BANGALORE INSTITUTE OF TECHNOLOGY

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DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Project Work Synopsis

VII – Sem 2020-2021

PROJECT GROUP:

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PROJECT DETAILS:

Title:	**Safe Distance and Face Mask Detection using Deep Learning**
Domain:	**Machine Learning**
Location:	**Bangalore Institute of Technology**

For office use only:

Group ID:	
Guide:	**Prof. Maya B S**
Status:	**Accepted/To be modified/Rejected**

Signature of the Project Co-Ordinator

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Safe Distance and Face Mask Detection using Deep Learning

1. Introduction

Coronavirus disease 2019 (COVID-19) has affected the lives of people and their families seriously. This pandemic is shattering mankind irrespective of caste, creed, gender, and religion. Until a vaccine is discovered, we should do our part to constrain the spread of the coronavirus. One major protection method that we could follow is to wear masks in public areas.

The COVID - 19 face mask detector uses deep learning techniques to successfully test whether a person is wearing a face mask or not. The system presents three classes of classification which are if a person is wearing a mask properly, or wearing improperly or not wearing a mask. The case in which the mask is properly worn is when the nose and mouth are completely covered. We can work with still images and also with a live video stream. First, we are trying to implement our model with still image datasets, and after this being successful we can use this with live video streams. Previously, binary classification has been performed to detect face masks. We use three-class classification and which is not common. A Retina face mask has been proposed by Jiang [1] which is a high-accuracy and efficient face mask detector. The models used are ResNet and MobileNet. Wang [10] has made face mask related projects by providing three samples of masked face datasets, which comprise of Masked Face Detection Dataset (MFDD), Real-world Masked Face Recognition Dataset (RMFRD) and Simulated Masked Face Recognition Dataset (SMFRD). G. Jignesh Chowdary and his team in their research [13] have demonstrated a method using transfer learning to detect face masks.

Furthermore, one of the effective measures to contain the recent corona outbreak is to maintain the so-called Social Distancing (SD). To comply with this constraint, governments are adopting many restrictions over the minimum interpersonal distance of at least 2 metres between people. To this end, we introduce the Visual Social Distancing (VSD) problem, which automatically detects the interpersonal distance from an image. VSD is a non-invasive analysis to find whether people comply with the SD restriction, and to provide statistics about the level of safety of specific areas whenever this constraint is violated. We conclude with future challenges related to the effectiveness of VSD systems, its ethical implications and future application scenarios.

2. Existing system and drawbacks

- The earlier models were able to predict any one i.e. either safe distance or face mask detection, in our model we try to implement both.
- Khandelwal [11] had stated in his work about a deep learning model that binarizes an image as a mask is used or not. 380 images had a mask and 460 images had no mask and these images were used in the training of the MobileNetV2 model. A few limitations were observed in the model. Those remarks were: it could not correctly classify partially hidden faces and the model is not able to detect faces if the camera height is greater than 10 feet.

3. 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.

4. 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 will 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 (e.g., a family with children or relatives, an elder with their caregivers).

5. Software Requirement Specification

- **Hardware Requirement**

  State of the art system.

- **Software Requirement**

  Functional Requirements:

  ➢ The input is classified as with a mask, improperly worn mask, and without a mask.
  ➢ When input feed has more than one person, the model should also detect if there is a sufficient distance of 2 metres or not between them.

  Non-Functional Requirements:

  ➢ The accuracy of the model should be more than 90%.

