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SEAT OCCUPANCY DETECTION USING MACHINE LEARNING

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Abstract—**According to research people have usually loved to have a seat for themselves assigned beforehand, it maybe because people might feel overwhelmed about not having a seat during an important conference though it is often neglected it is true that a person does go through a bit of stress when in between a conference or be it a ballet, therefore taking this as a problem statement this thesis is focused on the study of seating occupancy. With Convolution neural network being a beneficent recognizer and processor of the image, this thesis of Seating Occupancy was made possible. Seat occupancy monitoring involves techniques to sense the presence of a human occupant and the algorithm to relay the information and display the seat is occupied or unoccupied. We used COCO dataset along with YOLOv3 which has already been trained with weights for the thesis. COCO dataset is having more 380k images of different objects of world. From this it is easy to find a perfect dataset for persons and chair. The dataset has image with names of object labeled in Coco.names file. Also YOLO makes the idea of detecting object according to need easy in terms of speed and accuracy. As our goal is to detect unoccupied chair or seats in a frame, we need to find the chairs in the image which is not overlapped by any person or other object, For that it is very important to have perfect camera angle with best image quality so noise in image should not disturb the goal.**

Keywords—COCO, YOLO, Seat Occupancy, CNN.

I. INTRODUCTION

The Presented Seat Occupancy detection and display system consists of COCO dataset, YOLO object detection Model, Non-maximum suppression model and CNN capable for good accuracy on test datasets. COCO dataset is imported as a library and then the dataset is fine-tuned and optimized, and ready for use. To detect the chairs that are occupied/unoccupied by using YOLO object detection model that is trained on the COCO dataset with necessary classes. Non-maximum compression techniques are used to remove duplicate detections when the overlap passes a certain threshold value. To have a CNN that can predict seat occupancy on the test dataset with good accuracy. There was a question of accuracy between the computer vision based occupancy detection and hardware, A hardware system can sometimes detect an object, say for example a bad as weight and identify it as a person even though clearly it is just an object, while a trained Algorithm can identify an object as a noise and can detect that the seat is unoccupied unlike systems with hardware.

II. LITERATURE SURVEY

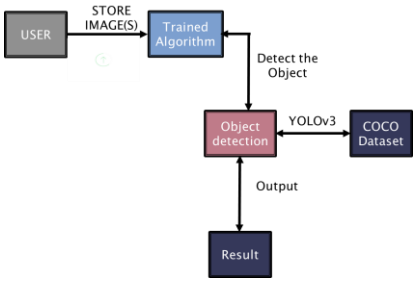
In recent years there were many studies done for object detection which is the main pericardium of out project today. Machine Learning in particular has attracted many such projects to solve day to day problems.

"CNN for Image Detection and recognition"[4] CNN models are built to evaluate its performance on image recognition on detection datasets. CNN models are built to evaluate its performance on image recognition on detection datasets. "Review of Deep Learning Algorithms and Architectures"[2] The method in this paper consists of a Deep learning and provides a superior framework for pixel-level task. "YOLO-LITE: A Real-Time Object Detection Algorithm Optimized for Non-GPU Computers"

III. HOW DOES THE SYSTEM WORK?

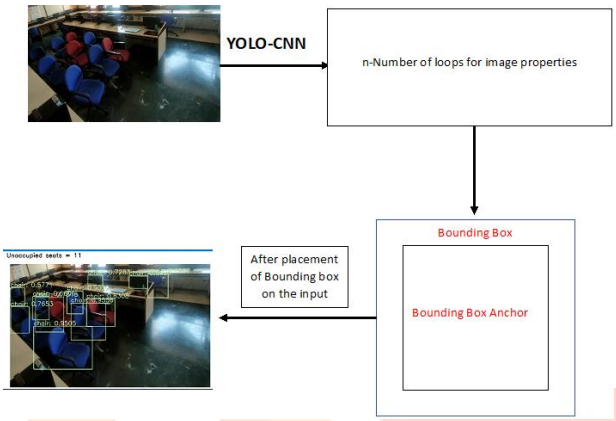
In this system we have implemented a pre trained YOLOv3 model on top of COCO dataset. The CNN will classify the image by segmenting the images based on the image attribute, property, and characteristic features. The CNN later will also perform "Max Pooling" which will sample down the convolved feature. Later the image is structured into tables as output, YOLO later solves the bounding box issue in CNN too. With the use of YOLO and COCO to detect objects in both image and video, where the images is read of the disks that is saved prior to running the system. The pre requisites that was done on configuration of COCO, COCO.names, networks and weights are initialized, the other configurations of box width and height to resize the input image/video and to label the chairs, objects and persons with the help of COCO.names is written in python prior to feeding the input image or live video. The image of the seat occupied/unoccupied in conference hall is fed as input to the system. The input is looped, bounding box is drawn and a labelled output is given as a result by the system.

IV. SYSTEM ARCHITECTURE



The user data is given as input and it will get processed and segmented by CNN. The objects are detected with help of YOLO and COCO, a bounding box is drawn around the objects along with label to get a labelled output image, while when a video/webcam is user data the system runs/iterates throughout the frames of the video/webcam and again the bounding box along with labels is displayed.

V. ACTIVITY DIAGRAM



To enter into the system, user needs to pick an image from the device and with the use of OpenCV library read the image and create borders with the help of OpenCV library and also we resize the image to 1080x720 pixels and feed the byte array to CNN algorithm, the CNN then check for the prediction accuracy of greater 0.50(50%). Later YOLO fetches the object name from COCO.names to label the bounding box and display it as output.

VI. COMPARISON WITH OTHER ALGORTIHMS

When deciding between algorithms, deep learning had ANN and RNN as alternative for the algorithm we choose which is CNN. With ANN in the mind we had a problem of changing the image dimensions which would be a greater problem than the problem we wanted to solve and moreover ANN had problem of interchanging or not properly pixelating the images. When coming to RNN, we were very close to choosing RNN over CNN but CNN had more speed than RNN, so CNN with speed and accuracy and RNN with accuracy we had to go with CNN and also we read about the explosion of gradient in RNN and advantage of CNN capturing the of pixels of images properly had us more leaning towards CNN.

VII. CONCLUSION

The use of hardware sensors were not only inaccurate with detecting object as a human but also costs a lot of bank when it has to be implemented over a large conference hall or any halls, another problem is that every time chairs are increased the hardware also have to be increased, hardware also usually wears out time to time therefore use of machine learning algorithm like CNN not only helps minimize hardware usage but also helps in giving accurate data to the user. With the project being helpful for the person to help search a chair in a conference hall can also benefit one's learning and interest. The system's another advantage is the COCO dataset where the images are being updated everyday with a conclusion more the data better the result.

VIII. FUTURE WORK

As enhancement to this project, the following can be implemented:

- Object detection for overlapping chairs new dataset can be created by aiming chairs with every angle.
- Posture detection to check weather person is seated or not on chair.
- For better image or video quality can add external cameras with best angle possible.
- For better user experience this project can be deployed to cloud with mobile or web application and can be stream live video
- Analyzing required number of chairs on basis no people present.

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