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K.R Road, V.V Puram, Bengaluru-04
DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

**“SAFE DISTANCE AND FACE MASK DETECTION
USING DEEP LEARNING”**

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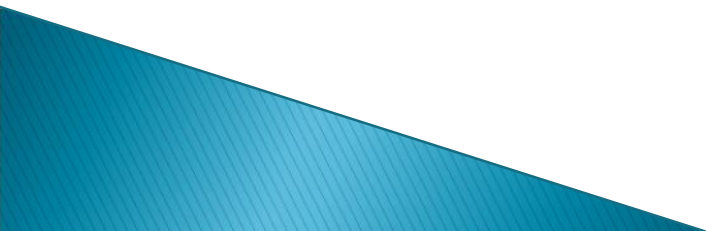
Agenda

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Introduction

- The COVID – 19 virus has affected the lives of many people and to curb the spread of this virus we are implementing a safe distance and face mask detector.
 - The COVID - 19 face mask detector uses deep learning techniques to successfully test whether a person is wearing a face mask or not.
 - Furthermore we implement the Visual Social Distancing (VSD) problem, which automatically detects the interpersonal distance from an image.
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Objectives

- To provide a system to detect if people are maintaining a safe distance of at least 6-feet (2-metres) between themselves and the surrounding.
 - To include a face mask detector to check if a person is wearing a mask, which could also be capable of displaying if he/she is wearing it properly.
 - The aim is to truly detect potentially dangerous situations while avoiding false alarms.
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Literature Survey

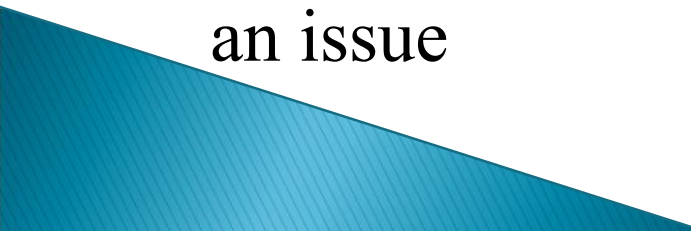
Using Computer Vision to enhance Safety of Workforce in Manufacturing in a Post COVID World

- Authors- Prateek Khandelwal and team.
- Year Published - 2020 (arXiv)
- Proposed idea - Uses deep-learning, projectivity geometry techniques, transfer learning approach and fine tuned MobileNetV2 with TensorFlow framework using computer vision on CCTV.
- The drawbacks are that the distance between persons can be calculated only if all persons are detected clearly and if face is partially covered by another person in front results are inaccurate.

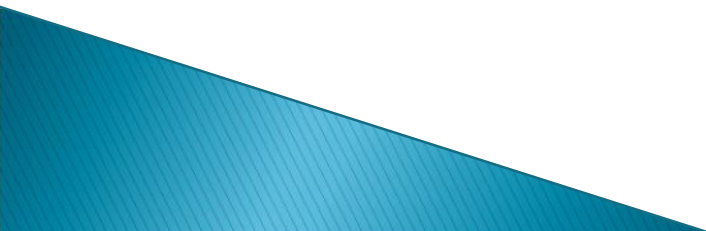
Deep Learning based Safe Social Distancing and Face Mask Detection in Public Areas for COVID19 Safety Guidelines Adherence

- Author - Shashi Yadav.
- Year Published - 2020 (ijraset)
- Proposed idea - Used MobileNetV2, Single Shot Detector (SSD) algorithm and raspberry pi4 with camera to automatically track public spaces in real-time and if wearing mask.
- The main disadvantage is that they are using an average height of 165 cms to detect the depth of person in camera.


