REPUBLIC OF TURKEY

ADANA ALPARSLAN TÜRKEŞ SCIENCE AND TECHNOLOGY UNIVERSITY

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SOCIAL DISTANCE AND MASK DETECTION

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ABSTRACT

Social distance and mask detection

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Abstract: The new Coronavirus Disease (COVID-19) is a virus first identified on January 13, 2020, as a result of research conducted in a group of patients in China's Vuhan Province who developed respiratory symptoms (fever, cough, shortness of breath) in late December.The outbreak was initially detected in those found in the seafood and animal market in this region.It was then transmitted from person to person and spread to other cities in Hubei province, especially Vuhan, and to other provinces of the People's Republic of China and other world countries.Coronaviruses are a large family of viruses that can cause disease in animals or humans.In humans, several coronaviruses are known to cause respiratory infections, from colds to more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS).The new Coronavirus Disease is caused by SAR-CoV-2 virus. Within the scope of these COVID-19 measures, it is necessary to benefit from today's technologies. For this reason, we will design mask detection and social distancing detection application with artificial intelligence neural networks algorithm. This program will determine whether people follow the rules of mask and social distancing. YOLOv3 recognition technology is used to identify people in video viewing. At the same time, the transfer learning method is applied to improve the accuracy of the model. In this way, the detection algorithm uses a previously trained algorithm. The detection algorithm uses a limiting box to detect people's masks and account for social distancing. The algorithm determines the values in the bounding box using Euclid distance. A physical distance approach was used to predict the rules of social distancing between people, and a range was set. Checked to see if the range value violated the minimum social distancing range. In addition, a tracking algorithm was used to detect people in video processing, in which people who violated the social distancing range were monitored.

Keywords: Deep Learning, Computer Vision, Convolutional Neural Networks (CNNs), Single Shot Detector, Transfer Learning, public Safety, OpenCV, COVID-19.

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1.INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).The first case was encountered in Vuhan, Hubei Province, China, in December 2019.It has continued to spread since then, causing a pandemic that is still going on.As of March 3, 2020, the worldwide mortality rate was 3.4%, with 106,818,698 confirmed cases worldwide as of February 8, 2021, 78,710,969 recovered, while 2,330,213 patients died due to the virus. Many health institutions and scientists are doing vaccine studies and drug studies to destroy this deadly virus. These days, vaccination efforts against COVID-19 have come to fruites. People around the world are getting vaccinated. But we have a long process ahead of us to vaccinate all people. In this process, we must again pay attention to mask rules and social distancing. Because the virus is a disease that is airlifted from person to person through droplets to nearby people. That is why we need to pay a lot of attention to social distancing and the use of masks. We aim to find out if social distancing and mask wearing rules are observed in the environments that people enter in social life with the program we develop.

