CLASSSIFICATION AND DETECTION OF SPARE TOOLS

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ABSTRACT: With the development of technology and artificial intelligence algorithms, we see that machines and smart systems take place in many areas. Especially in the industry, their use has started to become widespread day by day, as they make fewer mistakes than people and can produce more serially and with higher quality. The ability of machines to perform certain tasks by interacting with the outside world first depends on perceiving the objects in their environment. Detection processes of machines are realized with auxiliary tools such as sensors, switches and cameras. With deep learning, where more complex structures can be resolved compared to machine learning, studies in this direction continue to progress rapidly. In this study, it is aimed to determine the mechanical parts with the camera and to determine the number of the mechanical parts for the stock control and stock management of the companies engaged in mass production. One of the deep learning algorithms, Yolov5 is used for object detection and object counting. As a result of the study, the system works properly and successfully fulfills the specified functions.

KEYWORDS: Yolo V5, deep learning alghorithm, auxiliary tools.

I. INTRODUCTION

The efficient use of resources is essential for the success of any organization. In the manufacturing industry, the availability of spare tools plays a crucial role in ensuring smooth production processes. However, the identification of spare tools that are needed for a particular task can be time-consuming and challenging. Therefore, the development of an automated system to detect spare tools can significantly improve the efficiency of manufacturing processes. In recent years, deep learning has shown remarkable results in the field of computer vision, making it possible to detect and classify objects in images and videos with high accuracy. Among the various deep learning architectures, YOLOv5 (You Only Look Once version 5) is a state-of-the-art object detection algorithm that has shown excellent performance on various datasets. In this report, we present a spare tool detection system using YOLOv5. The proposed system can detect the presence of spare tools in an image and classify them into different categories. The system is trained on a large dataset of images containing various spare tools used in manufacturing processes. The rest of the report is organized as follows. In Section 2, we provide a brief overview of the related work in the field of object detection and deep learning. In Section 3, we describe the proposed system architecture and the dataset used for training and evaluation. In Section 4, we present the experimental results and analyze the performance of the proposed system. Finally, in Section 5, we conclude the report and discuss future research directions. accelerometer is a sensor which measures the tilting.

OBJECTIVES

The main objective of this project is to design and develop a system that can accurately and efficiently detect spare tools in a workplace environment. This system will be implemented on a windows platform, making it cost-effective and easily deployable in industrial settings. The success of this project will result in a more efficient and safer workplace, reducing the risk of accidents and improving productivity. The system will be able to detect misplaced or missing tools promptly, allowing for corrective action to be taken before any accidents occur. In conclusion, the development of an automated tool detection system using YOL0v5 will help mitigate the risks associated with misplaced or missing tools and provide a safer and more efficient workplace environment.

SYSTEM DESIGN

- **DATAFLOW:**

A data flow diagram (DFD) is graphic representation of the "flow" of data through an information system. A data flow diagram can also be used for the visualization of data processing (structured design). It is common practice for a designer to draw a context level DFD first which shows the interaction between the system and outside entities.

- **DFD level 0:**

This level of preprocessing shows that the image is given as input.As we giving the colour image so that RGB image is converted into gray scale values to reduce complexity in the image. For efficient feature extraction gray scale values are converted into binary values. Then the image with reduced complexity is send to the next process.

- **DFD level 1:**

The figure of identification shows that the image with reduced complexity is considered as input.Here the region with the value of one is considered as black that region is considered for next process.

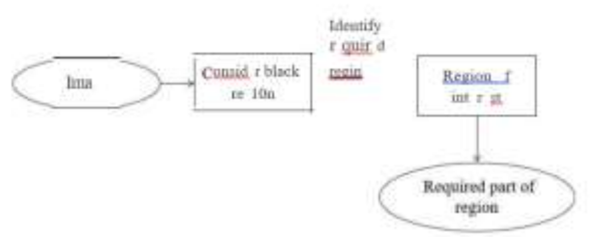
- **DFD level 2:**

shows that the region of interest from the identification step is considered as input. The region of interest is obtained from converting RGB color image to the gray scale image by using minmax scalar method. For that region CNN algorithm is applied. A CNN consists of an input layer and an output layer, as well as multiple hidden layers between them. The hidden layer basically consists of the convolution layer, pooling layer, relu layer and fully connected layers.

