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TRANSFORMING CRIMINAL INVESTIGATION THROUGH ARTIFICIAL INTELLIGENCE: AN INDIAN PERSPECTIVE

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Introduction:

Criminal Investigation are a critical component of the criminal justice process. The goal of an investigation is to find the truth of what happened, identify the people who have committed the crime, gather physical evidence, and successfully prosecute those individuals. Historically, police have used many methods to conduct criminal investigations, including physical surveillance; interviewing witnesses; obtaining confessions from the alleged perpetrator; and conducting forensic examinations of the crime scene and the physical evidence collected at the scene of the crime. Although these methods are still utilized today to investigate criminal activity, the emergence of sophisticated forms of crime, such as cybercrime; financial fraud; organized crime; and transnational criminal activity, is a significant challenge for law enforcement agencies throughout the United States¹. Additionally, the development and implementation of Artificial intelligence (AI) technology has changed the way investigations will be conducted in the future. AI is defined as the ability of computers to perform task normally performed by humans as a result of human intelligence, including learning and making decisions based upon data analysis; reasoning with information; developing new patterns based upon information; ascertaining future possibilities based upon the data interpretation. These capabilities can be utilised in conjunction with big data analytics; cloud computing, biometrics, and digital forensics to change the entire landscape of criminal investigations. In conjunction with technological advancements, India is focusing on the modernization of the police force as advances in technology are making crime much more complex and requiring to the police to develop highly efficient means of investigating crime. Initiatives such as Crime and Criminal Tracking Network and System (CCTNS) and the Inter-Country Justice System (ICJS) and providing Police, courts, all forms of incarceration, Forensic

¹ Stuart Russell and Peter Norvig, *Artificial Intelligence: A modern Approach* (4th edition, Pearson 2021)

laboratories, and Prosecution with integrated digital Infrastructures that Provide Communities with access to Comprehensive and real-time information about crime and Criminal offender immediately after the crime is Committed. These initiatives Provide Police with the means to improve their investigations by sharing Data and improving Coordination law enforcement agencies and the other components of the criminal justice system, as well as supporting a data-driven approach to policing. The Incorporation of Artificial intelligence (AI) into Criminal Investigation has transitioned policing from a reactive model to a proactive and intelligence-driven one. Through Rapid analysis of Massive Volumes of data, AI tools are able to reveal unseen trends, identify abnormal behaviour, anticipate future crime-prone locations, and help solve cases more quickly. However, advances in technology need to occur within the bounds of Constitution and laws so that justice operates fairly and accountability exists.

Concept of Artificial Intelligence in Criminal Investigation:

The Use of Artificial intelligence (AI) has changed the way Criminal Investigation are carried out in recent times as it is one of the advancements of new technology to the impact modern day law enforcement. To clarify this future, AI is the ability of the computers to automate specific task; thus, enabling computer system to complete task that typically require human intelligence based upon data, patterns, predicting outcomes or assisting with decision-making to promote the advancement of justice or to bring criminals and offenders to justice.²

With the vast amount of data generated from digital technologies in our society today, there is a tremendous growth of information every day due to electronic devices, including mobile phones and social media platforms (e.g., Facebook, Twitter), video surveillance cameras, financial Transactions (e.g., Credit and debit card purchases), email, and texting messaging. As a result of the amount of the data being produced across all digital mediums, investigators find it hard to review and evaluate all of the information available to them at one time. Data is too large to review manually so utilizing Artificial Intelligence will help to expedite the review process by evaluating the data quickly and providing relevant data to support an investigation; therefore, it relates to the field of law enforcement, AI is an integral part of today's policing strategies and practices and will continues to expand throughout the Criminal Justice System.

² John McCarthy, 'What is Artificial Intelligence?' (2007) Stanford University <http://jmc.stanford.edu/articles/whatisai/whatisai.pdf>

One of Main function of artificial intelligence in the criminal investigation process is to collect and manage data. AI-based systems assist investigators in collecting data from various channels and delivering it in an orderly fashion to support the collection of data and analysis of all data in one centralized location so that investigators can effectively retrieve the necessary evidence. In India digitalizing law enforcement and criminal records will improve the way enforcement agencies are able to share and cooperate with one another improving crime in investigation, thanks to initiatives like Crime and Criminal Tracking System (CCTS).³

Additionally, AI systems can assist investigators through pattern recognition. By utilizing machine learning, investigators can analyze historical records of crimes committed and find links between suspects, victims and locations, records of communication, and activities. As investigators use this type of data analysis, they may uncover hidden links that would not normally be noticed. When investigators deal with the complexities of crimes involving organized crime, cybercrime, financial crime/fraud and terrorism the volume of the data that is considered interconnected is incredibly large and will require extensive amounts of time to research.

