**Technical Report**

Title : - Social Distancing Using Computer Vision and Deep Learning

Team Name :- Tech Titans

Team Member1 : - Vipul Waskel

Team Member2 : - Shivam Kag

College :- Parul Institute of Computer Application

Date of Submission :- 15/07/2023

**Abstract**

This project presents a social distancing monitoring system that leverages computer vision techniques and deep learning algorithms. The system utilizes a combination of object detection, centroid tracking, and proximity analysis to detect and track individuals in a given video and identify instances of close proximity that violate social distancing guidelines.

The project's outcome is a real-time social distancing monitoring system that displays the video frames with colored bounding boxes around individuals. Green boxes indicate individuals at a safe distance, while red boxes indicate individuals in close proximity. The system calculates the frames per second (FPS) and provides visual feedback on the compliance of social distancing guidelines.

By combining computer vision techniques and deep learning models, this system offers an effective solution for monitoring social distancing in various scenarios, such as public spaces, workplaces, and events. It provides real-time feedback to individuals and authorities, enabling them to take appropriate actions to maintain social distancing and ensure public health and safety.

**Introduction**

Social distancing has become a critical measure for mitigating the spread of infectious diseases, especially in crowded public spaces. As technology continues to advance, computer vision and deep learning techniques offer innovative solutions to monitor and enforce social distancing guidelines. This project focuses on developing a social distancing monitoring system that utilizes computer vision algorithms and deep learning models to detect and track individuals in real-time video footage.

The project leverages the power of object detection models, such as MobileNet SSD, to identify and localize individuals within video frames. By employing pre-trained models, accurate and efficient detection of people can be achieved. The centroid tracking algorithm is then applied to track the movement of individuals across frames, ensuring consistent identification even in challenging scenarios where people may temporarily disappear or reappear.

The social distancing monitoring system goes beyond simple tracking by analyzing the distances between individuals. By calculating the Euclidean distance between centroids, instances of close proximity can be identified. When individuals breach the safe distance threshold, visual indicators are provided to alert both individuals and monitoring authorities. This allows for prompt intervention and enforcement of social distancing guidelines to protect public health.

With real-time feedback on social distancing compliance, this system serves as a valuable tool for various environments, including public spaces, workplaces, and events. It enables individuals to adhere to social distancing protocols and empowers authorities to efficiently monitor and manage crowd densities. By leveraging computer vision and deep learning technologies, this project contributes to creating safer environmentsand combating the transmission of contagious diseases.

**Our Approach**

Our social distancing monitoring project incorporates a robust technical approach that encompasses computer vision techniques and deep learning algorithms to achieve accurate and real-time monitoring of social distancing compliance. The project comprises the following detailed steps:

1. **Object Detection**:

We employ a powerful object detection model, MobileNet SSD, which has been pretrained on extensive datasets. This model utilizes a deep neural network architecture to detect and classify objects within video frames. By feeding each frame into the model, we obtain a set of bounding box coordinates representing the detected individuals.

2. **Centroid Tracking**:

To track individuals across frames and ensure consistent identification, we utilize a centroid tracking algorithm. This algorithm assigns a unique object ID to each detected individual and maintains a record of their centroids and bounding box coordinates. By calculating the centroid of each bounding box, we establish a reference point for tracking the movement of individuals throughout the video.

3. **Proximity Analysis**:

Our system analyzes the Euclidean distances between the centroids of tracked individuals to determine their proximity to one another. By applying a predefined threshold, typically based on social distancing guidelines, we can identify instances where individuals are within close proximity. This threshold acts as a criterion for determining social distancing violations.

4. **Visualization and Feedback**:

To provide visual feedback on social distancing compliance, we utilize bounding boxes to highlight individuals in the video frames. Individuals adhering to social distancing guidelines are displayed with green bounding boxes, indicating safe distances, while those in close proximity are highlighted with red bounding boxes, signaling potential violations. This visual representation allows for immediate identification and assessment of social distancing compliance.

5. **Real-Time Monitoring**:

Our system operates in real-time, processing video frames as they are captured. This enables instantaneous feedback and intervention when social distancing violations occur. Additionally, we display the frames per second (FPS) information, allowing for performance monitoring and system optimization.

By integrating object detection, centroid tracking, proximity analysis, visualization, and real-time monitoring, our technical approach delivers an effective solution for social distancing monitoring. The system can be deployed across various environments, including public spaces, workplaces, and events, to promote and enforce social distancing measures, ensuring the safety and well-being of individuals and communities.

**Results:**

Our social distancing monitoring project integrates computer vision techniques and deep learning algorithms to create an efficient system for real-time monitoring of social distancing compliance. By employing advanced object detection models, centroid tracking algorithms, and proximity analysis methods, we aim to accurately detect individuals, track their movements, and identify instances of social distancing violations. The system provides visual feedback in real-time, allowing for prompt interventions and corrective actions. While the system has not been tested with a specific video dataset, we anticipate positive outcomes based on the capabilities and performance of the individual components. Rigorous testing and evaluation will further validate the system's effectiveness and potential for widespread deployment in various settings.

**References :**

<https://docs.opencv.org/>

<https://docs.openvino.ai/2023.0/omz_models_model_mobilenet_ssd.html>

<https://www.analyticsvidhya.com/blog/2022/05/a-tutorial-on-centroid-tracker-counter-system/>

<https://github.com/intel-iot-devkit/social-distance>

<https://docs.openvino.ai/2022.3/omz_models_group_intel.html>

<https://chat.openai.com/>

<https://docs.openvino.ai/2023.0/omz_demos_social_distance_demo_cpp.html>

**Github Link :**

**How to Run :**

1. Go to code folder and run the social\_distancing.py file
2. To run use the below command
3. python social\_distancing.py
4. you will see the output video on your screen