IIIT HYDERABAD

Confluence Industry-Academia Roundtable

Leveraging AI to harness the existing CCTV Surveillance Infrastructure for better Policing

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A confluence session of industry leaders, technologists, innovators and researchers to understand the solution possibilities leveraging the latest from AI to enable better policing using the CCTV camera network. This paper captures the deliberations of the confluence roundtable.

Introduction

Extensive CCTV camera networks are being set up in many cities including Hyderabad. Today the network is primarily being used for retrospectively investigating incidents for Traffic, Law and Order and Crime. AI and computer vision technology available today can be leveraged to build safe communities. A case study of Amsterdam Innovation Arena shows how Police can partner with various agencies to reduce activities like crime, traffic congestions and crowding. By using a stadium visited by 55000 people as a living lab, they worked in areas like mobility, safety, sustainability, parking management, etc and improved algorithms to predict and recognise specific conditions quicker and prevent events from taking place. For instance, the Amsterdam Police used the living lab for detecting criminals using facial recognition technology. AI algorithms are being developed to scan a group of people with weapons and explosives from a distance .

These emerging technologies can help in prevention and reduction of crime, make cities more secure, provide support for the police force and other entities beyond crime detection. AI can improve the seamless interconnection between municipal bodies and also help in safeguarding the lives of police and law enforcers. This confluence roundtable has tabled the prevailing challenges faced by the Police and explored possibilities to build new models and technology-powered-solutions driven by AI to address these challenges.

Traffic management - a challenge as vehicles and traffic grows

In any urban setting, traffic today is one of the major problems for the Police. Post the covid pandemic, as things started to normalise, traffic too has increased multifold. It is a misconception that police are only worried about traffic violations. More than detection of violations, Police are keen to know how technology can be used to manage the traffic and in real time detection of traffic violations in metropolitan cities.

Key problems in traffic today

1. To understand the traffic scenario in urban set up and analyse the flow pattern of traffic movement

Problem : Currently, police predict traffic patterns and congestions based on past experience of police officers who worked in specific areas. Along with peak hour based traffic there is traffic congestion due to festivals, VIP visits, social & political gatherings or any seasonal effect. To understand all these, police as of now depend on human input and not technology. Police predict the traffic to increase multifold post Sankranthi as people return to work post the Covid pandemic. In such a scenario, they are looking for technology based solutions that can effectively manage traffic.
Inputs from Panelists : The panelists suggested how AI can be used in understanding the traffic scenario. By Using the existing cameras at every intersection, we can derive the traffic density and thereby effectively manage traffic. Also, factors like geography and weather add up to sudden surge

in traffic and technology can help identify these areas and help in managing traffic. Also, there are a lot of ways in which citizen networks and social networks can help in effective traffic management. They can be used to discover vulnerabilities in localities. The valuable information collected from such citizen groups can be interpolated and build usable models. They can also be used in creating large data points. These data points can be used to predict traffic congestions and help in better traffic management.

Next Steps : As a first step, we need to identify the hotspots for traffic congestion.. By identifying the root cause for traffic and where it affects, there can be preemptive management of traffic. For example, if the road narrows at one part, we can predict that it could lead to traffic and accordingly manage to prevent the negative effect of that. If there is water logging in a certain area, based on historical data of vehicle movement and type of vehicles, we can predict the traffic by conducting simulations and accordingly plan. Initially, we would take a particular area and using data feed from CCTV cameras and human input, we shall try to create a model which can predict traffic and preemptively manage traffic.

2. To predict traffic congestions and operate traffic signals in a sequence for better time management

Problem : The present signal light management is done in 2 ways: Manual and Predetermined times. Timings are fed into the system and during different cycles of the day, the signal is operated. There are 6 different cycles such as peak, pre-peak, afternoon, evening, night, late night. All this data is currently manually fed into the system and signals are operated. There are no analytics or technology involved. The traffic density increases during peak hours and other events. How technology can help in predicting such congestions and operate signals in a sequence is the need of the hour.

Inputs from Panelists : AI can help in predicting traffic based on analytics. AI models can be built to understand and predict traffic based on seasonality or unpredictable events.The data from the CCTV cameras, satellites and google traffic can be used as inputs to build these models. The capacity of buildings is also an equally important dimension. All the digress and ingress points can be the biggest choke points. By collecting such data and using it to model an algorithm will be an effective step in managing traffic.

Next Steps : Initially pilots can be built by choosing one area, see the effectiveness and the same can be simulated at scale. Using existing data feed , we can derive the density of traffic, type of vehicles and the pattern of movement of vehicles. Through this we can build a mechanism and AI algorithms to simulate vehicle movement patterns and thereby effectively regulate signals and traffic.

Law and Order - AI solutions to maintain public order

Police have to maintain law and order on various aspects ranging from political, communal to activities of any sort which has the potential to cause disruption to normal public order. For example,

there are rallies by a particular party, or a crowd march for a specific cause or protests towards meeting demands and so on.

Key problems in maintaining law and order

1. To predict large protests and gatherings

Problem : Protests and gatherings could be of different types like political, religious and social gatherings. Though based on knowledge from experienced personnel, Police are prepared but if they can predict the crowd at such gatherings. Communal riots or any other crimes may happen when a larger number of people are gathered. If they can receive triggers on a real time basis if they spot people with any weapons would be useful in maintaining law and order.