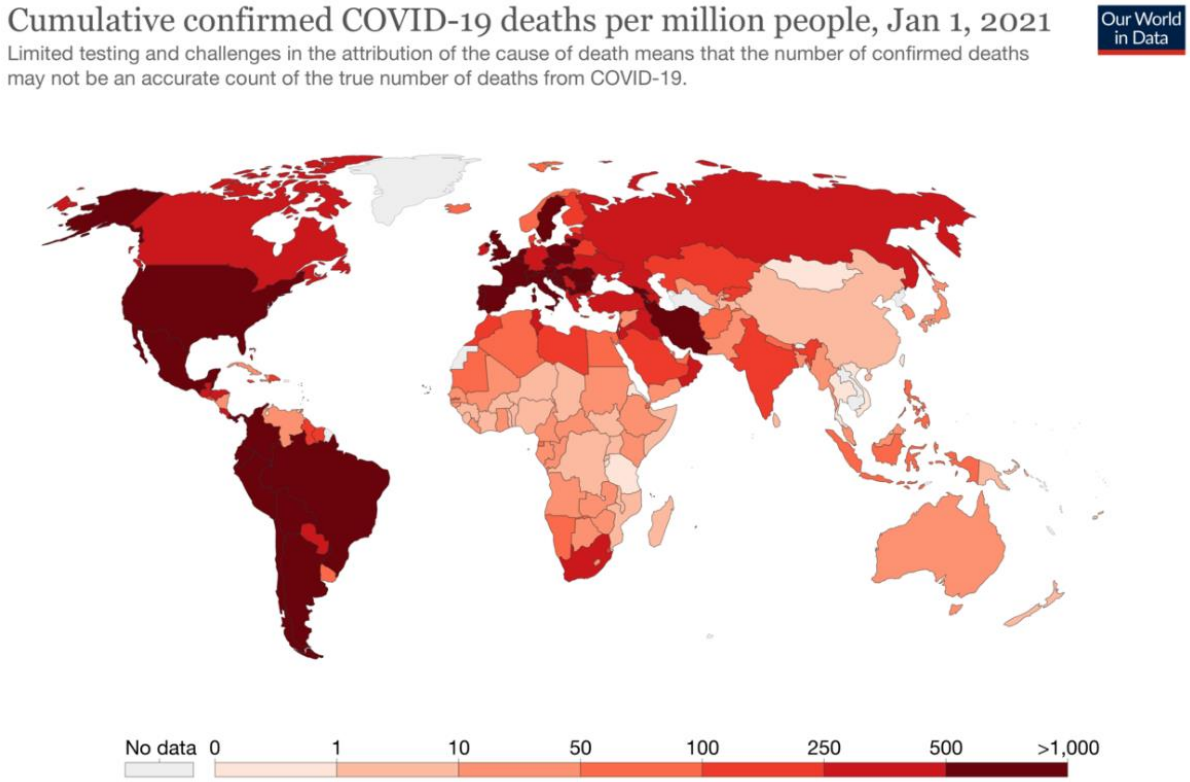


Fig 1

Complying with social distancing rules is especially important for people at higher risk of becoming covid-19. These are people over 65 years of age with chronic conditions and low immune systems.The fewer people who aren't with them, the less that spread. Proof of this is shown in figure 2. If people follow the rules of social distancing and wearing masks at the first stage, they play an important role in overcoming the spread of the virus and preventing the epidemic from reaching its peak.

