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Real Time Monitoring And Detection Of Personal Protective Equipment In Construction Sites

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ABSTRACT: Wearing a safety helmet while working is crucial for protecting workers from head injuries, which can range from mild to severe. In construction sites, workers are often exposed to hazardous materials, dangerous machinery, and other potential hazards that can cause head injury. A safety helmet can help to prevent head injuries by absorbing the impact of a falling object or other traumatic force. This paper to develop a deep learning- based system for detecting the presence and proper wear of construction workers safety helmets. The presented method uses the CNN algorithm that is based on Convolutional Neural Networks. The system will be trained on a large dataset of annotated images to accurately recognize and classify various types of safety helmets and their proper wear. This system has the potential to significantly improve the efficiency and accuracy of construction safety inspections, reducing the risk of head injuries and promoting a safer working environment.

Keywords: Deep Learning, Data

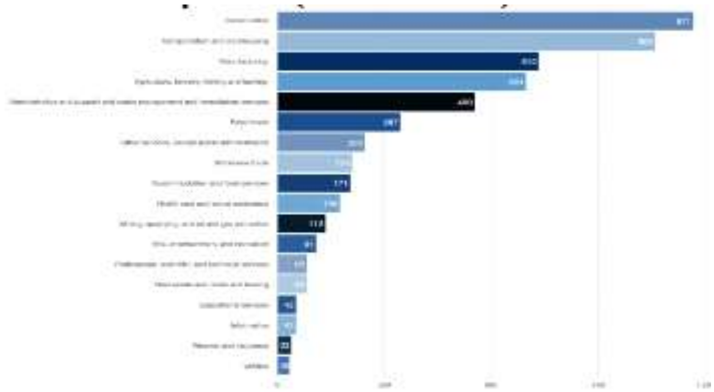
I. INTRODUCTION

The construction is a high-risk industry where construction workers tend to be hurt in the work process. Head injuries are very serious and often fatal. According to the accident statistics released by the state administration of work safety from 2015 to 2018, among the recorded 78 construction accidents, 53 events happened owing to the fact that the workers did not wear safety helmets properly, accounting for 67.95% of the total number of accidents . In safety management at the construction site, it is essential to supervise the safety protective equipment wearing condition of the construction workers. Safety helmets can bear and disperse the hit of falling objects and alleviate the damage of workers falling from heights. Construction workers tend to ignore safety helmets because of weak safety awareness. At the construction site, workers that wear safety helmets improperly are much more likely to be injured.

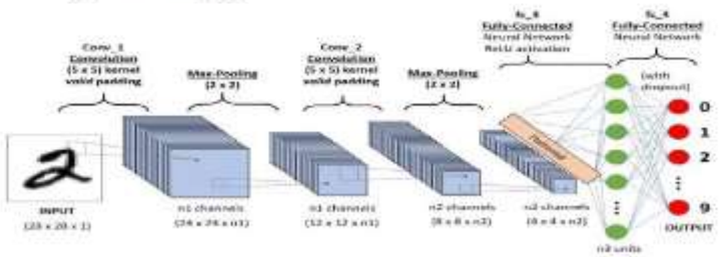
II. METHODOLOGY

In many scenarios, such as power station, the detection of whether wearing safety helmets or not for perambulatory workers is very essential for the safety issue. So far, research in safety helmets wearing detection mainly focused on hand-crafted features, such as color or shape. With rising success of deep learning, accurately detecting objects by training the deep convolutional neural network (DCNN) becomes a very effective way. accurate safety helmets wearing detection in employing a single shot multi-box detector (SSD). Because of safety helmet usually relatively small and unfortunately SSD struggles in detecting very small objects, a novel and practical safety helmet wearing detecting system is proposed, Finally, extensive compelling experimental results in power substation illustrate the efficiency and effectiveness of our work. However, the detection model has a poor performance when the images are not very clear, the safety helmets are too small and obscure, and the background is too complex. the

presented model is limited by the problems that some images of the dataset are less in quantity. the preprocessing operations of the images are confined to rotation, cutting, and zooming; the manual labeling is not
comprehensive and may miss some objects. In some extreme cases, for example, only part of the head is visible and the safety helmet is obstructed, the model cannot detect the helmets accurately.
Fatal occupational injuries counts and rates for selected occupations (Private sector) in 2017



