Use of Artificial Intelligence-based Computer Vision System to Practice Social Distancing in Hospitals to Prevent Transmission of COVID-19

Sir,

With confirmed cases of COVID-19 stand at 7,941,791 as on June 7, 2020 globally, and 434,796 have succumbed to it.[1] Currently, many countries are looking towards a soft easing of their lockdowns, while still abiding by social distancing guidelines. The epidemic has caused an immeasurable social change, as it continues to affect the lives of billions of people around the world. The duration of the pandemic can be evaluated in two stages: the first 100 cases and each case after the first 100. The first 100 positive coronavirus cases were diagnosed in India during the first initial 3 months, which then multiplied four times over the next 10 days. Whereas in countries like Japan, South Korea and Singapore there has been gradual drop in average rise of cases.[2]

In India and 23 other countries after the first phase of 100 cases, there has been a sharp rise in number of cases reported. These countries have shown accelerated curve and the disease prevention steps have declined. In contrast, East Asian countries have managed to decimate the curve despite recording the largest number of incidents.[3]

Although Italy has begun to flatten its new cases everyday in comparison with countries like the USA, Spain and France, the number still continues to be high with more than 69,000 cases.[4] Few of the high- income countries like Denmark, Ireland have been able to regulate the cases considerably post their initial 100 cases. Iran so far has shown the highest decline (60%) after its initial 100 cases.[3]

The coronavirus pandemic has quickly overwhelmed the global health-care infrastructure.[5] Hospitals and health-care workers are more vulnerable to infection as large number of people visit for medical care.

As we look towards technology to evaluate our current progress in curbing infection rates, artificial intelligence (AI) has made headlines in both diagnostic and predictive applications. Computer vision is an AI field that teaches computers to understand the visual world. Machines can accurately recognize and locate objects and then respond to what they "see" using cameras, images, and deep learning models.[6] There are various health-care areas in which computer vision is being utilized and has helped physicians diagnose patients and in health monitoring.[7]

The current evidence suggests that COVID-19 viruses mainly transmit through respiratory droplets and contact routes.[8] There is a need to follow the workplace Standard Operating Procedures to contain the spread of COVID-19, which includes social distancing, wearing masks, frequent hand-washing with soap, respiratory etiquettes, and installation and use of Aarogya Setu App by employees. Social distancing has proven to slow down infection rates while still allowing people to function in their respective environments. There is a need to deploy powerful computer vision models, to track employees and visitors and notify managers of workspaces and public areas about possible violations. This can help to either monitor the spread of contact or enforce existing guidelines. Numerous studies have been carried for the application of computer vision for human face detection using deep learning-based Single Shot Detectors.[9] Live camera footage can be fed to one of the lightweight object detection models such as MobileNets,[10] and objects can be detected even using lower-end hardware. Violation of the distance below preset threshold limit can be notified to respective authority. This information can be further processed for contact tracing, generating statistics on social distancing, or informing workers of possible spread.

The object identification, along with human identification, can be achieved by retraining the existing deep learning models on a dataset consisting of people in contact with surfaces or by creating boundaries within the image itself and monitoring breaches. Figure 1 shows the computer vision-based AI method for the detection of social distancing. However, care has to be taken to retain privacy of people under surveillance. This information can be passed onto relevant personnel who can quickly get on-site and disinfect the surface. Emphasis on feasibility and effectiveness of developing robust, cost-effective, scalable systems, deployable in the hospital environment without affecting other medical devices needs to be explored.

India is a multiethnic country with people of varied physical characteristics. Hence, the deep learning models developed using the Indian data can be used to deploy the technology globally. The focus on such technological solutions will help to fight the COVID-19 and other similar pandemic effectively.

Industrial GPU computers with the ability to perform these neural network algorithms on the edge are now available, allowing large-scale contactless monitoring that helps reduce the spread of the coronavirus and other potential lethal infections.[7] With the progressive rate of transmission of the pandemic globally, the governments should give it a priority in the health system, and all organizations should cooperate with the Ministry of Health and Family Welfare and Healthcare systems to fight COVID-19.

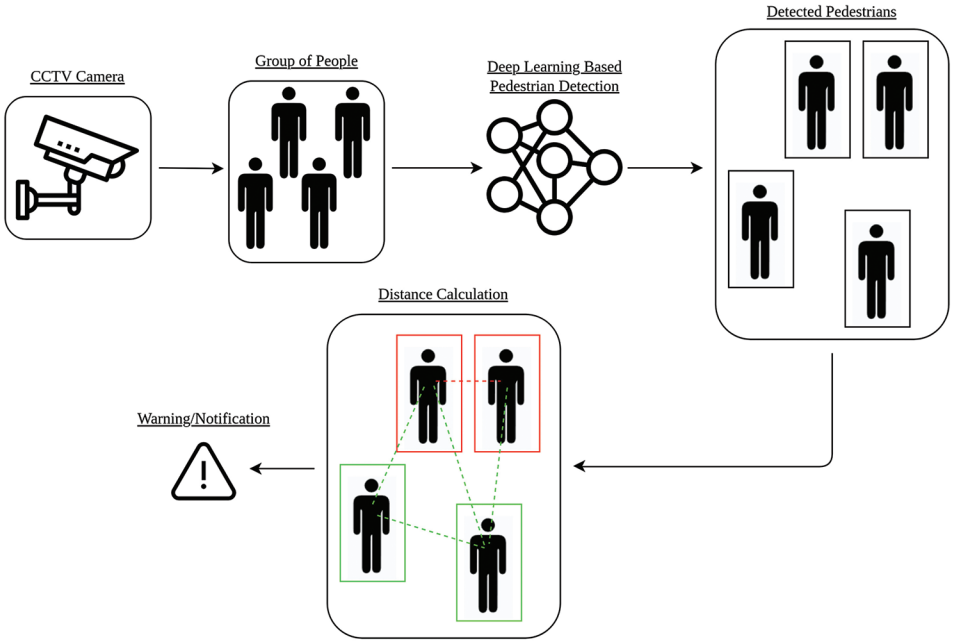

Figure 1: Computer vision-based artificial intelligence for social distancing

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Conflicts of interest

There are no conflicts of interest.

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