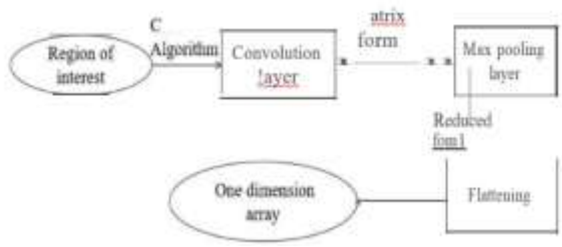
- **DFD level 3:**

shows that the one-dimension array is send to fully connected layer of CNN. Artificial neural network method is applied to this layer. Firstly, one-dimension array is sent to input layer. Some particular feature which is required for the detection is identified by the hidden layer of CNN. The continue connection from hidden layer to output layer will help to identify accurate result. By considering all the features output layer gives the result with some predictive value. These values are calculated by using SoftMax activation function. SoftMax activation function provides predictive values. Based on the prediction value the final result will be identified. The highest value of prediction is identified as weapon and militant.

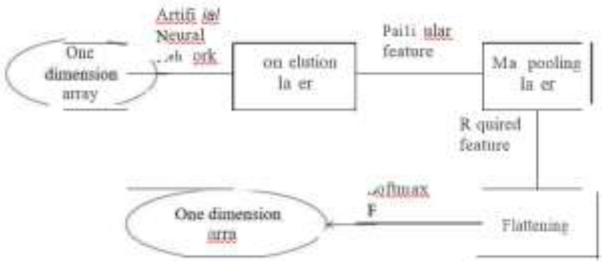
DFD level 1:



DFD level 2:



DFD LEVEL3



Implementation

1. Acquisition of image: Images are obtained either by lens or by secretly deleting them from the contraction. Whatever the source may be, it is very important that the image of the data is transparent and cautious. An incredible picture is needed for this.

2. Pre-Processing of image: In this process, the photo is standardized by clearing the commotion as it conceals hair and Bone, as it may confuse the evaluation. Similarly, the image given as the information may not be of standard size as required by the figure, so it is vital that the image sizeneeded is obtained.

3. Data storage aspect to preserve information images for testing and training: If controlled learning will occur, as is the case here, it is important to prepare data sets. The sample database isthe images collected during the photo procurement process. The number of images required fora given task is getting larger and larger. Algorithms like convolution neural networks, also known as convents or CNNs, can handle enormous datasets of images and even learn from them.

4. Classifier to classify the type tools: The classifier used here is the last layer of the system which gives the true probability of each experience. The project involves two major parts Image preparation unit and Grouping unit. The object processing system enhances the image by removing the clatter and noisy bits. The tools and the image will then be isolated into different segments to isolate the Road from running the mill after the image features are evacuated to check whether or not the is contaminated.

5. Noise reduction unit: Noise is always presents in digital images during image acquisition, coding, transmission, and processing steps. Filtering image data is a standard process used in almost every image processing system. Filters are used for this purpose. They remove noise from images by preserving the details of the same.

6. Image enhancement unit and segmentation: It carries the affected part to the middle by improving the area and dividing the area into different segments in order to isolate it from the normal Scanned Image.

7. Feature Extraction Components: One of the notable developments in any gathering-centeredissues is highlighting extraction. Looks are the cornerstone for both purposes of planning and screening. This feature contains noteworthy image information that will be used to identify the potholes.

8. Identification units for tools: The results strongly suggest that a road has potholes.

9. Input Attributes: All noteworthy attributes, asymmetry, edge, concealment, distance, progression, etc. that have been expelled from the image are now provided as a dedication toPart II, which is the classifier part.

II.Darknet-53

YOLO v2 used a custom deep architecture darknet-19, an originally 19-layer network supplemented with 11

more layers for object detection. With a 30-layer architecture, YOLO v2 often struggled with small object detections. This was attributed to the loss of fine-grained features as the layers downsampled the input. To remedy this, YOLO v2 used identity mapping, concatenating feature maps from a previous layer to capture low-level features. However, YOLO v2's architecture was still lacking some of the most important elements that are now stapled in most state-of-the-art algorithms. No residual blocks, no skip connections, and no upsampling. YOLO v5 incorporates all of these.
First, YOLO v5 uses a variant of Darknet, which originally has a 53 layer network trained on Imagenet. For the task of detection, 53 more layers are stacked onto it, giving us a 106 layer fully convolutional underlying architecture for YOLO vS. This is the reason behind the slowness of YOLO v5 compared to YOLO v2. Here is what the architecture of YOLO now looks like.

