

AI BASED GUN PARTS INSPECTION SYSTEM USING COMPUTER VISION

KRISHNA SAI K

*Dept of information technology
Sri Sairam Engineering College
Chennai-44
Sec20it064@sairamtap.edu.in*

DR.M SURESH KUMAR

*Associate professor
Dept Of Information Technology
Sri Sairam Engineering College
Chennai-44
Suresh kumar.it@sairam.edu.in*

VARUN ST

*Dept Of Information Technology
Sri Sairam Engineering College
Chennai-44
Sec20it128@sairamtap.edu.in*

Abstract—Nowadays, artificial intelligence (AI) is proving to be a game-changer with limitless applications in practically every field. It is now making its way into the production sector, enabling it to leverage the power of AI and so provide automation that is quicker, more precise, less expensive, and of higher quality. This article attempts to provide a quick overview of automated visual quality assessment and how using AI to implement it can save a lot of time and effort. These automated quality inspection applications typically apply deep learning, computer vision, and image processing (all of which are parts of AI).

Index Terms— Yolo-V3, computer vision, deep learning, image processing

INTRODUCTION

Many questions come to mind, such as why businesses should invest in developing AI-based autonomous quality inspection systems. They don't have to waste time and money developing AI; they can just keep using the manual inspection procedure. One could argue that employing an outdated manual inspection method has various drawbacks, some of which are listed below. A quality engineer must be present during a manual inspection in order to appraise the product being examined and make a decision based on his training or prior experience. Sometimes all that is required for inspection is the human eye, and other times measuring tools are utilised. Precision measuring is impossible with the human eye, especially at very small scales. Even when comparing two identical items, the eye could fail to detect subtle differences in size. The human eye can still be tricked, despite being more technologically advanced than any mechanical or electronic camera. Although it would be unwise to rely solely on manual inspection, this does not necessarily imply that it is completely useless. Simply described, computer vision is the act of understanding photos and movies that are available in digital formats. Computer vision is used in machine learning (ML) and artificial intelligence (AI) to train the model to detect specific patterns and store the data in their artificial memory to use the same for forecasting the results in real-life use. To build a model that can run on its own without human input, computer vision technology is mostly used in machine learning and artificial intelligence (ML and AI).. The entire process entails ways to gather data, process it, analyse it, and

comprehend digital images in order to use them in a practical setting.

USE CASE OF AI AND COMPUTER VISION

Why can't we just stick to manual quality inspection?

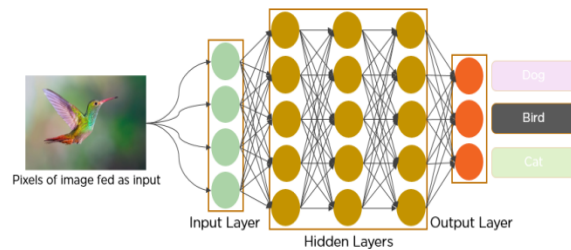
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RELATED WORK OF YOLO-V3

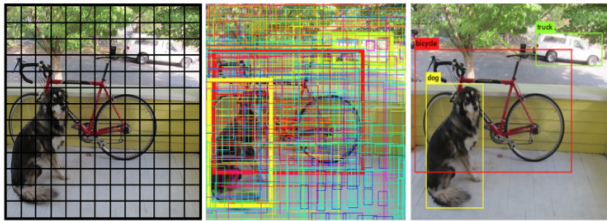
YOLO is an algorithm that uses neural networks to provide real-time object detection. This algorithm is popular because of its speed and accuracy. It has been used in various applications to detect traffic signals, people, parking meters, and animal. The YOLO models, which are end-to-end deep learning models, are well-liked for their rapid and precise identification. The techniques also teach generalizable representations of objects, which is crucial for using a model in the actual world. A YOLO network is built similarly to a standard CNN. It consists of several convolution and max pooling layers, ending with two fully connected layers.