AI systems also play an important role in predictive analysis. By studying crime rates and historical behavioural patterns AI, systems can predict potential criminal activity or help identify a location that is likely to be at a high-risk for future criminal activity. Predictive policing is what this method of policing is sometimes referred to as and it gives law enforcement agencies a way to allocate their resources more effectively and utilize prevention measures before crime happens. Even though predictive policing has shown a lot of promise as a new and efficient way to help reduce crime, there are still considerable public policy issues related to bias and discrimination that will need to be addressed before there is a widespread acceptance of predictive policing as an effective method of crime deterrence by law enforcement.

Also, Artificial Intelligence has changed the way we do investigations in forensics. There have been many advancements in technology that have aided law enforcement agencies in their ability to accurately and quickly conduct investigations into criminal matters, including advances in facial recognition technology, biometrics, and digital forensics and image analysis.

³ National Crime Records Bureau, Crime and Criminal Tracking Network & Systems (CCTNS) (Ministry of Home Affairs,GOI)

For Example, Facial recognition technology can identify a suspect from a surveillance camera image by matching it against previously stored images. Similarly, when law enforcement agencies use biometric identification (in this case, the use of fingerprints, irises scans and/or DNA profiling) to identify a suspect, they achieve a very high degree of certainty that they are identifying the correct individual. As well, digital forensic tools that use of artificial intelligence are designed to extract evidentially significant digital evidence from electronic devices (e-mail, social media, etc.) that can assist investigators.

Artificial intelligence systems that exist today rely on machine learning as the primary means through which they operate. As these systems use new data, their performance continues to improve. Therefore, with the increase in available data, artificial intelligence will continue to improve its ability to identify patterns and provide insights. This is unlike traditional software that is built around defined processes. Through the continued use of new data, Artificial intelligence systems can assist investigators to solve cases more efficiently and accurately than ever before.

The integration of Artificial Intelligence into the criminal investigation process represents a significant a step forward in the modernization of the Indian criminal justice system. AI does provide many advantages in relation to improving efficiency, increasing accuracy, and aiding law enforcement agencies in preventing crime, but these advantages need to be aligned with the fundamental principles of the Constitution, right to privacy, and legal protections established by statute. Consequently, it is possible to see AI as a complement to human investigators rather than as a substitute for them; AI will enhance the effectiveness of criminal investigation through the application of technology.

Technological Transformation of Criminal Investigation in India:

India has made great strides in modernizing its criminal justice system with an emphasis on technology. The introduction of the Crime and Criminal Tracking Network & Systems (CCNTS) has enabled law enforcement agencies to connect with the one another and share data through a single national platform that provides them access to both criminal records and investigation information.

The Inter-Operable Criminal Justice System (ICJS) connects police, courts, prisons, forensics laboratories and prosecutors into one overall system. This integration allows for all

participating agencies to share information regardless of which agency collected the information. By implementing a “One Data/One Entry” philosophy, redundancy is eliminated and coordination between participating agencies is improved. This framework also utilizes analytics as well as artificial intelligence when performing criminal investigations.⁴

In addition to ICJS integration, recent trends indicate that governments are becoming increasingly interested in applying predictive policing using AI technology for the crime forecasting. AI technology has been utilized by many police agencies when creating trend analysis reports on the incidence of crimes throughout their areas, evaluating the risk they pose to citizens and determining potential offenders based upon information contained in police reports or known about individuals. Several agencies have also developed AI databases that allow them to create suspects profiles, search for patterns of behaviour associated with specific offences and extract information from FIRs to assist them in identifying suspects. These developments demonstrate India’s movement towards data- driven methods of policing and smart criminal investigation methods.⁵

Applications of Artificial Intelligence in Criminal Investigation:

Predictive Policing:

Using Data analysis of a criminal’s previous offences to predict the chance of that criminal committing an offence in the future represents one of the most significant ways in which artificial intelligence can be applied to assist police investigations.

Data analysis allows for an in-depth evaluation of many different aspects of crime, i.e., location, time, methods, trends and historical reference to offenders, in order to determine future potential areas for crime occurring. This will assist law enforcement to allocate resources appropriately and take steps to prevent crimes occurring before they happen.⁶

In relation to India, predictive policing/AI is being examined as part of an advanced policing framework relating to Crime and Criminal Tracking Network and Systems (CCTNS) modernization. These initiatives may enhance the capacity for policing to prevent crime and to

⁴ United Nations Office on Drugs and Crime (UNODC), Artificial Intelligence and Criminal Justice (UNODC 2024)

⁵ <https://nij.ojp.gov/>

⁶ Andrew Guthrie Ferguson, The Rise of Big Data policing (New York in City Press 2017)

be operationally efficient.