6. Block Diagram / Architecture

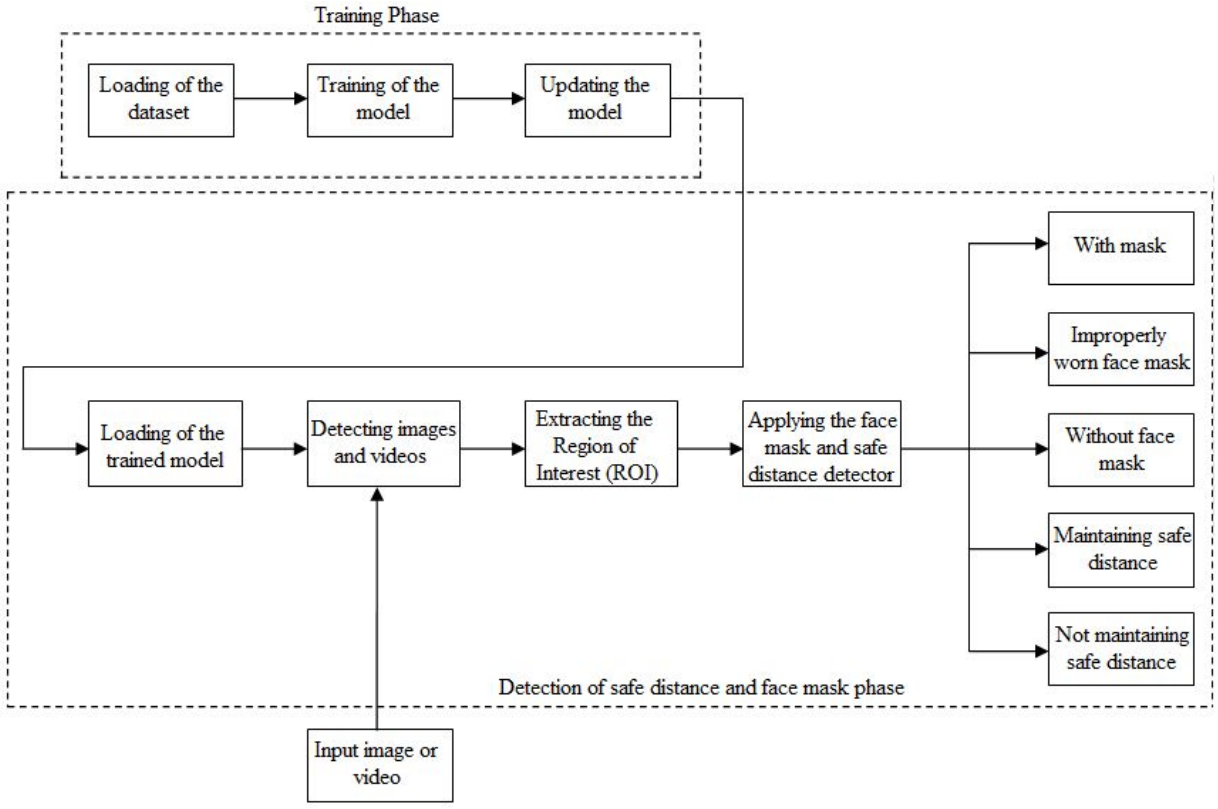

Fig. 1 Architecture of Safe Distance and Face Mask Detection using Deep Learning

7. Module description

- **Loading of the dataset:** This module is a part of the training phase where we load our dataset to the model to test its accuracy.
- **Training of the model:** This module is a part of the training phase where we train the model against the given dataset.
- **Updating the model:** This module is a part of the training phase where we modify the model if the training accuracy is less than expected.
- **Loading of the model:** In this module we load the trained model into the system for testing against the untrained data.
- **Input image and video:** This is the module where the feed is given to the model for testing.
- **Detecting images and videos:** The data is processed to detect faces.
- **Extracting the region of interest:** The region of interest(ROI) is extracted and we mark both mask and face separately.

- **Applying the face mask and safe distance detector:** The proposed algorithm is used to detect and classify if the person is wearing a mask properly, wearing improperly or not wearing a mask. For the feed with multiple faces, we also detect if they are maintaining a sufficient safe distance of 2 metres or not between them.

8. Applications

- Our face mask and safe distance identifier is least complex in structure and gives quick results and hence can be used in CCTV footages to detect whether a person is wearing a mask perfectly and are people maintaining social distancing so that they do not pose any danger to others and to themselves.
- By monitoring the placement of the face mask on the face, 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, markets, streets, shopping malls, schools, colleges, corporate organisations, etc.

9. References

[1] P. Khandelwal, A. Khandelwal, S. Agarwal, “Using computer vision to enhance safety of workforce in manufacturing in a post covid world”, arXiv preprint arXiv:2005.05287 (2020).