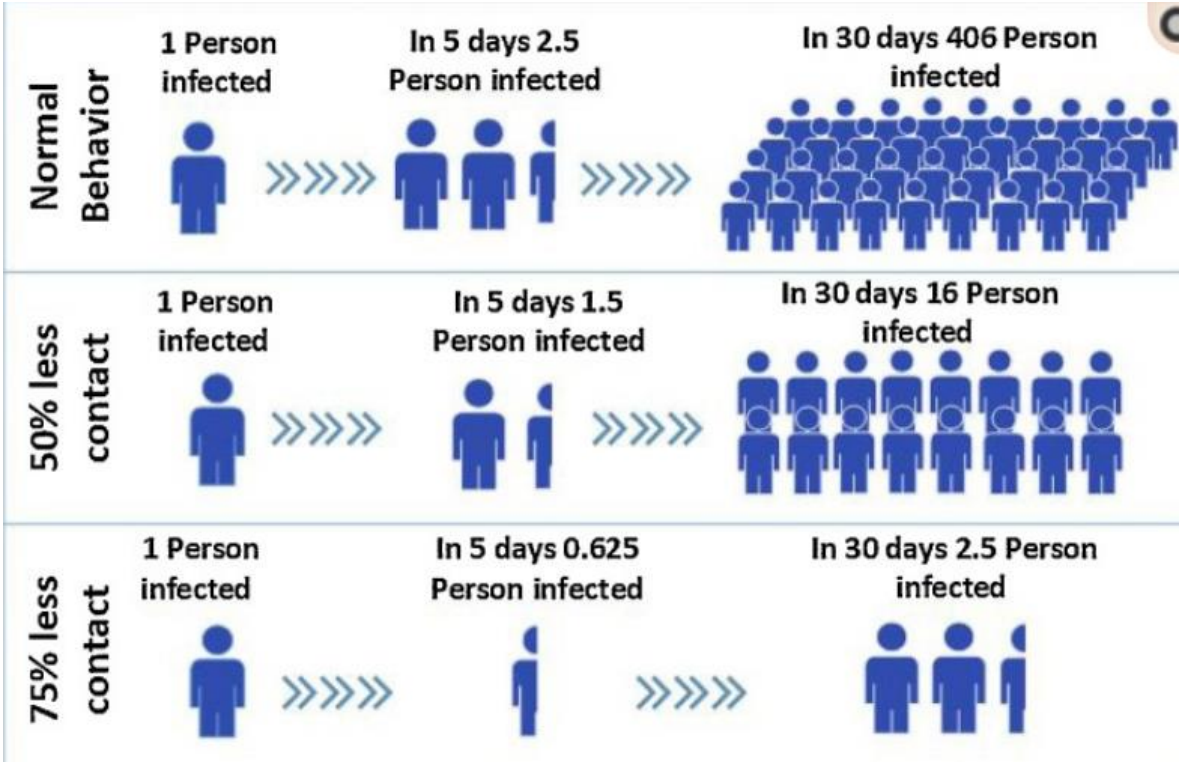


Fig 2

In recent years, machine learning, deep learning and artificial intelligence have achieved promising results in solving universal problems. As shown in Figure 3, moving people use this method to measure the social distancing between people in bounding boxes. The person in the red frame disobeys the rules and violates social distancing or wearing a mask, while the people in the green frame follow the rules of social distancing and wearing masks.In order to accurately measure the social distance between the people in the 4th, an accurate camera calibration is required. If we put the camera at an angle from above, then it would be a better way to calculate the distances from the point of view in the air.

Fig-3

The camera's top overview offers a better view and plays an important role in calculating the distance between people by eliminating people's problems of not being selected in the crowd. This work provides a framework that follows the rules of remote social distancing and mask wearing with deep learning from an overview in crowded places such as campus environment. Yolov3 is used to identify people with a pre-trained data set. Yolov3 transfer is used to increase efficiency in detection for learning. Transfer learning is there to use an overview perspective to monitor social distancing. The detection model defines people and shows them in the bounding box.The detection model detects people and provides bounding box information. After human detection, the perceived person is calculated using euclid distance, detected limiting box and centroid calculations. The minimum social distancing identification threshold we set is used using pixel technology. The calculated distance is colored in the bounding box according to the threshold value we set. If the person follows the rules of social distancing and wearing a mask, the bounding box appears as green color. If the person is below the threshold we set and does not follow the rules, the bounding box appears in red.

This study aims to:

First, the aim of the project is to provide an AI-based remote monitoring framework using an overall viewing angle.

The pretrained YOLOv3 data set is used to identify people and calculate bounding box information. In addition, the transfer learning method is used to increase the efficiency of the model.

Euclid distance is used to calculate the social distance between individuals. Euclide distance is used to determine the distance between the detected bounding box and another person.

A tracking algorithm is used to identify the person who violates the social distancing threshold.

2.Literature review

Researchers provide important and effective solutions for social distancing using remote monitoring videos, along with machine learning, artificial intelligence, artificial neural networks, and deep learning-based approaches.YoLov3, a pre-trained data set to detect people's compliance with the rules, defines people and provides a framework using a deep perspective using bounding boxes. In addition, CNN results were compared with SSD results. In order to determine the distance between people at social distance, the model was developed and yolov3 data set was trained. The data set consists of a front and side view of people. Camera YOLOv3 algaritation monitored people for social distancing and wearing masks. Human identification, social distancing account and mask wearing were determined for situations where people were in crowded areas. The model was made to identify people who violated social distancing rules. As a social distancing rule, 1.5 meters was chosen, which is the international distance rule. A significant amount of tests were conducted to monitor social distancing in public and crowded environments. Most of the study was based on people's front

and side camera views. Therefore, the overview social distancing framework was used to calculate social distancing, which offers a better field of view and thus eliminates the problem of people getting involved.

3.Social Distance and Mask Detection Calculator

In this study, as we mentioned earlier, people benefited from the front and side perspective and a remote monitoring framework was developed for social distancing and mask detection based on artificial intelligence and deep learning using an overview. The working mechanism and flow diagram of the frame are like figure 4.At first, our general general dataset is divided into train and test. A deep learning-based detection algorithm is used to detect individuals.

