



A Literature Review: Artificial Intelligence in Public Security and Safety

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Abstract:

This paper will describe the significance of artificial intelligence and its adverse circumstances too and also the applications of artificial intelligence. It also examines the ongoing process of application technology which is being used in daily life in the real world. The paper not only explains the major applications of artificial intelligence but also apart from these applications it also gives you the journey and brief usage of AI in public sector. In the current world where artificial intelligence is being used there will be an increase in their quality and efficiency of their products which are useful for the public safety, products like CC cameras, face detection devices in public places which can identify the uncommon people or suspicious people.

In the last few years, as you know that the growth rate of artificial intelligence is increasing very rapidly and AI has been developing very well in the last few years. Also this paper will tell you the current ongoing AI safety and also the upcoming artificial intelligence (AI) advanced devices. Also you will be able to know the problems that we found in artificial intelligence in the area of public places. This paper also analyzed the developments in the ongoing Artificial intelligence (AI) and its applications. At the end you will get an analyzed review on possible future potentials of artificial intelligence (AI).

Keywords: Artificial Intelligence (AI), Facial Recognition, Visual Surveillance, Public Safety, CC camera, Gunshot detection

1 Introduction

The roots of Artificial Intelligence (AI) could be traced back in the 1950s, this proves that the AI industry is not new to the world of technology. But with the increase of technology advancement in the past few years, we cannot deny that the AI has picked up a rapid as well as dynamic pace of development. But yes it's true that AI is making it difficult for the tech industry to predict its future path. As everyday new developments are coming up in this field and these changes are altering our world in such a way that was never thought off.

In all sectors AI has been increasingly driven by data and analytics. Crime analytics are getting upgraded day by day which can generate more accurate predictions about crime which is likely to occur and also the suspects.

To know more about AI we first need to understand and analyze the existing literature of AI and subsequently recommend policy on the matter. This review is a collection of information obtained through various articles, policy related documents, news items and research papers across the world. The main objective of this review paper is to give a multidimensional idea about Artificial Intelligence role in public safety and security.

The review is a step to prevent criminals by developing Law-enforcements. AI helps to organize the knowledge more efficiently and effectively. Man has developed and increased the power of computers with divergence, size reduction and high speed. There is an area under computer science termed as Artificial Intelligence pursuing by making computers, devices or any appliance as intelligent as a human. Artificial Intelligence (AI) is a mixture of computer science and physiology intelligence. The technology of artificial intelligence has been increased a lot which results in the increase in quality of applications in the industry in recent years. Day by day the industry investments in AI are increasing rapidly and governments are trying to find that with this AI technology they can help others. There are already many applications based on artificial intelligence (AI) which are visible in healthcare sectors, public safety, transportation, service robots, education and entertainment, and also slowly it will be available in more fields also.

Artificial Intelligence is one approach to create a computer system or device in a way similar to the human's thoughts and thinking [3]. AI is attained by doing study on the human brain and its capabilities like thinking, learning, taking decisions, and working. Then the results of this research will be a basis for developing intelligent software and AI systems. Above all AI is a study and development of intelligent machines and software that can reason, gather knowledge, learn, communicate, manipulate and to distinguish the objects.

This paper will elaborate you about the implementation of ambient intelligence methods and technologies for monitoring the public safety mainly in the public places such as parks, where there are more children to play, walking area, and the benches for sitting, schools and malls etc. Moreover the trees and the occlusion makes the area more complex, which requires multiple cameras so that to cover the entire area with each and every corner of the park or the mall for public safety.

Video camera based systems such as *visual surveillance applications*[1] are generally considered a high and rich source of local intelligence and also it covers a wide range of video with high quality that detects the people but the technology used for face detection was a little bit low quality but now slowly it is getting improved but also it costs very high that it is the reason this technology is not used in all places. Even in 3D calibrated cameras, there is a lack of technology which we have to update in the upcoming years.

This application uses the Passive Infrared (PIR) sensors. This sensor detects a human being moving within a range of 10m from the sensor. These sensors are currently used in some public parks, lift lobby, for garden lights and in shopping malls also. These sensors are used to trigger activation of the *surveillance cameras*.

Wireless connected PIR based sensors[2] with advanced Artificial Intelligence(AI) – This AI technology is to provide drastically improved tracking and identification of all people who is entering into that zone/area.