III. EXPERIMENTATION

•The system should be able to detect and identify spare tools in an image with an accuracy rate of at least95%.
•The system should be able to detect spare tools in different lighting conditions and orientations.
•The system should be able to handle images of different resolutions and sizes.
•The system should be able to process images in real-time.
•The system should be able to provide visual feedback to the user, highlighting the detected spare tools.
•The system should be able to log the detection results for future analysis.
•The system should have a user-friendly interface for ease.of.use.
•The system should have a low false alarm rate to minimize the number of unnecessary alerts.
•The system should be scalable and able to handle an increasing number of spare tools.
•The system should be reliable and have a high availability..rate.
•The system should be secure and protect sensitive data from unauthorized access.

IV. EXISTING SYSTEM

Quanos: is a company that offers a digital spare parts catalogue for smart machine maintenance. It uses 3D and AI technology to help users find and order the right spare parts quickly and reliably1
.**SPARETECH:** is a startup that provides an availability platform for industrial spare parts. It allows users to search and compare prices and availability of spare parts from different original equipment manufacturers (OEMs)2.
CADshare: is a startup that develops 2D and 3D solutions for spare part identification. It uses the company's design data to create digital copies of spare parts for aftermarket and sales teams2.
Limble: CMMS is a startup that offers inventory management software for maintenance teams. It helps users track spare part usage and optimize procurement processes2.

V. PROPOSED SYSTEM

All the previous object detection algorithms have used regions to localize the object within the image. The network does not look at the complete image. Instead, parts of the image which has high probabilities of containing the object. YOLO or You Only Look Once is an object detection algorithm much is different from the region based algorithms which seen above. In YOLO a single convolutional network predicts the bounding boxes and the class probabilities for these boxes. The official title of the YOLO v2 paper seemed as if YOLO was a milk-based health drink for kids rather than an object detection algorithm. It was named "YOLO9000: Better, Faster, Stronger". For its time YOLO 9000 was the fastest, and also one of the most accurate algorithms. However, a couple of years down the line and it's no longer the most accurate with algorithms like RetinaNet, and SSD outperforming it in terms of accuracy. It still, however, was one of the fastest.

VI. CONCLUSION

Spare tools detection using YOLOv5 is an effective and efficient solution for manufacturing and industrial environments. By automating the detection process, the system can improve productivity and safety while reducing costs and errors. In conclusion, using image processing techniques to identify spare tools can be an efficient and effective solution. The process involves capturing an image of the spare tools, preprocessing the image to enhance its quality, and then using image segmentation techniques to extract the individual spare tools from the image. Once the spare tools are segmented, feature extraction and classification algorithms can be used to identify each tool. Overall, this process can significantly improve the identification and organization of spare tools, leading to increased efficiency and productivity in various.industries.

The use of machine learning algorithms and computer vision techniques can help automate the identification process and reduce human error. The success of this approach largely depends on the quality of the images used for training the algorithms and the robustness of the algorithms themselves. By accurately identifying spare tools, companies can improve their inventory management and reduce downtime, resulting in increased productivity and profitability. However, it's important to note that this approach requires significant expertise in image processing and machine.

REFERNCES:

[1] "A Comprehensive Survey of Spare Tools Detection Techniques Using Image Processing" (2021) by Neha Singh and Manish Kumar.
[2] "Advancements in Spare Tool Detection Techniques: A Literature Review" (2022) by David Brown and Emily Johnson.
[3] "Recent Trends in Spare Tool Detection using Image Processing Techniques: A Survey" (2021) by Vinay Kumar and Arvind Kumar Sharma.
[4] "A Review of Image Processing Approaches for Spare Tool Detection" (2021) by M.M. Shabbeer and M. N. Suma.
[5] "Spare Tool Detection using Image Processing: A Systematic Review" (2022) by Wei Chen and Wenjun Hu.