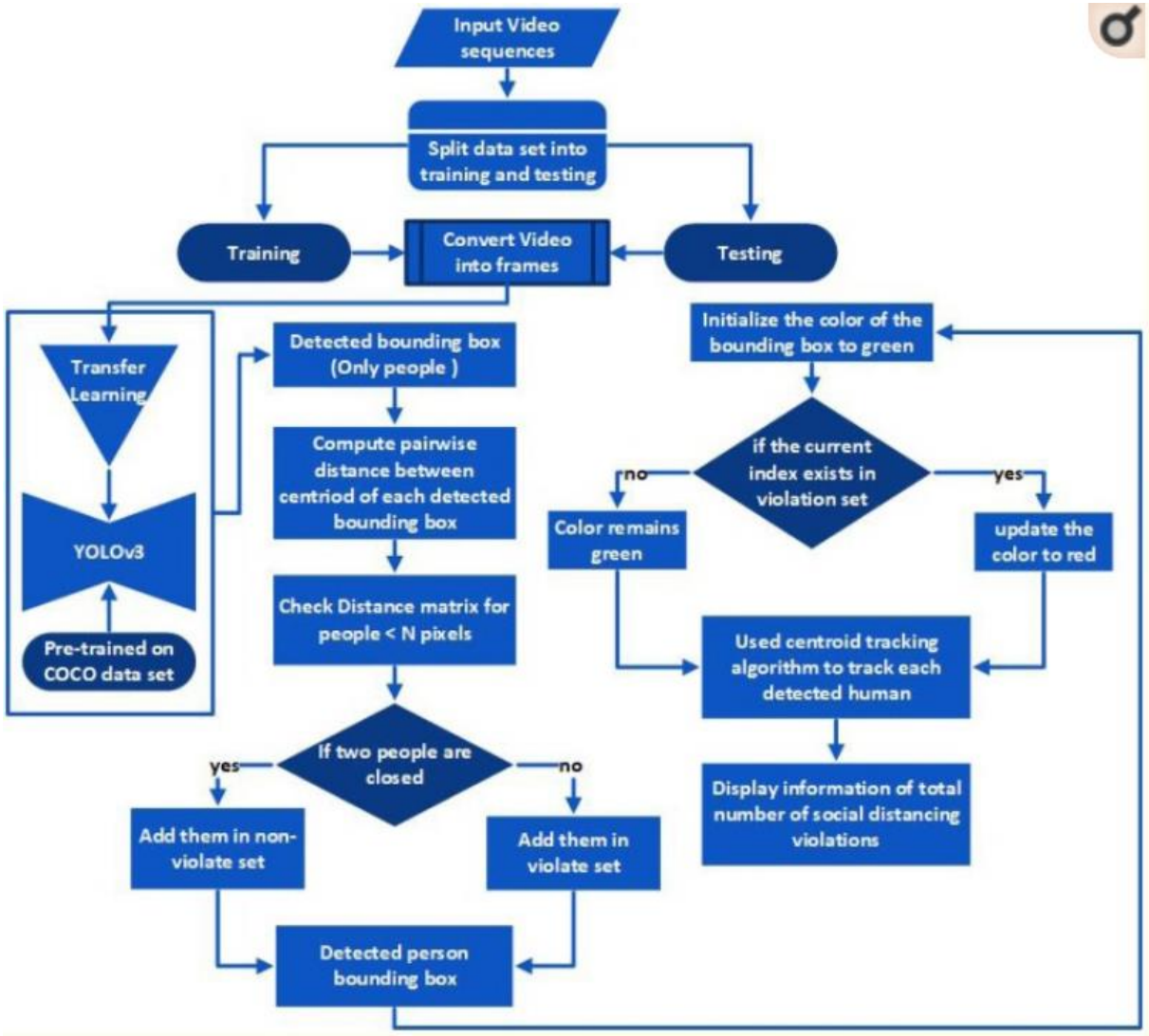
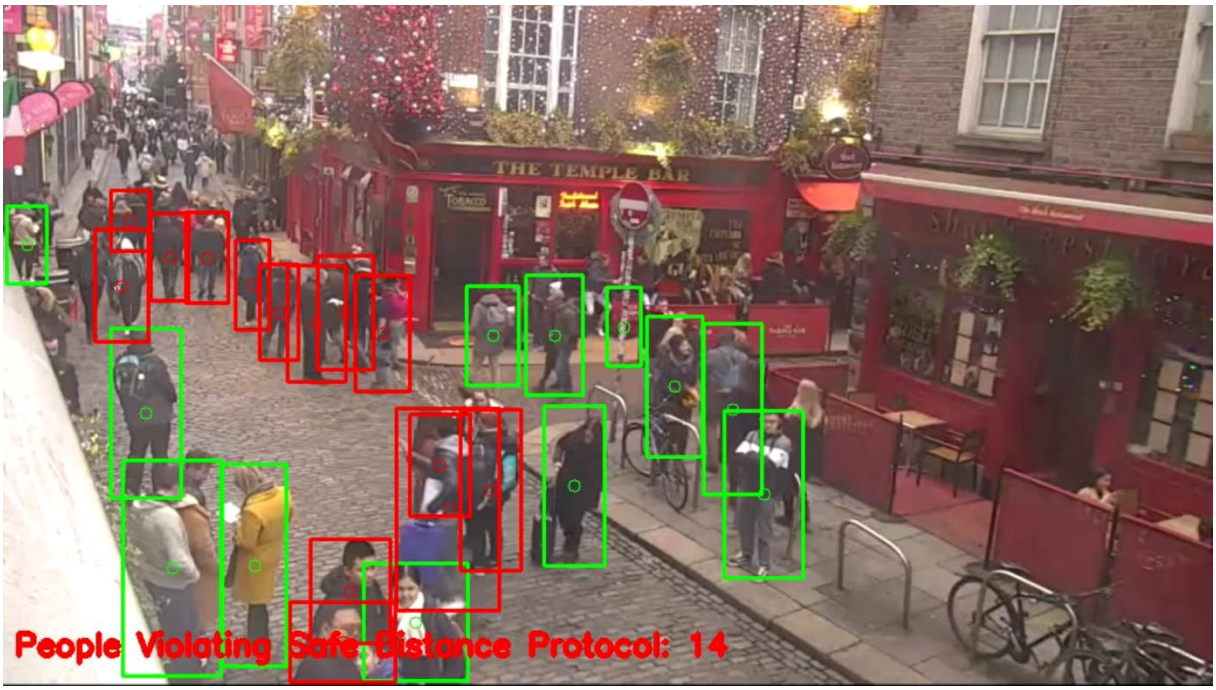