In this paper, we will explain majorly two complementary aspects: on one side, a new idea which allows accurate tracking of people in public places in multiple cameras. Basically Video Surveillance requires the identification of the subject in the zone and if, the subject moves; its identity must be preserved to analyze its behaviour. This is a challenging task in video surveillance, since the identity must be maintained also when the subject moves from one place to another from the camera viewing field. Nearby cameras may or may not have a viewing field. If there are uninterrupted cameras the only feature used to retain ownership of the moving title is its visual appearance.

On the other side we will introduce wireless PIR sensors so that it can straight forwardly used as a trigger for computer to know the entry or exit or any action done by human in a specific zone. Moreover, specifically, they can be used to measure and provide the speed, size and direction of any particular person present in that specific area. However, it requires sufficient training to specifically identify the number of persons in the zone.

2 AI Applications for Investigation of crime and Safety of Public

Extensive research has been done for AI related applications on public security and safety with various techniques. One important application of AI is “facial recognition”, it is set up in many public places[4].

To form an individual’s identity, intelligence investigators often reckon on facial images. Processing the large number of video clips and image data in fast and accurate way is not only meticulous also time-consuming task. It also has more scope for errors caused by human due to various factors such as tiredness, fatigue but, where as machines or computers don’t get tired like humans.

With the initiatives under “Janus Computer-Vision” project of Intelligence Advanced Research Projects Activity(IARPA) researchers are making experiments on algorithms which can be used for distinguishing between person to person using the features and expressions of face like a human.

AI techniques are used in medical field for interpretation of radiological images for investigating criminals. It also gives clarity to medical analysts about cause of death.

AI techniques have been explored and used in forensic science, DNA analysis which may imply to identify the criminals. AI techniques are becoming key tools in fraud detection also.

3 Artificial Intelligence(AI) Research areas – Public Safety and Security

The AI research that mainly falls into these areas with respect to public safety and security: public security and safety through analysis of video and image data, DNA analysis, rescue missions, natural disasters, gunshot detection and crime forecasting.

3.1 Public security and safety through analysis of video and images

Video clips and image data analysis is used extensively in law enforcement communities to obtain information about people, objects, and actions to support criminal investigations. However, the

analysis of video and image information is very labour-intensive, requiring expert people with subject matter. This analysis also has more scope to error by human due to large volume of data.

AI techniques provide the solution to overcome such human errors. Traditional computer algorithms are limited to features like eye shape, colour and distance between eyes for facial recognition and pattern analysis. AI algorithms related to video and image learn complex tasks and also develop and identify their own independent facial features, parameters to attain these tasks, beyond what humans may do. These AI algorithms have the capability to match faces, techniques to identify weapons and other hazardous objects. Also these AI technologies detect critical events like crimes and accidents[4].

3.2 DNA analysis

Over the years we are taking the help of forensic testing, DNA finger prints for processing of evidences in scientific way for investigating criminal cases. But sometimes these have unprecedented impact on investigation.

AI could revolutionize DNA evidence – but we cannot blindly go with the machines[9]. DNA evidence sometimes is not as perfect as we think. Presently sensitive and high-precision techniques are in place, developed over the years. These techniques can help police in detecting small remnants of DNA at the place of crime. But sometimes the clues from culprit are mixed with other people who are there at the crime scene due to handshake or touch etc., this leads to convicting a wrong person as the culprit or criminal.[5]

Algorithms are also available to separate DNA soup to estimate the relative quantity of each person's DNA in a sample. These "*Probabilistic genotyping*" techniques are used by the investigators to find the possibility of existence of an individual's DNA in the mixed sample got from the crime location.

In present scenario, more advanced artificial intelligence techniques are to be developed to extract DNA profiles [6] ensuring consistency, reducing variability and to look for if a DNA sample came from the actual culprit who was at the crime location directly, or if it had just been ingenuously transferred.

3.3 Gunshot detection using AI

AI algorithms can be used in gunshot analysis with the help of pattern signatures.

Many people are using gunshot detection technology across the globe. Those are mostly high-cost systems that ultimately depend on humans for differentiating between gunshots and non-gunshots. Thus, a scalable gunshot detection system would be a great advantage for different cities across the world. Further, the system should be low cost and high accuracy[7].

The scientists are developing algorithms using well defined mathematical models for detecting gunshots, muzzle blasts, determine timings of shot-to-shot, the number of firearms and calculate probabilities of class and calibre; these all could help enforcement agencies in investigations.

Presently, some agencies are there to provide AI based security services related to Gunshot detection and tracking through smart video threat detection and response systems (eg.SafeSchool & GunLockers) with available camera system. It uses both video and audio detection for identifying threat in schools[8]. Subsequently, the information can be passed to security personnel through messages, apps or email within seconds as soon as gun is detected in CC cameras. Further, lockdown could be activated with press of a button, before gunfire.