Previous methods, like region-based convolution neural networks (R-CNN), require thousands of network evaluations to make predictions for one image which can be time-consuming and painful to optimize. It trains each component separately while concentrating on a particular region of the image. On the other hand, a YOLO model ("You Only Look Once") only runs the image through the neural network once. The network separates the image into a grid of cells, each of which forecasts five bounding boxes and classes an object by. A procedure known as non-maximal suppression will be used to eliminate the boxes with a low likelihood of containing an object as well as those that share significant space with other boxes.



The deep learning concepts ensures to make the image processing and the source code for in which the transmission of the input layer and the output layer to be clear in between the CNN and RNN neural network concepts for inspection or image detection algorithm

RELATED WORK FOR GUN PARTS INSPECTION SYTEM



Deep Learning is a subset of ML, which on the other hand is a subset of AI. AI is a general term that refers to techniques that enable computers to mimic human behavior. ML represents a set of algorithms trained on data that make all of this possible. Deep Learning, on the other hand, is just a type of ML, inspired by the structure of a human brain.

Deep learning algorithms continually examine data using a predetermined logical structure in an effort to reach conclusions that are comparable to those reached by humans. Deep learning technology is used to accomplish this because it can discriminate between anomalies, parts, and characters while tolerating natural fluctuations in complicated patterns. Neural networks with thousands of layers can approximate human level intelligence in this way. Deep learning combines the adaptability of human visual inspection with the quickness and reliability of a computerised system in this manner.

Deep learning teaches computers to mimic human behaviour so they may learn by doing. The deployment of multi-layered "deep" neural networks that resemble the neuron networks in the human brain is now feasible because to new, affordable hardware. As a result, manufacturing technology now has incredible new powers to identify images, trends and make intelligent predictions and decisions. Starting from a core logic developed during initial training, deep neural networks can continuously refine their performance as they are presented with new images, speech, and text

The main benefit of using an A.I. based gun parts inspection system is to reduce the time spent in checking these parts manually and to increase the accuracy of the product inspection process. Our product provides a feasible approach in this domain which helps in reducing the manpower used in the inspection process.

In this system we use YOLOv3 which is **fast and accurate in terms of mean average precision (map) and intersection over union (IOU) values as well**. Compared to other detection techniques with comparable performance, it operates considerably faster. The computerized object detection technology brings many benefits to the companies and **helps them deliver better experience and service to the users**. Object recognition, as the name suggests, finds and classifies items on the photographs. With the help of these technologies and a well organized dataset related to the gun parts which is our primary focus we can easily improve the accuracy of the system in the inspection process. This methodology involves deep learning and computer vision technology in which it used to calculate the wide range of outcome source of the technical condition in the gun parts. In order to provide the correct detection we are using **YOLO-V3** this indicates the real object detection from the the particular part of the gun this provides high efficiency in detection or inspecting the parts of the gun.

By using computer vision technology we can create a wide range of source in which a step by step procedure to inspect the things in which it is present in the guns as parts or any other defect part present in the gun. In the first stage the gun part will be inspect by an inspecting camera and later it detect the image.

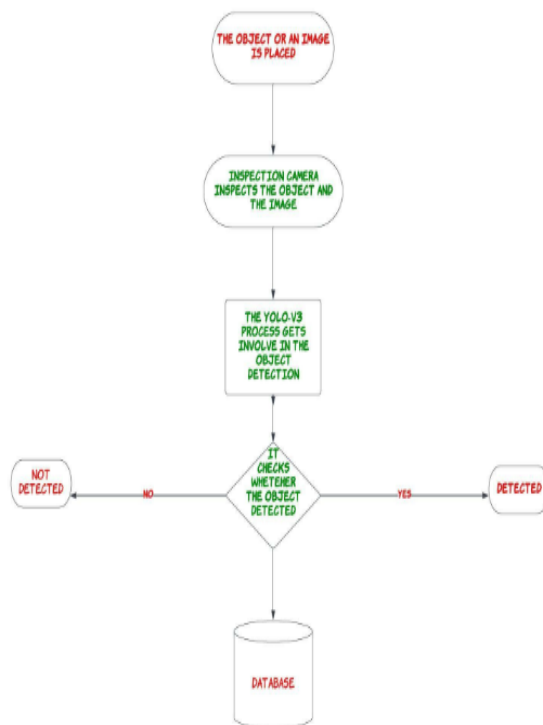
- After the image inspection process gets over it later on move on to the object detection process.
- Later on the data sets are collected in the system by the computer vision technology and detect the parts which are good and defective in the system.
- In The final process it checks the whether the object is good or fault Finally the inspection system inspects the overall parts of the SRGM 76/52 machinery gun for marine navy army purposes in which it clearly

