

Crowd Analysis for Covid

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Abstract—In the recent Covid-19 state of affairs, we need to spot the most huddled place and stop the mass unfold of the virus. As countries around the world begin to ease their restrictions, places as various as public areas and high streets, transport hubs, events and attractions, yet as individual offices, face the challenge of reopening safely. This presents several challenges once considering the come back to the ‘new normal’ and reopening society. Our project provides period of timely crowd analytics with object detection of individuals and average interframe and intraframe metrics, like group size, velocity, placement heatmap, and distancing for a given fundamental measure. We have got to analyze hours of video so as to stream to match the period of time current analytics to historical information for finding events like group of individuals or quick movement. The project examines the character of the crowd and its dynamics with specific relation to the problems of crowd safety.

I. INTRODUCTION

Crowd Management is a challenging task that impacts the functioning of public areas. Analyzing and surveilling crowd is of high priority in current Covid scenario. Covid-19 bought a whole lot of restrictions to peoples lives and has made a huge impact on our lifestyle. Many countries after the initial lockdown lifted the restrictions without thorough planning and the second wave of the pandemic hit them and caused much more destruction. People are now living the ‘new normal’ lifestyle. However, communities are still wondering how to resume the normal life while the risk of a community spread still cannot be ignored. One of the measures is to maintain ‘social distancing’. People are expected to follow the county specific protocols for months to come. A crowd analysis system can be used to analyze the crowd and get an insight about the crowd behaviour.

Crowd analysis can make a huge impact on functioning of public areas. In the current scenario, there is a need for analyzing the crowd in almost everywhere to reduce the spread of the disease which may cause a lot of problems for the community. By having a crowd analysis system that have the capability to monitor the crowd movement and behaviour it will be easier to maintain social distancing in small and large public areas.

Until a proper vaccine for the disease (Covid) is developed and made easily available to the public social distancing and

related protocols are the only measures to prevent the disease from spreading. Even though the vaccines are under development it will take time to reach the general public and due to this, people have to follow the protocols for a few more months at least. During this time a cost effective crowd analysis system that can do the tasks of crowd monitoring without direct human contact will be very useful. As of now, we’ve seen people trying to control the crowd in front of stores and malls risking their life to maintain social distancing. With this project, the human involvement in crowd controlling can be reduced.

The aim of this project is to develop a crowd dynamics system with the ability to monitor social distancing in crowds. The project should also be able to reduce human involvement in crowd controlling and surveillance.

The major application of the project is crowd analysis and social distance monitoring in the current scenario. The project can also be used to analyze crowd behaviour and crowd trends.

For example, in a shopping mall, with the crowd data analyzed by the system, the authorities can know the perfect time and place to host an event. Thus, the project will have an extensive application.

Since the project deals with crowd, we need to ensure individuals privacy. The project uses video footages from surveillance cameras. The identification needs to be done in real time and needs a system with very accurate space-time information. The project requires a very efficient dataset and gpu power for smoother running.

II. EXISTING SYSTEM AND RELATED WORK

A. Microsoft COCO: Common Objects in Context

This Work has presented a detailed statistical analysis of the dataset in comparison to PASCAL, ImageNet, and SUN. They have also provided baseline performance analysis for bounding box and segmentation detection results using a Deformable Parts Model. The Microsoft Common Objects in Context (MS COCO) dataset contains 91 common object categories with 82 of them having more than 5,000 labeled instances. In total the dataset has 2,500,000 labeled instances

in 328,000 images. In contrast to the popular ImageNet dataset, COCO has fewer categories but more instances per category. This can aid in learning detailed object models capable of precise 2D localization. They have presented a new dataset with the goal of advancing the state-of-the-art in object recognition by placing the question of object recognition in the context of the broader question of scene understanding. They have achieved this by gathering images of complex everyday scenes containing common objects in their natural context. Objects are labeled using per-instance segmentations to aid in precise object localization [3].

B. Faster R-CNN: Towards Real-Time Object Detection with Region Proposal Network

This Work observed that the convolutional feature maps used by region-based detectors, like Fast R-CNN, can also be used for generating region proposals. The object detection system, called Faster R-CNN, is composed of two modules. The first module is a deep fully convolutional network that proposes regions, and the second module is the Fast R-CNN detector that uses the proposed regions. The entire system is a single, unified network for object detection [1].