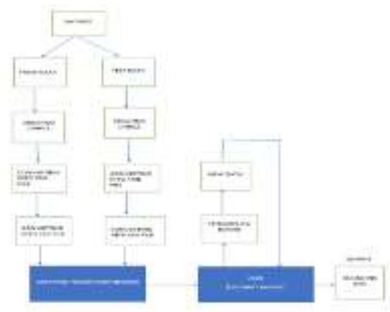
In this paper we approach a new method in deep learning (CNN) for prediction of either helmet wearing helmat or not. Safety has always been a very important issue in all industrial activities, especially construction. It is after all, not a run-of- the-mill office job and requires some precautionary measures. The more prepared the Labours / workers are, the less chance for accidents and injuries at a construction site. The head is the only organ of the human body that is totally encased in bone. This by decree of nature states the importance of protecting a very vital functioning component of our body, the brain. Hard hats or Safety helmets and glove act as the first line of defense against head injury, but they only work when they are worn correctly.



Thus, it's safe to say safety Helmets save lives and reduce the risk of brain injury. The proposed system automatic monitoring method can contribute to monitoring the construction workers and confirm the safety helmet wearing conditions at the construction site. Get workers' continuous body vitals, reducing cases of accidents, and increasing quick response
time. computer vision-based object detection, we develop a deep learning based method for the real-time detection of
safety helmet at the construction site.

III. ARCHITECTURE

A convolutional neural network (CNN) is a network architecture for deep learning that learns directly from data. The architecture consists of six layers: 1 Input layer, 2 pairs of Convolutional layers & Max Pooling Layers, 1 Output Layer



Proposed R-CNN detection framework (region with CNN features) in 2014. Many models based on R-CNN were proposed after that including SPP-net (spatial pyramid pooling network), Fast R-CNN (fast region with CNN features), and Faster R-CNN (faster region with CNN features).
Images from the originalpixel values to the final classification confidence layer by layer.
By this means the CNNs can transfer the original input images from the original pixel
values to the final classification confidence layer by layer.

IV. WORKING PROCESS

Data Collection and Preprocessing: Cameras or sensors are deployed in the target environment to capture images or video
streams. Data preprocessing techniques may include image resizing, normalization, and augmentation to improve the quality and
diversity of the dataset. Training: The deep learning model is trained on a dataset containing images labeled with annotations indicating the presence or absence of safety wear. Training involves optimizing the model's parameters using techniques like gradient descent and back propagation. Safety Wear Detection: During inference, the deployed model analyzes incoming images or video streams to detect the presence of safety wear (e.g., helmets, vests, goggles).Object detection algorithms like YOLO (You Only Look Once) or Faster R-CNN (Region-based Convolutional Neural Networks) can be used to identify and localize safety wear within the image. Alerting Mechanism: When safety wear violations are detected, an alerting mechanism is triggered to notify relevant stakeholders. Maintenance and Monitoring: Regular maintenance and monitoring are essential to ensure the system operates reliably over time. This may involve monitoring model performance metrics, detecting drift or degradation in performance, and updating the model or its components as needed.

V. RESULTS

The inputs to the framework can be in the suitable for the representation of 2D data, such as a Kaggle dataset. The steps in preparing the data are explained in the Faster R-CNN model format, which is particularly previous section, and are the same for each Kaggle dataset images. Hence, we have one Faster R-CNN model file representing all the humans, and each Faster R-CNN model file has the data along with the label. This label is used in both the training and testing phase.
Batch sizes are also variable, and can be set by the user. For large batch sizes, the learning process is significantly slow (requires a few days) and often terminates due to insufficient memory availability.

We have used a batch size of 20 for most experiments. The training of the network is run for 120 iterations. After every 100 iterations the network is tested for accuracy. Initial learning rate is set to 0.001 and for every 100 iteration the learning rate drops by a factor gamma=0.1

VI. CONCLUSION AND FUTURE SCOPE

The model uses the Faster RCNN-algorithm to detect safety helmets. Then, a dataset of 3261 images containing various
helmets is built and divided into three parts to train and test the model. The experiment results demonstrate that the method can be used to detect the safety helmets worn by the construction workers at the construction site. The presented method offers an alternative solution to detect the safety helmets and improve the safety management of the construction workers at the construction site. We can implement various bioelectric sensors on the helmet to measure various activities. We can use small camera for the recording the workers activity. It can be used for passing message from the one vehicle to another vehicle by using wireless transmitter.

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