3.4 Crime forecasting with AI techniques

In criminal investigation, Predictive Analysis is used by police personnel and other professionals, who have expertise over several years. But, this process is complex and time consuming.

AI techniques can be used to predict and point out people at risk by identifying the criminal enterprises. This uses large amount of data on social information, law, and legal precedence to suggest rulings. It could potentially increase the speed of criminal investigations using Artificial Intelligence.

The machine learning and AI concept has been jumped from science fiction to the real world. The main idea is to predict when an offence is going to happen, so that measures can be taken to prevent it. This is can be achieved by AI techniques.

One such example is “Tech firm PredPol - Predictive Policing”[10], This guides police on patrolling by using its machine learning prediction algorithms. Historical datasets (2 to 5 years data) are used to train the algorithm with an updation of new events every day they receive. They claim that 10-50% improvement of crime detection will be there in some cities by their analytics algorithms.

It takes the type, location and time of crime. Predictions are displayed as red boxes on an internet interface via Google Maps. Each box has 150×150-meter square. The boxes represent the highest-risk areas for every day and for the corresponding shift: day, swing or night shift. Police were instructed to spend roughly 10% their shift time patrolling PredPol boxes.

3.5 Artificial Intelligence for Rescue Missions

What we majorly require is that the use of Artificial Intelligence and technology to make sure that help arrives faster. We will start by developing systems which help first responders find victims of fireside accidents, earthquakes, floods, and the other natural disasters.

Often, responders got to examine aerial footage to work out where people might be stranded. However, exploring a huge number of photos and drone footage is extremely time consuming and labour intensive. This is often a time critical process and it'd alright be the difference between life and death for the victims.

An Artificial Intelligence system developed[11] at Texas A&M University permits computer programmers to write down basic algorithms which will examine detailed images and locate missing people within two hours. The Singapore Civil Defense Force (SCDF)[12] has deployed UAVs in monitoring activities outdoors and publicly spaces, like fire tracking, surveillance, and Search and Rescue missions. The mixing of those systems complements current operations and aims to enhance operational effectiveness. An example is SCDF’s use of a Red Rhino Robot (or 3R) for autonomous fire detection, with an auto heat-seeking mechanism to assist find heat sources. This robot can potentially reduce a standard four-man crew to a team of three, and penetrate far deeper into the seat of fireside without risking a person's fire fighter.

3.6 Responding to natural disasters

Factors like global climate change and increased urbanization, the amount of natural disasters – and therefore the amount of individuals they affect – continues to grow. Governments round the globe have used AI as a comparatively cheap and impressively effective way of detecting:

- Where natural disasters will occur
- Which areas are going to be hit hardest
- The mitigation systems that are presumably to fail
- Which communities and demographics are going to be within the most danger
- What actions are presumably to mitigate the impact of the disaster and its after-effects.

On average, flooding in India causes economic losses of an estimated US\$7.4 billion a year [13]. Three months after the floods of 2018 left more than 1,400 dead, the country's Central Water Commission partnered with Google to make a flood warning system. This approach uses AI technologies, geospatial mapping and water data analysis to warn when a flood is coming and where, so agencies can take action. CWC and Google sent out the primary alert in September 2018, warning residents of Patna about heavy rain and certain flooding. It was recently announced that the Google Flood Prediction System is now active throughout India and uses a very sophisticated AI [14].

4 Facial Recognition (current scenario in Asia)

Facial recognition are going to be a big topic for the 2020 Olympic Games in Tokyo (postponed to September 2021). This technology are going to be wont to identify authorized persons and grant them access automatically, enhancing their experience and safety.

In India, Face Recognition(FR) System is undergoing test trials at airports to assist move people through security much faster and safer. The Rajiv Gandhi International Airport(Hyderabad) has initiated FR system on a trial basis for passengers for entry into the aerodrome from July 1, 2019[15].

In India, the Aadhaar project[16] is that the largest biometric database within the world. It already provides a singular/unique digital identity number to 1.26 billion residents as of August 2020. UIDAI, the executive authority, has announced that face-to-face certification will be presented in phased releases. Face authentication are going to be available as an add-on service in fusion mode along side another authentication factor sort of a fingerprint, Iris, or OTP. India could also launch the world's most comprehensive facial recognition system by 2020.

The National Crime Records Bureau (NCRB)[17] has issued an RFP inviting bidders to develop a nationwide face recognition system. consistent with the 160-page document, the system will be a webized central web application hosted at the NCRB Data Center in Delhi. It'll be available for access to all or any the police stations. it'll automatically identify people from CCTV videos and pictures. The Bureau states that it'll help police catch criminals, locate missing people, and identify bodies.