C. Spark: Cluster Computing with Working Sets

In this Technology, they have focused on reusing a working set of data across multiple parallel operations. This includes many iterative machine learning algorithms, as well as interactive data analysis environments. they have propose a new framework called Spark that supports these applications while maintaining the scalability and fault-tolerance properties of MapReduce. To achieve these goals, Spark introduces a data abstraction called resilient distributed datasets (RDDs)[6].

I. OBJECTIVES AND PROPOSED INNOVATION

To maintain Social distancing, as a measure to contain the spreading of Covid-19, is defining a “new normal”. Unless belonging to a family, pedestrians in shared spaces are asked to observe a minimal pairwise distance. Get an insight of crowd behaviour, managers of public spaces may be tasked with the enforcement or monitoring of this constraint. As privacy- respectful real-time tracking of pedestrian dynamics in public spaces is a growing reality, it is natural to leverage on these tools to analyze the adherence to physical distancing and compare the effectiveness of crowd management measurements. Reduce human involvement in crowd control, to find a particular area where social distancing is not maintained, and take necessary measure to avoid such incidents. It provides real-time crowd analytics with object detection of people and average interframe and intraframe metrics, such as number of people, group size, velocity, and location heatmap for a given time period. By analyzing minimum of 30 hours of video and then use streaming to compare the real-time current analytics to the historical data for the corresponding time period in order to detect interesting events such as large groups of people or fast movement. The basic solution is by feeding the data through an object detection model to obtain bounding boxes identifying person locations.

Then compute analytics such as number of people, velocities, group sizes, and locations based on bounding boxes. For historical analysis, perform some aggregation of these statistics over short periods of time. For streaming, directly work with the output analytics. After analytics computation is complete, it will feed the results into a variety of visualizations. The basic features are the use of Spark and GPU, and the advanced feature is use of TensorFlow for ML model and implementation of real-time video analytics. For the TensorFlow advanced functionality, scheduling deep learning jobs on the GPU. Also, implementation of an alert system comparing real-time analytics to historical data for the corresponding hour will produce a variety of visualizations.

II. HYPOTHESIS, DESIGN AND METHODOLOGY

a) Hypothesis

Object Detection Bounding boxes and timestamps are obtained for objects determined as humans by running Faster-RCNN on input video. A Spark dataframe is created for the video containing model output for each frame.

b) Analytics

Link people across successive frames to find group size, average velocity, heat map and area where bounding boxes intersect.

c) Visualization

Convert aggregated dataframes after analytics to Pandas dataframe. Visualization is done using Bokeh(Python library) and matplotlib and can be accessed from the web interface.

d) Design and Methodology

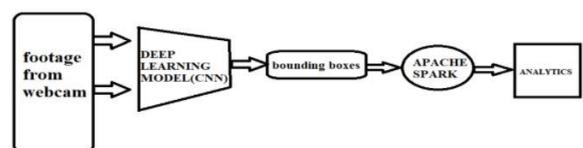


FIG 1. PROJECT DESIGN (BLOCKDIAGRAM)

As shown in the Fig 1, initially we will begin by feeding our data through an object detection model to obtain bounding boxes identifying person locations. Then analytics such as number of people, velocities, group sizes, and locations based on bounding boxes is computed. For historical analysis, we are then planning to perform some aggregation of these statistics over short periods of time. For streaming, we are going to directly work with the output analytics. After analytics computation is complete, we feed the results into a variety of visualizations. Note that our basic features are the use of Spark and GPU, and our advanced feature is use of TensorFlow for our ML model and implementation of real-time video analytics. For the TensorFlow advanced functionality, we scheduled deep learning jobs across GPUs.

We are going to use AWS EC2 GPU instances to run object detection, and Spark on AWS EMR to perform analytics computation.

III. CONCLUSION

Actually, this project reveals need and importance for an efficient method for crowd dynamics. This system with existing systems will have multiple applications. Scope and application of the project and the ability of the project in crowd analysis was discussed. The report also proposed the implementation technique of the project. The advantages and challenges of the project was also listed. Since the project provides a system with reduced human involvement in crowd controlling, it will be highly beneficial. Until a proper treatment for the disease is found, the system will be able to help in maintain social distancing and after the current scenario the system can be used in different applications that needs crowd behaviour insights and trend analysis.

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