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COMPARATIVE ANALYSIS OF FOOD FRESHNESS DETECTION USING MACHINE LEARNING

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ABSTRACT

Deep learning and neural networks have emerged as a new area in machine learning and is applied to a number of signal and image applications. Here it is based on the comparative analysis of food freshness using machine learning algorithms and it uses different technique such as food detection and feature extraction based on its time, precision and recall value we can find which algorithm is more give accurate result to find the freshness of food and also the average time to detect the food also an important factor for finding the freshness we can find this too ,also we use certain images from the paper written by Mubashiru Olarewaju Lawal and certain architecture are used for the construction such as Dense Architecture.

Keywords: Deep Learning, Time, Precision, Object Detection, Histogram Features, Bag of features, Gray level co-occurrence Matrix

I. INTRODUCTION

Artificial intelligence has started playing a task in our daily lives. particularly, artificial neural networks are accustomed solve kind of complex problems like object classification, communication processing so on ResNet, which was proposed in 2015 by researchers at Microsoft Research introduced a replacement architecture called Residual Network. So on resolve the matter of the vanishing/exploding gradient, this architecture introduced the concept called Residual Network. During this network we use a way called skip connections.

TensorFlow is additionally a machine learning software developed by Google. The unique feature of TensorFlow is that each one the information objects are stored as tensors, including scalar values which are considered to be tensors of rank zero. In image processing, grayscale images are stored as rank two tensors which are generally referred as arrays and color images are stored as rank three tensors (arrays). This makes the implementation of a new method called convolutional neural network. The whole flow of computations in any Tensor+ Flow program is stored as a computational graph which runs within a session object. For complex machine learning programs, the modules may also be distributed across two or more CPUs and GPUs.

TensorFlow originated as an enclosed library that Google developers accustomed build models in-house, which we expect additional functionality to be added to the open source version as they're tested and vetted within the interior flavor. At a high level, TensorFlow might be a Python library that allows users to specific arbitrary computation as a graph of data flows. Nodes during this graph represent mathematical operations, whereas edges represent data that's communicated from one node to a special node.

In TensorFlow data's are represented as tensors, that's is in multidimensional arrays. Although this framework for pondering computation is effective in many various fields, TensorFlow is primarily used for deep learning in practice and research. Image classification is one in every of the fundamental problems in computer vision. It forms basis for several other computer vision tasks like seeing, image segmentation and object detection. The task of categorizing images into one among several predefined classes is named image classification.

II. METHODOLOGY

Here the project is based on food freshness detection based on machine learning we use different machine learning algorithm for detecting the freshness of food like tomato. based on feature extraction we use various studies and find which method is more suitable for feature extraction and finding more accurate result compared to other methods.

For finding the freshness of food, it goes through 3 stages:-

1) Detection of food
   a. YOLOv3 based on dense architecture
   b. YOLOv2
   c. Faster R-CNN
   d. YOLO
2) Feature Extraction
   a. Histogram Features
   b. Bag of features
   c. Gray level co-occurrence Matrix

3) Freshness calculation

III. MODELING AND ANALYSIS

Image classification are often done using both supervised classification algorithms and unsupervised classification algorithms. Supervised classification uses training data along with human intervention whereas in unsupervised classification human intervention isn't required because it's fully computer operated. The supervised classification has two phases namely training phase and classification phase. In training phase the classifier is given information about classes. This could be the phase where learning of a model takes place. In classification phase it uses the knowledge provided by the training data and classifies the image into one all told the predefined classes. During training phase, the models are created using architectures like RasNet looking on the architecture used the effectiveness of the model may vary.

