Idea Description

It is estimated that by 2050, 70% of all world population will be living in cities. Hence it would require a lot of manual human intervention in managing crimes.
We aim to solve this problem by automating the surveillance in cities by statistical analysis of the live feed, of the already existing CCTV cameras and crime records
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India being a large country geographically and densely populated, makes it difficult to monitor all the CCTV cameras at once since it requires a lot of computing resources. Hence we intend to solve this problem by determining the areas whose video feed needs to be monitored based on statistical analysis of the existing criminal data of that particular area and particular time.
After the CCTV cameras are determined, the feed from every camera is then collected at a suitable location for further processing. This is done using Kafka. We then process the video feed by detecting abnormal motion. This feed is then passed on to control room to be overtaken by the concerned authorities.

Technical Details

The pipeline for the product is as follows,

1. Determination of CCTV cameras.
2. Optical Flow Detection.
3. Collection of video feeds from multiple sources.
4. Anomaly detection.
5. Notifying the authorities.

1. Determination of CCTV cameras

Database of crimes in chicago is considered for the demonstration of this part of application.

1.1 Dividing the data into buckets according to timestamp

The data is divided into buckets according to intervals of their occurence. This is significant because criminal activity of the area also depends upon the time.

1.2 Clustering data

The data in each bucket is then clustered separately to obtain criminal hotspots with respect to the specific time interval. The nearest camera to the centroid is then activated and authorities are informed.

2. Optical Flow Detection

Lucas kanade algorithm is used to detect the optical flow because it is computationally inexpensive and can be done at real time. Moreover the camera frame is mostly still and anomaly detection only needs to be applied once the optical flow is above a threshold value.

3. Collection of video feeds from multiple sources

We are using Kafka to collect data from multiple clients i.e., CCTV cameras, and send them to a common server where the data is processed for anomalies. After the data is processed, it is sent to one common place or control room.Authorities are then notified accordingly. Kafka is easily scalable and fault tolerant. Kafka server can easily be deployed on cloud. The distributed architecture of Kafka makes it scalable using capabilities like replication and partitioning.

4. Anomaly detection

We assume that a group of people larger than a certain threshold i.e., 5 might need monitoring as there exists a possibility of a crime.
We have used object detection and localization models to predict if there exists a group larger than threshold in a frame. For this purpose YOLOv3 and FastRCNN Inception networks which are trained on COCO image object localization dataset.
FastRCNN works well on higher resolution images whereas YOLOv3 works well on the lower resolution images and is much faster. We hence use an ensemble of these models to accurately detect the humans in images of different resolutions.

5. Notifying the authorities

Finally, the detected anomaly is notified to the authorities via a user interface present in the control room. The authorities are then required to investigate into the concerned situation, and then manually restore that camera back into the pipeline.