Visual Social Distancing Problem

- Authors: Marco Cristani and team.
 - Year Published: 2020 (IEEE)
 - Proposed idea: The paper estimates the ground to be plane where people walk to visualise the scene as a bird's eye view for ease of visualisation and data statistics representation.
 - Drawback: Estimating depth from single image might be a viable option, but a metric reference is still needed and precise SD measures from images is an issue
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Real-time face mask identification using Facemask Net deep learning network

- Authors - Mahura Inamdar and team.
 - Year Published - 2020 (SSRN)
 - Proposed idea - Introduced a face mask detector uses Facemask Net, deep learning techniques to successfully test whether person is wearing a mask or not.
 - Drawback - It doesn't correctly classify partially hidden faces.
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Validating the correct wearing of protection mask by taking a selfie

- Authors - K. Hammoudi and team.
 - Year Published - 2020 (arXiv)
 - Proposed idea - Designed a mobile application allowing people able to take a picture with a smartphone to verify that their mask is correctly positioned on their faces or not.
 - Drawback - It always preferred rigid masks because they reduce possibilities of wrong positioning on the face.
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A Vision-based Social Distancing and Critical Density Detection System for COVID-19

- Authors - Dongfang Yang and team.
 - Year Published - 2020 (arXiv)
 - Proposed idea - By using a monocular camera and deep learning based real time object detectors, implemented an automated system that can help monitoring & analysing social distancing in a real time without data recording.
 - Drawback - It is difficult to detect social distance if the place is over crowded.
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A deep learning-based social distance monitoring framework for COVID-19

- Authors - Imran Ahmed and team.
 - Year Published - 2020 (Elsevier)
 - Proposed idea - Developed a deep learning platform for social distance tracking using a overhead perspective, YOLOV3 object recognition paradigm, Transfer learning & tracking algorithm.
 - Drawback - Having overhead cameras are practically rare, so it can not be implemented in most of the cases.
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Facial mask detection using Semantic Segmentation

- Authors - G. Jignesh Chowdary and team.
- Year Published - 2019 (ResearchGate)
- Proposed idea - Aims to design a binary face classifier which can detect any face present in frame irrespective of its alignment using Semantic Segmentation with the help full of Convolution model, with the accuracy of 93.884%.
- Drawback - Detects faces from images but does not identify as masked face or unmasked face.

Application of a Novel and improved VGG-19 Network in the detection of workers wearing masks

- Authors - Jian Xiao and team.
- Year Published - 2020 (Journal of physics)
- Proposed idea - This paper uses improved VGG-19 Net (by replacing 1 of 3 FC layer into Flatten layer and original Softmax classifier with 2 labeled Softmax classification layers) to detect whether workers are wearing mask or not, with a precision of 97.62%.
- Drawback - Does not detect improper wearing of mask.

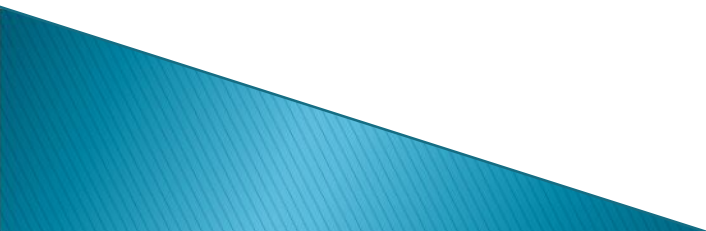
Identifying Facemask wearing conditions using image Super-Resolution with classification network to prevent Covid-19

- Authors - Bosheng Qin and team.
- Year Published - 2020 (Research Square)
- Proposed idea - Developed a new facial image classification method, by combining SR network with classification network and using deep learning method in automatic identification of facemask wearing conditions as properly worn, improperly worn or without facemask.
- Drawback - Designed only for images as dataset, and not the videos.


Detecting Masked Faces in the Wild with LLE-CNNs

- Authors - Shiming Ge and team.
- Year Published - 2017 (IEEE)
- Proposed idea - Proposes LLE-CNNs for masked face detecting which can detect masked faces in different orientations accurately & also presents a dataset of masked faces that can be used as an additional training source for developing new face detectors.
- Drawback- Considers any type of occlusion in the face as a masked face.


Face Mask Detection using Transfer Learning of InceptionV3

- Authors - G. Jignesh Chowdary and team.
 - Year Published - 2020 (arXiv)
 - Proposed idea - Developed a face mask detection model by over-sampling the available limited number of dataset samples using image augmentation and transfer learning.
 - Drawback - The dataset used is not realistic.
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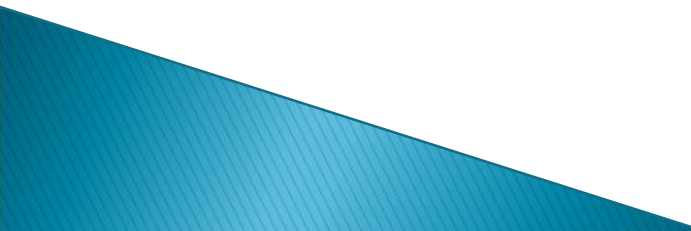
RetinaFaceMask: A Face Mask Detector