For calculation of freshness we uses some feature extraction method Since the Primary emergence of successful machine learning algorithms, diverse techniques are proposed for distinct applications . Fresh and rotten fruit classification s among these studies which commonly employs different techniques like regression trees, support vector machines (SVMs) and Fisher Linear Discriminant Analysis (Fisher-LDA) to enhance the classification rate. The aim was to spot and classify different fruits and vegetables using machine learning tools. A dataset was collected using fruit resistive dataset for tomato although the background of all images was the identical, a number of the samples had shadows. Thus, K-means based background subtraction was first employed. Different kinds of algorithms like SVMs, LDA, classification trees, K-nearest neighbors (K-NNs), and ensembles of trees along with LDA were later adopted to obtain the most effective performance for this dataset.

In line with the experimental results, SVMs and LDA demonstrated the most effective performance. Color was chosen as a feature in RGB color space and color histograms were calculated. In order to eliminate the noise and reduce the dimensionality of the feature space, Fisher-LDA was adopted. The regions of defects on tomato were successfully determined using SVMs with a recall rate of 96.7%.

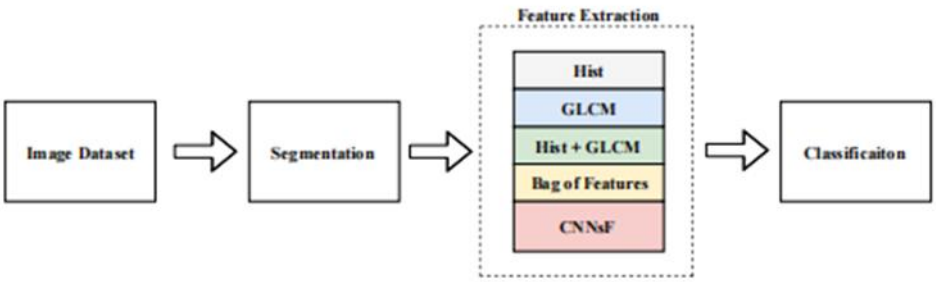

Figure 1: General Experiment Setup for feature extraction

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Figure 2: Ripe and Unripe tomatoes detection result

Setting Up Matplotlib

Matplotlib is one amongst the foremost popular Python packages used for data visualization. it's a cross-platform library for creating 2D plots from data in arrays. it's written in Python and makes use of NumPy, the numerical mathematics extension of Python. One of the best benefits of visualization is that it allows us visual access to large amounts of knowledge in easily digestible visuals. Matplotlib consists of several plots like line, bar, scatter, histogram etc.

IV. RESULTS AND DISCUSSION

Based on its precision , time and recall and it find that out of these algorithm YOLO has achieved highest recall, precision and time and also it achieved the detection time of average 0.054sec per image.

Table 1. Comparison of algorithm under precision, recall and time

	Precision	Recall	Time(ms)
YOLOv3	91.6	90.9	45
YOLOv2	87.2	86.2	30
Faster R-CNN	92.9	91.8	231
YOLO	94.8	93.1	54