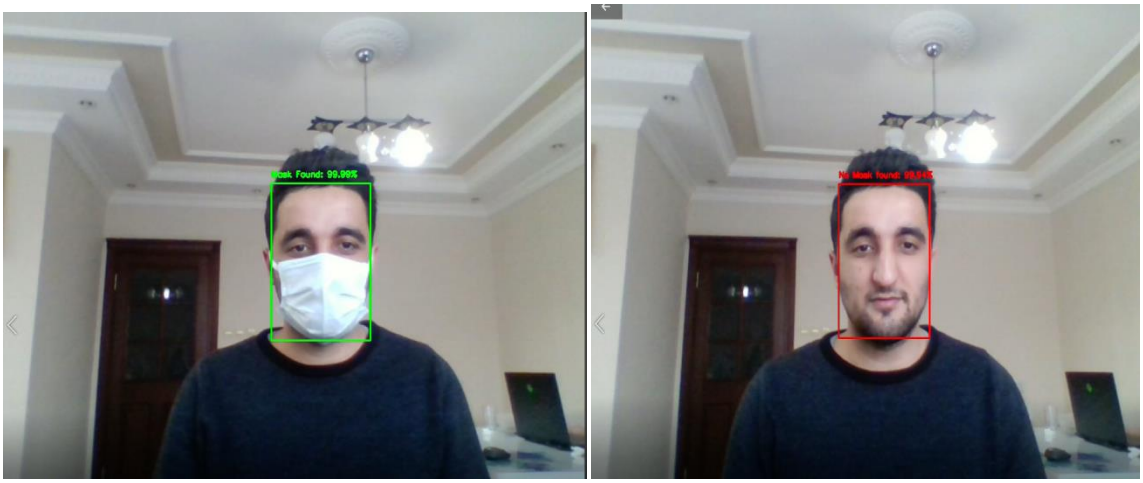