[2] Shashi Yadav, “Deep Learning based Safe Social Distancing and Face Mask Detection in Public Areas for COVID-19 Safety Guidelines Adherence”, International Journal for Research in Applied Science & Engineering Technology, Volume 8, Issue 7, DOI: 10.22214/ijraset.2020.30560, July 2020, Available: https://www.ijraset.com/fileserve.php?FID=30560.

[3] Marco Cristani, Alessio Del Bue, Vittorio Murino, Francesco Setti and Alessandro Vinciarelli, “The Visual Social Distancing Problem”, digital object identifier 10.1109/access.2020.3008370, 2020, Available: IEEE Xplore, https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9138385.

[4] Mahura Inamdar and Ninad Mehendale, “Real-Time Face Mask Identification Using Facemasknet Deep Learning Network”, 6 August 2020, DOI: 10.2139/ssrn.3663305, Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3663305.

[5] Karim Hammoudi, Adnane Cabani, Halim Benhabiles and Mahmoud Melkemi, “Validating the correct wearing of protection mask by taking a selfie: design of a mobile application "CheckYourMask" to limit the spread of COVID-19”, HAL id: hal-02614790, version 1, 21 May 2020.

[6] Dongfang Yang, Ekim Yurtsever, Vishnu Renganathan, Keith A. Redmill and Umit Ozguner, "A Vision-based Social Distancing and Critical Density Detection System for COVID-19", The Ohio State University, Columbus, OH 43210, USA, 8 July 2020, Available: https://arxiv.org/pdf/2007.03578.pdf.

[7] Imran Ahmed, Misbah Ahmad, Joel J.P.C.Rodrigues, Gwanggil Jeon, Sadia Din, "A deep learning-based social distance monitoring framework for COVID-19", 19 October 2020, Available: https://doi.org/10.1016/j.scs.2020.102571.

[8] Toshanlal Meenpal, Ashutosh Balakrishnan, Amit Verma, "Facial Mask Detection using Semantic Segmentation", 2019 4th International Conference on Computing, Communications and Security (ICCCS), DOI: 10.1109/CCCS.2019.8888092, 2019.

[9] Jian Xiao, Jia Wang, Shaozhong Cao and Bilong Li, "Application of a Novel and Improved VGG-19 Network in the Detection of Workers Wearing Masks", Journal of Physics: Conference Series, Volume 1518, 2020 4th International Conference on Machine Vision and Information Technology (CMVIT 2020) 20-22 February 2020, Sanya, China, 2020.

[10] Bosheng Qin and Dongxiao Li, "Identifying Facemask-wearing Condition Using Image Super-Resolution with Classification Network to Prevent COVID-19", 2020.

[11] S. Ge, J. Li, Q. Ye and Z. Luo, "Detecting Masked Faces in the Wild with LLE-CNNs", 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), Honolulu, HI, 2017, pp. 426-434, doi: 10.1109/CVPR.2017.53.

[12] G. Jignesh Chowdary, Narinder Singh Punn, Sanjay Kumar Sonbhadra and Sonali Agarwal, "Face Mask Detection using Transfer Learning of InceptionV3", 20 October 2020, Available: https://arxiv.org/pdf/2009.08369.pdf.

[13] Mingjie Jiang, Xinqi Fan and Hong Yan, "RetinaFaceMask: A Face Mask Detector", 8 June 2020, Available: https://arxiv.org/pdf/2005.03950.pdf.

[14] Narinder Singh Punn, Sanjay Kumar Sonbhadra and Sonali Agarwal, "Monitoring COVID-19 social distancing with person detection and tracking via fine-tuned YOLOv3 and Deepsort techniques", 6 May 2020, Available: https://arxiv.org/pdf/2005.01385.pdf.

[15] M. R. Bhuiyan, S. A. Khushbu and M. S. Islam, "A Deep Learning Based Assistive System to Classify COVID-19 Face Mask for Human Safety with YOLOv3", 2020 11th International Conference on Computing, Communication and Networking Technologies (ICCCNT), doi: 10.1109/ICCCNT49239.2020.9225384, Available: IEEE Xplore, https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=9225384.