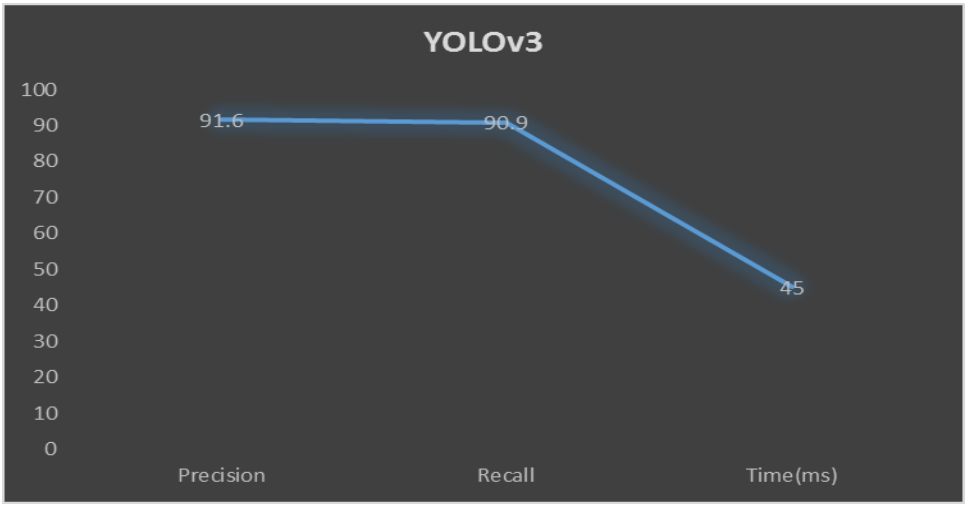

Figure 3: showing precision recall and time of yolov3

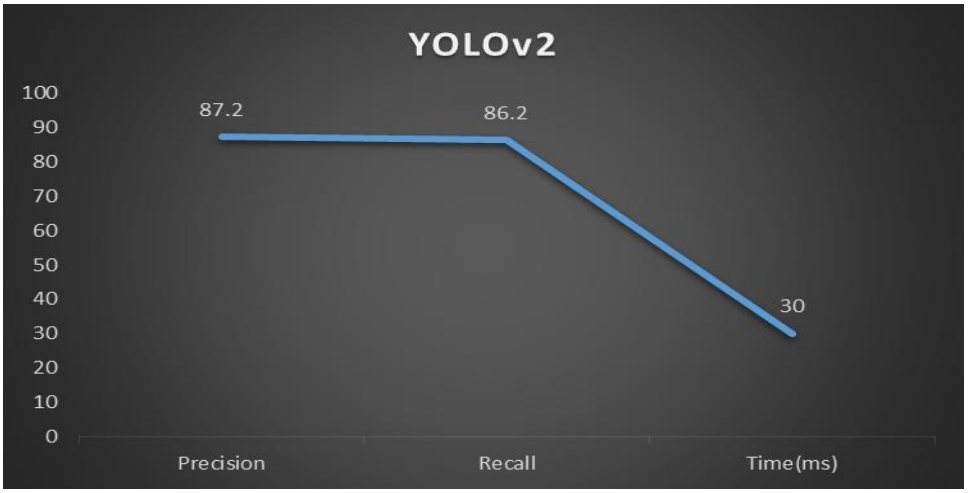

Figure 4: showing precision recall and time of yolov2

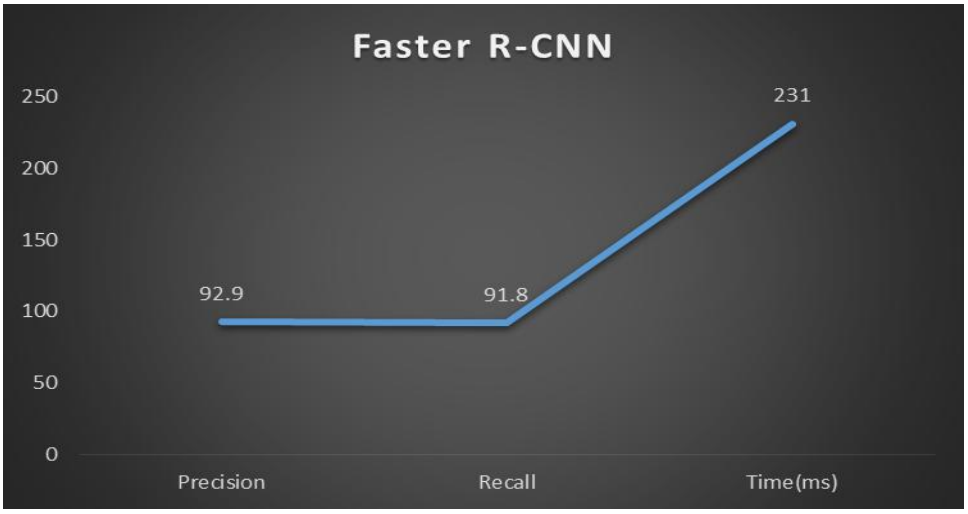

Figure 5: showing precision recall and time of Faster R-CNN

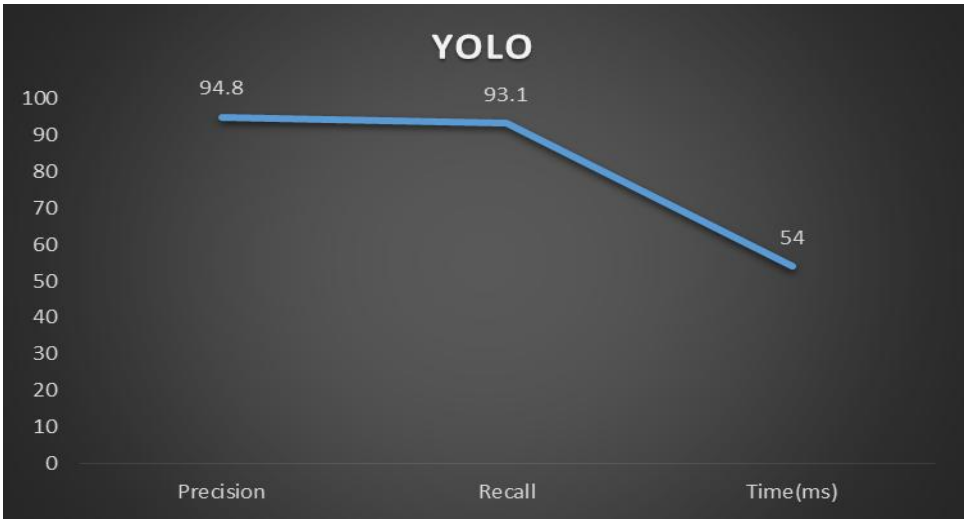

Figure 6: showing precision recall and time of YOLO

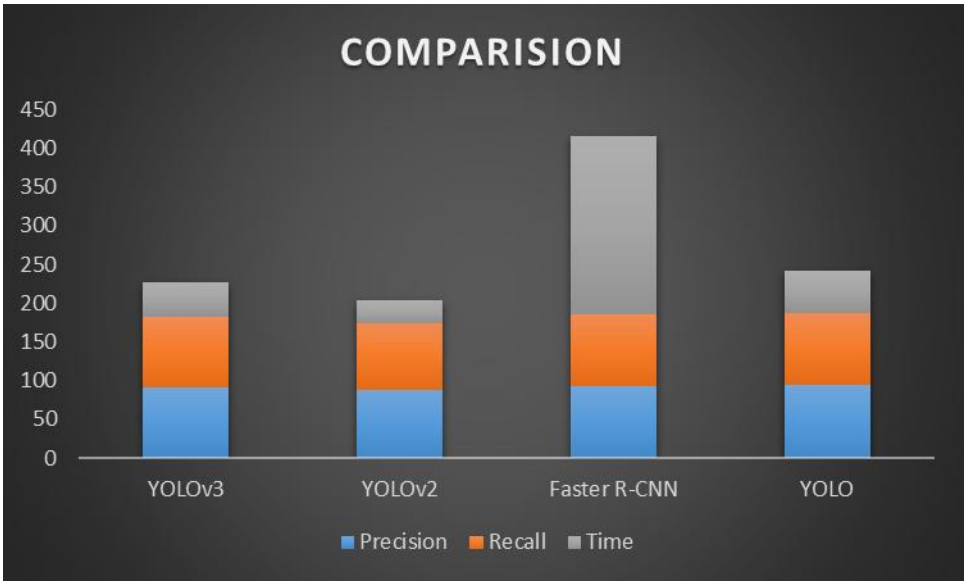

Figure 7: comparison of all the algorithm

V. CONCLUSION

From these we can conclude that the most effective method for detection of fruit freshness algorithm in machine learning is YOLO because by comparing the algorithm based on its time, precision and recall value it is higher ie, 94.8,54and 93.1and also also it achieved the detection time of average 0.054sec per image.

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