Use Computer Vision To Detect Whether A Group Of People Are Social Distancing

Abstract:

Social distancing (SD) is an effective measure to prevent the spread of the infectious Coronavirus Disease 2019 (COVID-19). However, a lack of spatial awareness may cause unintentional violations of this new measure. Against this backdrop, we propose an active surveillance system to slow the spread of COVID-19 by warning individuals in a region-of-interest. Our contribution is twofold. First, we introduce a vision-based real-time system that can detect SD violations and send non-intrusive audio-visual cues using state-of-the-art deep-learning models.

Second, we define a novel critical social density value and show that the chance of SD violation occurrence can be held near zero if the pedestrian density is kept under this value. The proposed system is also ethically fair: it does not record data nor target individuals, and no human supervisor is present during the operation. The proposed system was evaluated across real-world datasets.

Existing System:

State and local governments imposed social distancing measures in March and April 2020 to contain the spread of the novel coronavirus disease (COVID-19). These measures included bans on large social gatherings; school closures; closures of entertainment venues, gyms, bars, and restaurant dining areas; and shelter-in-place orders. We evaluated the impact of these measures on the growth rate of confirmed COVID-19 cases across US counties between March 1, 2020, and April 27, 2020. An event study design allowed each policy's impact on COVID-19 case growth to evolve over time.

Adoption of government-imposed social distancing measures reduced the daily growth rate of confirmed COVID-19 cases by 5.4 percentage points after one to five days, 6.8 percentage points after six to ten days, 8.2 percentage points after eleven to fifteen days, and 9.1 percentage points after sixteen to twenty days.

Holding the amount of voluntary social distancing constant, these results imply that there would have been ten times greater spread of COVID-19 by April 27 without shelter-in-place orders (ten million cases) and more than thirty-five times greater spread without any of the four measures (thirty-five million cases).

Proposed System:

With the outbreak of the novel Coronavirus Disease 2019 (COVID-19), social distancing (SD) emerged as an effective measure against it. Maintaining social distancing in public areas such as transit stations, shopping malls, and university campuses is crucial to prevent or slow the spread of the virus. The practice of social distancing (SD) may continue in the following years until the spread of the virus is completely phased out. However, social distancing is prone to be violated unwillingly, as populations are not accustomed to keeping the necessary 2-meter bubble around each individual. This work proposes a vision-based automatic warning system that can detect social distancing statuses and identify a critical pedestrian density threshold to modulate inflow to crowded areas. Besides being an automated monitoring and warning system, the proposed framework can serve as a tool to detect key variables and statistics for local and global virus control.

Vision-based automatic detection and control systems are economic and effective solutions to mitigate the spread of COVID-19 in public areas. Although the conceptualization is straightforward, the design and deployment of such systems require smart system design and serious ethical considerations.

First, the system must be fast and real-time. Only a real-time system can detect social distancing statuses immediately and send a warning. Privacy concerns can be mitigated with a real-time system by not storing sensitive image data while only keeping aggregate statistics, such as the number of SD violations. With a real-time active surveillance system, appropriate measures can be taken as quickly as possible to reduce further spread of COVID-19.

Software Tools:

1. VS Code
2. Jupyter Notebook
3. Anaconda
4. TensorFlow
5. OpenCV
6. Keras
7. Python3

Hardware Tools:

1. Laptop
2. Operating System: Windows 11
3. RAM: 16GB
4. ROM: 8GB
5. Fast Internet Connectivity

6. GPU

Applications:

1. The same architecture can also be used for identifying the distance between vehicles in anti-collision system of driverless cars.
2. This can be used in colleges, and larger gatherings to automate the social distancing.