gives us the output result which part is defected and about the information like a data set.

- In the Deep learning concept it later visualize that how the formulated object gets detected and later it collects the data sets from YOLO-V3 and then it gets back to the computer vision technology to identify the right path of the part is defected or good.

ARCHITECTURE DIAGRAM AND DETAILED EXPLANATION

This is the module one architecture diagram which represents the YOLO-V3 structure and how the process is happening in the real time object detection. This methodology clearly explains how the process undergoes each and every step in the form of identifying the real time objects in the case Whenever an object is detected this YOLO-V3 software predicts the data and directly send it to the system in a data set format After the dataset format gets collected it later on discussed about the formulated process involved in the memory access for the computer vision purpose The process of completion gets the overall result from the output from the dataset whether the object is detected or not.



MODULE TWO ARCHITECTURE DIAGRAM AND EXPLANATION

The module 2 represent the architecture flow of the computer vision after the database is collected from the YOLO-V3 software and the data sets are extracted from the system to form the computer vision by openCV.

- This part clearly shows that how the data sets are extracted from the database and hence from the database the datasets are entered into the system for the analyzing of the object detection
- After the object gets detected in the source by which the YOLO-V3 it later on now detects what are the parts that involves in the big machinery guns.
- These parts are very critical to identify whether they are in defected or good by using computer vision we can clearly identify the parts present in the machinery guns.
- It later on gives the clear cut output by which the part is defected or else it is good in condition.
- This provides even though for military purposes weapon detection by using CNN and RNN technical purpose.

This is an example in this rifle the parts that are come as outcomes in which these are the parts present in the rifle and thus by computer vision and YOLO-V3 it detects the object and parts gives the output as which is defected and good.

General composition of a rifle

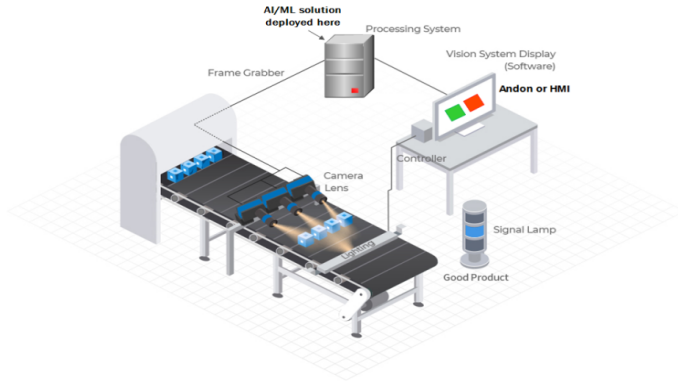


RESULT AND CONCLUSION

The result is said to be the complete overview of the project to the undercover of the military purposes and also to the navy army for the detection of weapon and parts by using the computer vision technology and the deep learning format it mainly involves the source in which the detection algorithm with the YOLO-V3 module involves the overall coverage of the Gun parts detection and the rectification

ACKNOWLEDGMENT

The main advantage of the module to precautionary until the weapon or the opposite offence army to attack with the weapon that detected by the object and later on it detect the parts involve in the weapon of an example SRGM 76/52.



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