However, there are major concerns regarding issues such as algorithmic bias, discrimination in policing of specific communities and the over- policing of a specified community. Therefore, there are ongoing auditing and oversight of predictive models.

Facial Recognition Technology:

Facial recognition Technology (FRT) is now widely used as an investigative tool. AI Facial recognition Systems compare captured facial Features from images or videos through CCTV and other sources to identify potential suspects using pre- existing databases.

The Use of facial recognition significantly decreases the time spent identifying suspects and provides investigators with a tool to track recidivist offenders. Additionally, FRT can be utilized to locate missing persons, identify unidentified deceased individuals, and monitor the movements of criminal offenders.

Despite the advantages that FRT provides to law enforcement, there is still much concern and controversy concerning the issues of accuracy, false positives, violations of individuals' privacy rights, and mass observation by the government. There are also many critics of FRT who believe that improper use could result in the wrongful identification of a suspect and infringe upon civil rights.⁷

Biometrics in Crime Investigations:

Biometrics is used increasingly for criminal investigation using crime scene identification methods such as DNA, fingerprints, iris scans, and facial features. With the use of Artificial Intelligence, some of the biometric systems being used by investigators today have advanced capabilities for biometric collection and analysis of the multiple biometric all at the one time; these new AI-based biometric systems have the ability to detect a suspect's identity even if they try to change their physical appearance.

Biometric databases are extremely valuable for solving repeat offender cases and assisting in

⁷ National Institute of Standards and Technology (NIST), Face Recognition Vendor Test FRVT Part 3: Demographic Effects 2020

the accuracy of investigations. The collection and analysis of biometric data also must comply with stringent regulations to ensure the long-term storage and use of biometric data is protected from misuse and unauthorized access.

Digital Forensics in the Digital Age:

The Digital world represents the largest evidence sources of investigations with electronic devices playing a critical role in how criminals commit their crimes. Examples of devices which may contain evidence are mobile devices, computers, storage in the cloud, social media accounts, and communication apps.

AI can help digital forensic experts and filter data from large data sets, identify suspects' communications, and find hidden digital evidence. With the immense data produced, AI digital forensic tools can rapidly review, analyze, and shift through tons of database records versus the lengthy process of human digital investigators conducting their investigations.

With continued increases in cyber-crimes, as predicted by the cyber-crime specialists, AI will continue to be at the forefront of Digital forensics in the future to support criminal investigations.

Analysis of Crime Scenes:

The use of artificial intelligence in both forensics and crime scene reconstruction is gaining popularity. AI-based (artificial Intelligence) image recognition programs can analyze pictures taken at crime scenes in order to find patterns that will help reconstruct events that happened, as well as to discover and identify evidence that might otherwise be overlooked.

Use of high-tech tools such as virtual crime scene simulation, augmented reality simulation, and intelligence forensic analysis tools will contribute to producing more accurate results from the investigations. Experts have recognized that AI is having a huge effect on how crime scenes are analyzed as well as how forensic investigations are conducted.

Legal Framework to Control Technical Investigations in India:

When investigating a criminal case using technology, an investigator must include it within the framework of Indian constitutional law and/or statute.

By virtue of Article 21 of the Indian Constitution, the right to life and personal liberty is guaranteed. The Supreme Court of India ruled that the right to privacy is a fundamental right in the landmark decision of justice K.S Puttaswamy v. Union of India⁸; therefore, any technological surveillance system must be lawful, necessary and proportionate to the aim sought for.

In addition to Indian constitution of Bharat Nirman act, the Bharatiya Nagarik Suraksha Sanhita,2023 and the Bharatiya Sakshya Adhiniyam, 2023 define the procedural/evidentiary scope of electronic evidence and criminal investigation.

In addition, the Information Technology Act, 2000 also plays an important role in determining how to conduct investigations into cybercrime using electronic records.

The enactment of the Criminal Procedure (Identification) Act,2022⁹ has improved methods for obtaining biometric data from individuals involved in a criminal investigation helping to make identification methods through technology available across the Criminal Justice System.

Advantages of Artificial Intelligence in Criminal Investigation:

The many advantages associated with the application of AI (artificial intelligence) will result in significant value added for the investigator.

The first benefit of AI applications is that they will improve efficiency, as they can process an incredible amount of data much quicker than a human can. The second benefit of using AI is improved accuracy through the advanced capabilities of recognizing patterns and analyzing data. The third benefit of AI will be to give law enforcement the tools to identify crime trends and anticipate where crime may happen in the future, which will lead to more effective policing. As well, using AI technologies and applications can help decrease the nature of working on administrative tasks, thereby allowing investigators to spend their time working on complex analytical activities. Finally, through the use of AI application technology, investigators can improve their use of forensic science to analyze evidence and to identify potential suspects.