- Authors - Mingjie Jiang and team.
 - Year Published - 2020 (arXiv)
 - Proposed idea - Developed a novel face mask detector called RetinaFaceMask (consists of ResNet and MobileNet as backbone, feature pyramid network as neck and context attention modules as head)
 - Drawback - Does not detect properly if face is covered with miscellaneous objects.
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Monitoring COVID-19 social distancing with person detection and tracking via fine-tuned YOLOv3 and Deepsort techniques

- Authors - Narinder Singh Punj and team.
 - Year Published - 2020 (arXiv)
 - Proposed idea - A efficient real-time deep learning based framework to automate the process of monitoring the social distancing via object detection and tracking approaches.
 - Drawback - The proposed model sometime fails to identify people and draw the bounding box.
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A Deep Learning Based Assistive System to Classify COVID-19 Face Mask for Human Safety with YOLOv3

- Authors - M. R. Bhuiyan and team.
 - Year Published - 2020 (IEEE)
 - Proposed idea - An approach for detecting a person is wearing a mask or no mask using state of art YOLOv3 architecture.
 - Drawback - Doesn't detect face if partially visible.
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Existing System

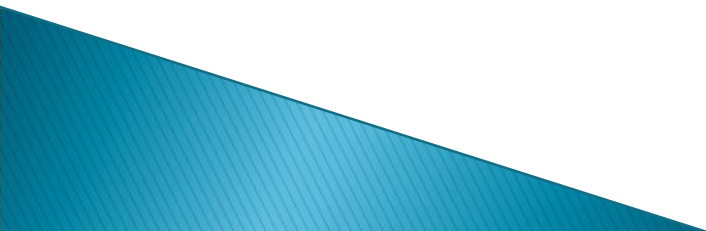
- Most of the models were able to predict any one i.e. either safe distance or face mask detection, in our model we try to implement both.
- A few limitations were observed in some models like, it could not correctly classify partially hidden faces, the model is not able to detect faces if the camera height is greater than 10 feet or camera is far, if a face is covered by another person in front, etc.

Problem Statement

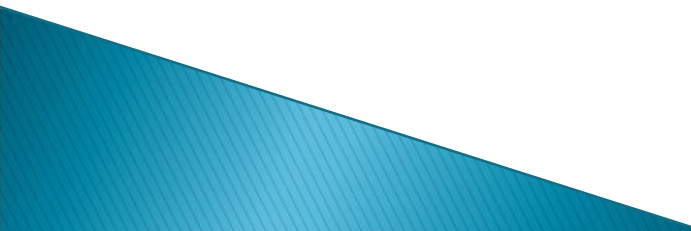
“To implement a system that provides quick and efficient results on whether people are maintaining social distance and to check if people are wearing face masks properly or not.”

Input: Image or video with people wearing mask and no mask.

Output: A bounding box indicating red if violating social distancing norms and no mask, green otherwise.