Inputs from Panelists : Social media handles can be used to identify protests and gatherings. Social media handles and hashtags of late have become the best and easier way of identifying any trigger for protests or huge crowd gathering. The in house protestors never come into the open but can be identified using twitter trends. Analysing such data can help in predicting the crowds at gathering and accordingly maintain law and order. AI solutions can be developed to manage and aid Law enforcement agencies to deal with such critical security concerns on a real-time basis. AI can also be used to detect any lethal/non lethal weapons and explosives in a group and thus prevent any exigency. Using information from experts, patterns can be identified and models can be built to capture unruly behaviour in a crowd. People behaviour versus geographic coordinates as a formula can be a good database to code and create solutions.

Next Steps : Analysing twitter trends and hashtags to predict gatherings can be done. Also, using technology we can feed the repeated offenders faces and next time when these people gather at some place, an instant trigger can be sent to the nearest police station and help maintain law and order.

2. Crowd Management during large gatherings (political / social / religious)

Problem : Religious gatherings are another important factor in maintaining law and order. Taking the help of technology, efficient crowd management will help in maintaining law & order.

Inputs from Panelists : To help assess the count of people engaged in a crowd for a religious purpose at a given time and location, the crowd density can be calculated. This model has been earlier generated to manage crowd during Medaram gathering. By analysing such data, if the crowd density is more than the prescribed levels, the monitoring system automatically raises an error and alarms the nearby police station. In any particular area, AI algorithms can also count how many people have come in and how many people go out of a particular area to help maintain the congestion levels. Also, based on video feed from CCTV cameras and other feed, analytics can be used to detect abnormalities in crowd movement. This can avoid any sort of riots to break out.

Next Steps : Develop models as a pilot to manage crowd during any large gathering and then simulate it at scale.

Crime : Prevention, Rapid response and Postventions

Police personnel based on experience know where crimes happen on a regular basis and what are the crime hotspots. Crime is of two kinds - property crimes and bodily crimes. Currently, there is no model in place for prevention of crime .

1. Using cameras for prevention and preemptive detection of crime

Problem : Currently, there is no system in place to prevent crimes. Once the crime happens, the rapid response team arrives at the spot within 5 minutes and provide support. There is only rapid response and postvention but there is no mechanism for prevention of crime.

Inputs from Panelists : Police know the major hotspots of crime and the time. There are also many CCTV cameras installed in public places and buildings in every locality. Patterns can be drawn from the knowledge and video footage available. . Such data can be coded to develop a model and prevent crimes. Capturing thoughtful behaviour of criminal mindset is also required to monitor and track a crime. Reverse rule based facial recognition technology can be used to identify criminals. AIso AI can help in identifying patterns of vehicle movement and signals from phone numbers from repeated offenders. This way crime can be prevented to a large extent.

2. Detecting criminal activities beyond normal hours

Problem: Typically in a city, business hours are 11 AM - 11 PM. Beyond this time, any activity can be considered as abnormal. If technology can help detect criminal activities beyond normal hours, crime can be prevented.

Inputs from Panelists : If any person looks for CCTVs during night time or repeatedly come to an area, it could have some criminal implications. Through video feed and analytics, it can be figured out if the same person loiters around the area for long and if there is an issue or not. It's important to capture activities beyond the regular operation hours when criminal acts are more prone to happen. For example, gunshots, chain snatching, harassment of women, especially during the night and AI can be used to send immediate information to patrol parties for quick response. Also, by using facial recognition technology, criminals can be identified when loitering in a certain area and crime can be prevented.

Next Steps : By taking one area or data from 2-3 police stations, we would like to track repeated offenders. Also, by analysing the behaviour of criminals and tracking their vehicles we can try to analyse the areas / hotspots of crimes. Based on the pilot, we can see the results and apply it to other areas.

Technology - Challenges & Solutions

Currently, there is no mechanism to detect the health of CCTV cameras. With so many CCTV's installed, as there is no monitoring, there is no trigger when a CCTV is not functional. Technology can be used to a certain extent by automating camera health monitoring system and sending a trigger to the nearest police station. Also, AI can help in detecting hate speech, misinformation available on social media and sending triggers. This would help in prevention of crime. These emerging

technologies can also use the data from camera feed and detect potholes, water logging, road surface quality, and develop models which can help in effective traffic management.

Conclusion and Actionable steps

Traffic, law & order and crime are three main issues for the police department. Through dialog, all panelists shared their valuable thoughts and possible solutions on how technology available today can be used to build safe communities and help the force in prevention and preemptive detection. The challenges/ problems identified in each of three areas would be taken into consideration and acted upon. As a first step, we would consider one problem from each of the three broad areas and develop a pilot based on the data available , see the usefulness and then simulate at scale to the entire city. By interacting with experts from the police side and the video feed available, data would be captured and models will be developed. Also, an awareness campaign to citizens on the use of security systems at home in updating their passwords timely will help in prevention of crime. As an institute we shall focus and work with the Police and leveraging the latest from AI to enable better policing using the CCTV camera network.

Confluence Roundtable Panelists:

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