⁸ (2017) 10SCC 1, AIR 2017 SC 4161

⁹ Ministry of Electronics and Information Technology Government of India, Digital Personnel Data Protection Act 2023

Additionally, integrated systems such as the Integrated Criminal Justice System (ICJS) can help law enforcement agencies and other Criminal Justice (CJ) entities work more cooperatively, resulting in faster investigations and improved delivery of justice.

Challenges In Ethical Dilemmas and Issues:

AI presents innumerable ethical challenges, though there are numerous benefits to implementing it.

The top ethical concern regarding AI is related to personal privacy. The ability to collect and analyze massive amounts of personal information poses a risk for governmental abuse through surveillance. Recently, the extensive use of Facial recognition systems and biometric databases has sparked an ethical debate regarding the right of individuals to maintain their privacy and hold government accountable.¹⁰

Another ethical dilemma associated with AI is the presence of algorithmic bias. AI systems are designed to learn from their respective datasets, but if the underlying datasets contain inherent bias, then the outputs will reflect that bias. As an example, predictive policing tools will target a community in a biased way if they are based on historical crime data that reflects systems inequalities in society.

A further ethical issue associated with AI is the lack of Transparency/explainability that exists with these types of AI algorithms. Many AI algorithms run as “black boxes” where it is very difficult to see how algorithms make decisions. This creates ethical issues for criminal proceedings since there should be a reasonable expectation that prosecutors and defendants should have access to the evidence that supports a level of scrutiny associated with any type of evidence or investigative technique.¹¹

As it relates to ethical issues, investigators now have to determine what type of digital evidence is “real” and what is “fake” (e.g., audio, video, image files) due to the rise of AI- generated products such as deepfakes.

¹⁰ Weapons of Math Destruction (Crown Publishing 2016).

¹¹ Organization for Economic Cooperation and Development (OECD), OECD Principles on Artificial Intelligence 2019

Lastly, issues with cybersecurity create a massive ethical concern. Cybercriminals have the potential to hack into criminal databases, obtain biometric information, and retrieve investigative records. This could threaten both individual privacy and national security.¹²

Future of Criminal Investigation:

In the near future, it is anticipated that the criminal investigation process in India will involve a much greater use of emerging technologies- such as Artificial Intelligence (AI), big data analytics, and blockchain (distributed ledger) systems, as well as digital forensics techniques and advanced intelligent surveillance systems¹³. For example, AI- based solutions will likely support real-time evidence assessments, behaviour assessments, and automated case management for law enforcement officials.

The national government's commitment to modernizing its criminal justice system through the expansion of the Centralized Criminal Justice (CCJS) network and the Integrated Criminal Justice System (ICJS) supports the use of current trends in technology as well. Future uses of these technologies will likely include such advances as predictive analytics, developed biometric identification systems, intelligent crime mapping, and a nationally integrated criminal database.

Successful implementation of these new technologies will depend on the creation of comprehensive legislation to govern the use of AI technology in law enforcement (AI Law), robust privacy protection legislation, independent oversight mechanisms, transparency requirements, and accountability legislation.

Conclusion:

The Introduction of AI technologies have the potential to revolutionize how the criminal investigation process operates in India. Current initiatives undertaken by India, including the Centralized Crime Tracking System of India (CCTNS), the integrated Criminal Justice system (ICJS), biometric identification technology, digital forensics, and AI- assisted tools, have all been designed to improve the effectiveness, efficiency, and overall operations of the law enforcement agencies to process large amounts of data, identify suspects more accurately, and

¹² For the Economic Forum, Global Risk Report 2025

¹³ NITI Aayog, National Strategy for Artificial Intelligence (Government of India 2018).

make predications as to the likely occurrence of the crimes and the adequacy of forensic analyses.

Nevertheless, there will be some critical concerns associated with the use of AI technology in criminal investigations, including the need to provide adequate privacy protections, concerns about how AI technology is used in determining the legitimacy or bias of police investigators, concern about the transparency of the AI process, and concerns with the reliability of AI-related evidence in any potential prosecution. Therefore, the challenge for public policy holders will be able to find the appropriate balance between advancing technologies and preserving the constitutional and fundamental rights of individuals.

AI cannot be used as an alternative or Substitute for human investigators but will serve best when used as supports and enhancement to all the human- related investigations through appropriate regulation of AI, establishing and enforcing ethical standards for the use of AI, and holding agencies responsible for their use of AI to improve law enforcement in India's Criminal Justice System.

