer learning approach.

Overall, the VGG19 is better as VGG19 is based on transfer learning, there is no requirement of feature extraction and feature selection process. Although the transfer learning approach needs complex architecture, high training time and large datasets it is one time only.

However, the achieved accuracy in both machine learning and transfer learning is 100% and beat the previous method i.e., 94.7% of accuracy. [4].

# A deep learning-based framework for fruit classification was proposed in this work. Two CNN models were investigated in the proposed framework, a small CNN model, and a VGG-16 fine-tuned model.

# The VGG-16 fine-tuned model achieved excellent accuracy on both datasets.

# The light CNN model also achieved excellent accuracy on dataset 1 with data augmentation

# The performance of the two models has been compared with two other methods in the literature. It was found that the two proposed models outperformed the two existing methods on dataset.[5].

# The proposed paper tells us they have created a fuzzy model to check whether the fruit banana is ripe, unripe or overripe. For this they have used Regression Tree Algorithm and also the classification method. This process is evaluating the banana on different ripening stages on the MUSA database.[6]

In this paper, it is used to classify the fruit by capturing the image of the fruit using a camera. To classify the fruit, multi-class kernel support vector machine (kSVM) is used. Then the split and merge algorithm is used to eliminate the background of the image and focus only on the fruit. Next will rely on the shape, texture and also the color histogram to get a proper feature space and to minimize the dimensions of the feature space by principal component analysis (PCA).[7]

The proposed paper tells us that convolution neural network is used for object recognition and some of the important components for the information processing system and decision -making system are recognizing the visual image. CNN is mainly used for the detecting the fruit and recognizing the fruit too.[8].

In this paper, it has been discussed there may arise a human error while checking the quality of the fruit so using image acquisition and image classification for checking the fruit quality and three important factors used are image segmentation, image pre-processing, Classifier. In addition to this k-means clustering is used to achieve better improvement of accuracy and speed of the classifier.[9].

In this proposed paper, it is discussed about apple defect detection where first the apple image is captured and then background are deleted and the algorithm used in this paper is e Fuzzy C-means Algorithm and the Nonlinear Programming Genetic Algorithm (FCM-NPGA) and for multivariate image analysis. Using this algorithm the image of apple that is apple is examined every angle so that the defect can be found easily.[18].s

# III. METHODOLOGY

The proposed method is based on Machine Learning and uses transfer learning as well as computer vision and algorithms to automate the process of quality analysis of fruit and vegetable and to predict shelf-life. SDD is based on the Single Shot Detector Algorithm, which is faster and has a high object detection accuracy.

The VGG-16 base network for SDD is standard CNN architecture for high-quality image classification, but without the final classification layers.

The overall flow of the proposed system is presented in Various state-of-the-art deep learning techniques were initially trained and tested for the fruits’ image data sets and then these off-line models for each technique were saved and deployed for real-time testing.

The components of the system are explained in the subsequent sub-sections algorithm is used.

In order to develop the real-time visual inspection system for grading the fruits, deep learning models were trained and tested using the existing data sets. The details of the data sets, image pre-processing and training/testing of the models are described below.

The system can work both in offline and real time mode and can accurately grade the multiple instances of the fruits in a given image or real time using efficient segmentation process.

# IV. RESULTS

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