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A SURVEY ON HARVEST PREDICTION USING MACHINE LEARNING AND INTERNET OF THINGS

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ABSTRACT
Machine learning is a subset of Artificial Intelligence. In general, Artificial Intelligence is an emerging technology which is a simulation of human intelligence processes by machine especially computer systems. Subsequently, it is used in wide range of applications like Face Recognition, Automation Vehicles, Chat bots and Personalized Online Shopping etc. Further, this research work focuses on upgrading farmer's harvesting process using Artificial Intelligence. Farmers cultivating through organic farming method are facing many challenges and as a result they are unable to produce desired quantity. As a result, organic productscost are higher than other farming methods. By switching to modern agricultural technology, we can increase production more than 20%. So, we are focusing on creating a Automated Robotic Harvesting devise based on Artificial Intelligence to help the farmers by providing a total statistics of the field such as detection, counting and finding the maturity of the fruits/vegetable. This device is going to be built with help of technologies like Artificial Intelligence, Computer Vision and Sensors. As, a vital improvement of the next age of Internet, the AI pulls in numerous considerations by industry world and scholarly circles.
Keywords: Artificial Intelligence, Computer Vision, Robotic Harvesting, Sensors.

I. INTRODUCTION

In Robotic Harvesting a robot is designed to pick fruits automatically under certain environmental conditions. The automatic harvesting of fruits by a robot basically involves two big tasks: 1)Fruit detection and localization of plants/trees in the field. 2) robotic arm to detect the position of the fruit/vegetable. But, research on robot-based harvesting is still in its infancy. With the developing technologies like Artificial Intelligence, Compute Vision, 3d spatial system which collects the information about the target and other such technologies can be implemented for robotic or automated harvesting. In today's world, automated and manual interference in the system becomes non-commercial as well as time consuming task. Fruit/Vegetable detection is important for a harvesting robot and yield estimation. Computer Vision is a field that deals with methods for procuring, processing, analyzing and understanding images. The interest in this field is growing rapidly as it is seen as one of the useful to reduce human workload. Biometric recognition such as face and fingerprint and iris, and also object recognition have been receiving most of the attention in computer vision. Interestingly, though fruit recognition gained fewer attention, it has been gaining attention in recent years due to its applications in agricultural and fruit industries.

II. REVIEW OF LITERATURE

A Computer Vision Based Robotic Harvesting System For Lettuce

Viet-Cuong Pham, et al [1], proposed a Computer Vision based robotic harvesting system for lettuce in hydroponic farms. Where, the hole centres are estimated instead of the lettuces' stems using the Vision system which consists of a Logitec webcam C270 connected to a laptop running computer vision algorithms. The uncovered holes are found using
Hough transforms. And for harvesting task they have used robotmanipulator and a servo-controlled gripper.

Fruit Categorization and Disease Detection Using MI Raspberry Pi based fruit categorization and quality maintenance with disease detection using AI and Machine Learning

Saleem Ulla Shariff, el at [2], used Raspberry Pi to shoot a short movie of 20 seconds was recorded by planting the fruits in the shaft of a low-speed motor by placing a white sheet of paper as background for thus the images were obtained for fruits data- set. Then fruit image was scaled down to 100x100 pixels.

A Detection Method for Apple Fruits Based on Color and Shape Features

Xioyang Liu, el at [3], Where they have segmented an image to approximately 350 super-pixel blocks by SLIC. The averages and variances of color components in RGB,HSV, Lab and YCbCr color space are used to make up the color vectors of super- pixel blocks. And, a SVM classifier with Gaussian Kernel function is applied to classify color vectors. The shape feature described by HOG vectors are extracted are classified by a linear SVM classifier. Finally fruits are detected by rectangle boxes.