Fig 4-

YOLOv3 was used to detect and identify people, giving the best performance results. Model, bounding boxes and single-stage architecture were used to predict probabilities. The model was first tilted on coco.names and transfer learning was used to detect people from an overview and to improve the performance of detection data, and a new trained training layer data set was added with the existing architecture



After detecting people's social distancing and wearing masks, bounding box information is used to be calculated according to euclid centroid account. When performing the calculation, we used the threshold value we set before following the centroid distance to measure the distance between the two bounding box centroids. According to the results we calculated, the threshold value was passed or not crossed. Bounding boxes carry no violations or violations in them, as shown in figure 4. The color of the bounding box is updated on a case-by-case. A centroid calculation algorithm has been used for monitoring to help track people who violate the social distancing rule. Bounding boxes show information such as the number of people in the environment and how many people follow the distance rule. In this study, YOLOv3 was used for small-scale non-human objects and to somsing these objects from people and to improve accuracy in estimating them. The most important advantage is that the network structure is set for object detection.



4.Experiment,Result and Discussion

In this section, we will give detailed descriptions of the tests and experiments carried out in this study. A data set is required to calculate social distancing. In this study, we used the pre-trained data set with the overview perspective of YOLOv3 of the data set. We've separated the data set into 70% train and 30% test data set. While the data set was recognized, there were no restrictions on people's mobility. The people we monitor can move freely, there are no restrictions on their movement. People's visual appearance may vary based on their distance and camera location. For example, differences in the information of the bounding box were observed in the shooting of the camera from different angles. Our study is examined in two subse sections. Because we split it into train and test data. The performance evaluation of the model will be explained in this section comparing deep learning algorithms.

4.1 Social Distance and Mask Detection using pre-trained

We visualized the results of the social distancing account using the pre-trained data set. We watched our camera from different angles. As a result, we have concluded that the visual appearance of an individual is not the same in the front or side view. Since our model only considers people or only identifies people, an object with a human-like appearance can also be detected by a pre-trained data set based on the camera angle. Our pre-trained data set produces very good results. When the bounding box is green, green rectangular information comes out because people maintain the social distancing threshold. At the same time, this study has been tested in more than one person. Regardless of the number of people, distance

and mask detection and accounting are made as much as the number of people detected. When there is more than one person in an environment, the distances between other people's bounding boxes are updated and recalculed with each transaction. The color of the bounding box is red when there is more than one person in an environment or when two people in a crowded environment violate the social distancing threshold, that is, when they do not comply with social distancing and mask rules.

4.2 Social Distance and Mask Detection using transfer learning

We used the transfer learning method to improve accuracy in detecting people. The Model 600 is trained using a sample data set. Our study was tested for test video recordings. Experimental results have been observed to greatly improve accuracy in the perception and identification of people by transfer learning. It is detected by transfer detection method in various features and various environments, and social distancing between people is calculated in the most accurate way, as shown in the bounding boxes. The libraries used in this study are as follows: tensorflow.keras.applications.mobilenet_v2, tensorflow.keras.preprocessing.image, tensorflow.keras.models, imutils.video, numpy,time,cv2,os,cuda, pandas scipy.spatial import distance, argparse.

5.Conclusion

In this study, we carried out the social distancing and mask detection monitoring program based on deep learning, machine learning and artificial intelligence using an overview. We used the pre-trained YOLOv3 data set for human identification. We used the transfer learning method to improve a person's performance because the angle, visibility, scale size and pose of the camera angle vary significantly in the overall viewpoint. The model is trained by transfer learning method and the newly trained data set is added to the existing layer model, thus increasing the accuracy of our data set in detecting contacts. Our detection model provides color information in bounding boxes containing centroid coordinate information when calculating distance distance between contacts. The calculation of centroid coordinates is done using the Euclid distance account and the center points are repeatedly measured and updated after the distances between the persons are detected. Physical pixel calculation is

performed to control social distancing and mask detection violation rules between individuals. It works more accurately because it's done this way, but it runs slower than expected. This physical pixel calculation uses a threshold value. The threshold value is used to check whether the minimum social distancing limit of the social distancing value has been violated. The social distance we used in this study is 1.5 meters, which is internationally determined. The centroid tracking algorithm is used to track people. As a result of the tests and observations we obtained, it was observed that people walking very close to the camera were correctly perceived and identified, and that control of violation of social distancing had a high accuracy. In addition, the transfer learning method increases the accuracy of the study. The accuracy of our work is achieved by 92% with a pre-trained model without the use of transfer learning method. Increases to 95% when the transfer learning method is used. This means that it is inevitable to use the transfer learning method.

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