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Proposed System

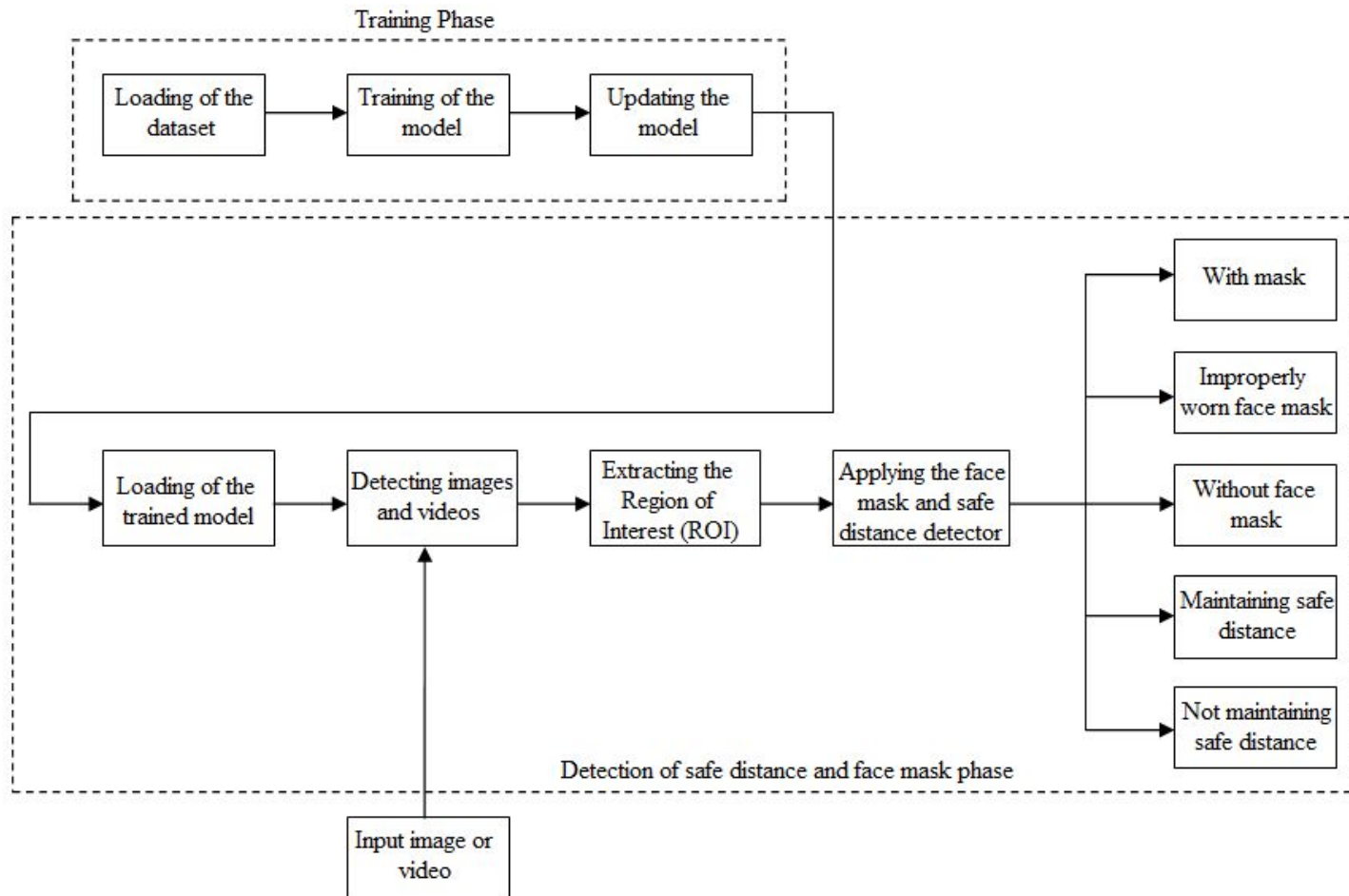
- A single efficient system to detect social distancing and face mask.
 - We use OpenCV projectivity techniques to detect social distancing and deep learning techniques like SSD, FaceMaskNet, etc along with transfer learning to detect face mask.
 - Use of bounding box algorithm to classify the frames and give a confidence score over the box for the predicted output.
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Project Planning / Scheduling

Gantt Chart



Architecture



Sample Data Set



Fig: 1a

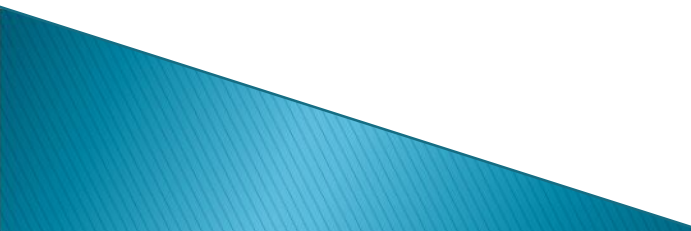


Fig: 1b



Fig: 2

Applications

- The structure of our model is least complex and gives quick results and hence can be used in CCTV.
 - We can make sure that an individual wears it the right way and helps to curb the scope of the Coronavirus.
 - Mass screening is possible and hence can be used in crowded places like railway stations, bus stops, Market areas, schools, colleges, corporate organisations, etc.
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