Fruit quality detection using machine vision techniques

S. Krishna Kumar, el at [4], used a smart fruit separator

which is controlled by raspberry pi. The fruit separator has a pi camera to the quality of the fruits. The raspberry pi is connected to a web server and the information is communicated from server. Smart fruit separator consists of Microcontroller sensor and a servo motor. First, it captures the image, then it is pre-processed, then the CNN model predicts whether it's a good fruit or rotten fruit and based on the response from the raspberry pi, it will decide whether the fruit is rotten or not.

Fruit Localization and Environment Perception for Strawberry Harvesting Robots

Yuanyue ge, el at[5], A deep convolution neural network for segmentation is utilized to detect the strawberries Mask R-CNN was used for the detection and segmentation of fruits, tables and straps. IT is a deep neural network that can generate both the bounding box and the masks for each instance. There are several networks available for object detection that are fast, accurate and will suited for fruit counting and yield estimation. The instance segmentation method was used because it can generate pixel level segmentation for each object. This work proposed a localization method and environment perception algorithm for strawberry harvesting robots. The localization method was based on the segmented masks of a deep convolutional neural network and depth images from an RGB-D.

Towards an Efficient Tomato Harvesting Robot: 3D Perception, Manipulation, and End-Effector

Jongpyo Jun, el at [6], Used a robot, where tomatoes are detected based on deep learning, after which coordinates of the target crop are extracted and motion control of the manipulator based on 3D coordination. Fruit perception is defined as image processing and sensor-based determination of status and location of a fruit tree. Manipulator motion planning is performed using visual serving to maintain a predetermined position while removing to the image centre coordinates of the detected fruit. Different motion plans are established according to the pose of the fruit and the end-effectors. The end-effectors for harvesting is developed according to the different methods used to harvest the existing crops. The proposed tomato harvesting robot was evaluated and verified using a laboratory test bed.

Movable Surveillance Camera using IoT and Raspberry Pi

Bandi Narasimha Rao, el at [7], used Iot based project idea with robot chassis embedded with USB webcam, DC motor drivers connected using raspberry pi to build a robotic car. The USB we camera is mounted on this robotic car and using which they can get live video and the we can control the movement of the robotic car using the webpage which is created using HTML, CSS rendered with Python flask.

Detection of fruit-bearing branches and localization of litchi clusters for vision-based harvesting robots

Yunchao tang[8] used harvesting robots, RGB-D image etc to detect the fruit-bearing branches of the litchi clusters in fruit groves which are randomly scattered and occur irregularly at one time. In this study, Kinect V2, a low cost RGB-Dcamera was used, which can generate a RGB image with a resolution of 1920×1080 pixels and a depth image of resolution 512×424 pixels at 30 fps. In this research process fertile branch detection and location algorithm is used, and its overall procedure for vision-based fertile branch detection and 3D spatial localization of litichi clusters.
Image segmentation is used to segment the fruits and twigs from the background in the RGB images. A morphological process analysis is used to obtain information about the fertile branches. Revised DBSCAN clustering-based branch extraction and optimal clustering parameter analysis are also used.

Robotic aubergine harvesting using dual-arm manipulation

Delia sepúlveda [9], used a dual arm robot using machine vision and AI, consisting of two robotic arms for harvesting aubergine. To detect mad locate the aubergines automatically, they implemented an algorithm based on a support vector machine (SVM) classifier and designed a planning algorithm for scheduling efficient fruit harvesting that coordinates the two arms throughout the harvesting process. They also proposed a novel algorithm for dealing with the occlusions. The segmentation algorithm is responsible for detecting and localizing the aubergines. The experiment results show that the robotic harvester can pick 91.67% of the total number of aubergines in the proposed common scenarios.

III. CONCLUSION AND FUTURE SCOPE

With AI assisted Robot, Raspberry Pi, Computer Vision technology and sensors, we have made a robotic device which captures the field and gives an output and statistics about the field to the farmer. An already made robot is made to control by a human with some set of algorithms. And, with AI and computer vision assistance, the statistics or the desired output for the farmer is made possible. The proposed work can be developed using Arduino as well as by using already developed TinyML library. The results can be accessed from both the laptop environment and from raspberry pi.

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