Telangana [18] claims to be the first state in India to use AI-based facial recognition to effectively affect COVID-19 by ensuring that those on the streets wear masks and adhere to social distancing and other safety measures to curb the spread of COVID.

Intelligent safety systems: AI technology can provide safety through intelligent command centers with sophisticated surveillance systems that would keep track on human movement, potential crime incidents, and the general safety of residents. Social media intelligence platforms can provide assistance to public safety by collecting information from social media and predicting potential threats and activities that would disrupt public peace. within the city of Surat, the crime rate has dropped by 27% after the launch of AI-enabled security programs systems.

Improving public safety: Cities in India today are hotbeds for a variety of crimes. Smart cities aim to deal with the problems of increase in crime and increased risk of urban emergencies through improved city construction and surveillance analytics. Some Smart Cities have already started implementing these features through specific projects. Pune, for instance , has launched The Pune Street Light Project to set off energy efficient street lights which will be remote controlled through a Supervisory Control and Data Acquisition (SCADA) systems. Surat has built a network of quite 600 surveillance cameras installed in all major locations within the city, Also as partnered with Microsoft to develop solutions for water management and city planning solutions. Because of the large amount of data they can build, smart cities are more active in AI application, which can make sense of the data being generated, and transform it into predictive intelligence – thus transitioning from a 'sensible city' to an 'intelligent city'[19].

The Singapore Civil Defence Force (SCDF) has used AI based UAVs to monitor operations outdoors and in public spaces, like fire tracking, surveillance, and Search and Rescue missions.

5 Some of the AI based Solutions for Public Safety and security

Cognitive Enabled AI System Boost Public Safety with

- Accelerate the reaction time of emergency vehicles
- Creating a better approach to public health
- Detection and deactivation of robotic bombs Detection based on drones
- Smart AI monitors for social media scanning
- Upgrade vehicles with AI sensor to stop accidents
- Credit-Card fraud and Cyber-Crimes detection.
- Implement Robot security at banks, ATMs, and other public places.
- Emergency helping points in campus, parks, railway stations, malls, visiting places etc.
- Replace legacy systems with standards based systems
- Use of Machine Learning and Deep Neural Networks for better decisions and predictions

6 AI based Real-Time Safety Solutions

- Mobile Alerting- Emergency Alert Messages and Public Alert System, Incident and Crisis Response Tracking, Pervasive Intelligence, Safety Connections, Smart Notifications, Passenger Information and Self Services, Chat and Voice Escalation.
- Real-time video analytics- Security and protection, critical facilities, supercharge surveillance, portable cameras, event detection and prediction. Crowd monitoring and Staff tracking, real time video content analytics.
- Build Community Resilience and ensures safer environments, Strengthen communities by preventing and reducing crimes, Building Resident Resilience helps us to stay in Smart cities
- Smart City Operations, the essential ICT functions include using sensors, CCTV, smart energy meters, social media engines for Real-Time activity observation.
- Crowd management, estimation of size, predicting behaviour, suspicion tracking objects and enabling rapid response in incidents.
- AI solutions for building Smart Mobility and Smart Public Facilities Systems such as Video Surveillance, Emergency Management, Digital City Services and Street Lighting Management.

7 Security and Law Enforcement

- Detect patterns and anomalous behaviour
- Predict crowd behavior and crime patterns
- Protect critical infrastructure
- Uncover criminal networks

8 Safety and Prediction

- Predict infrastructure disruptions with distributed sensor systems and pattern information
- Adapt operations for minimal impact

9 Conclusion:

By using AI and prognosticative policing analytics integrated with computer-aided response and live public safety video enterprises, enforcement are higher ready to reply to incidents, stop threats, stage interventions, divert resources, and investigate and analyze criminal activities. AI has the potential to be a permanent a part of our criminal investigation and safety scheme, providing help and permitting criminal investigation for professionals to raised maintain public safety.

One of the most important hurdles in AI adoption is low visibility for the work being done across the country. Government incorporates a distinctive role during this era of AI disruption. Not solely ought to government adopt AI to boost operations and public services, it conjointly has to manage the economic and social impacts of AI on alternative industries, and set the moral and policy frameworks for AI to be used safely in our communities.

Government can also take initiatives for spreading awareness on advantages of AI, Development of quality education in data science and AI, Impulse colleges / universities to adopt credit-bearing MOOC's in their curriculum. Promote cross disciplinary AI education.

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