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HARNESSING MACHINE LEARNING FOR PROTECTION OF VICTIM RIGHTS IN THE CRIMINAL JUSTICE SYSTEM

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ABSTRACT

The right to access timely information, protection, participation and redress are key to a fair criminal justice system of victims. Machine learning (ML) can provide the means of enhancing the victimization detection, tailoring support, predicting the risk of becoming a victim (e.g., in domestic violence), and minimum resource allocation. Nevertheless, historical bias, loss of privacy, and diminished participation or procedural justice are also potential outcomes of unprotected use of ML systems. This article summarizes the recent information on ML applications in the area of victim protection, suggests a victim-centered ML framework that should stress its transparency, fairness, and privacy-by-design, and provides an implementation roadmap along with legal and ethical guardrails. Suggestions include human control, auditability, participatory design with survivors, and legal protection to help ML empower, instead of undermine, the rights of survivors.

Keywords: Victim rights, machine learning, criminal justice, fairness, transparency

1. INTRODUCTION

The emergence of machine learning (ML) is a turning point in the criminal justice system, as it allows shifting law enforcement to proactive victim protection. Machine learning algorithms are also a subset of the larger field of artificial intelligence and examine large volumes of data to identify trends in criminal behaviour, forecast at-risk zones, and customize victim services. These technologies have made judicial processes efficient, transparent, and

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just and have resolved historical issues of underreporting of crimes, lack of resources, and the delay in the delivery of justice[2].

ML is being introduced in law enforcement and judicial processes worldwide to aid in predictive policing, assessing the risk to victims, and identifying threats in real-time. An AI-based system is used to assist case management, legal research, and victim counselling interfaces in India and elsewhere to provide timely psychological and procedural advice. With the evolution of crime in terms of complexity and transnationalism, especially in areas such as human trafficking and cybercrime, ML models are important to mark vulnerable groups and link them to preventive and remedial systems[3][4][5].

Nevertheless, although this prospect of ML in enhancing the rights of the victims is quite important, it should be restrained by the moral control. The issues of privacy, bias in the algorithms, and automated profiling explain the importance of establishing governance mechanisms that would guarantee the dignity of the victims, justice, and responsibility. An ethical approach to machine learning hence incorporates a balanced understanding of technology effectiveness and constitutional values and procedural justice. It is a cross-section of law, technology, and human rights, which is the new paradigm of AI-assisted victim protection a paradigm shift intended to bring to life compassionate justice with the help of computational intelligence.

The rights of the victims are a crucial component of the criminal justice system that guarantees that the victims of the crime receive justice, dignity, and fair treatment. The right to information, the right to participate in the proceedings and the right to compensation or rehabilitation have all been included in the idea of victim rights. Nevertheless, even when legal frameworks and institutional apparatus are progressive, victims report to face systemic hurdles like delays in the system, secondary victimization, and failure of justice agencies to communicate with the victim in a timely manner.

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[2] TECHUK, https://www.techuk.org/resource/all-you-need-to-know-about-ai-adoption-in-criminal-justice.html, (last visited Oct. 20, 2015)

[3] NJAGOV, https://nja.gov.in/Concluded_Programmes/2021-22/P-1281_PPTs/2.Introduction%20of%20Artificial%20Inteligence%20in%20the%20Judicial%20System.pdf

[4] Kristen Bell, Jenny Hong, Nick McKeown, Catalin Voss, A New Direction for Machine Learning in Criminal Law, HAI STANFORD UNIVERSITY 1-7, (2021).

[5] Muskan Shokeen, Vinit Sharma, *Artificial intelligence and criminal justice system in India: A critical study*, 5 INTERNATIONAL JOURNAL OF LAW, POLICY AND SOCIAL REVIEW 156-162, (2023).

Criminal cases in the modern world have grown more complicated, with large volumes of digital evidence and cross-jurisdictional crime as well as data-intensive crime investigations. Such intricacy can usually cause strain among customary procedures of inquiry, prosecution, and support of victims. As a result, the need to have a technological intervention to enhance efficiency, accuracy and responsiveness of the justice delivery systems is increasing.

Machine Learning (ML) as the branch of Artificial Intelligence (AI) has become the game changer, having the ability to process vast amounts of data, detect latent patterns, and contribute to making informed decisions. ML used in a proper manner may lead to an increased level of protection of the victims and include predicting possible risks, customizing support services, streamlining routine administrative procedures, and prompt response to re-victimization or domestic violence. Nevertheless, unless they are ethically and legally protected, these technologies have a risk of violating privacy and sustaining discrimination.

2. VICTIM-CENTERED MACHINE LEARNING

The conceptual framework of Victim-Centered Machine Learning represents an emerging paradigm that integrates computational intelligence with restorative justice theory, human rights principles, and ethical AI governance to ensure that victims' experiences drive system design and outcomes. It focuses on embedding empathy, fairness, and procedural justice into algorithmic processes within the criminal justice ecosystem.

Victim-Centered Machine Learning positions victimsnot institutionsas the primary stakeholders in AI-driven justice processes. The framework aligns with the three-pillar model proposed by Impunity Watch (2025)People, Practice, and Policywhich ensures that technological efficiency is always subordinate to human dignity and victim needs. It emphasizes a shift from AI being a tool for institutional management to one that actively supports empowerment, recognition, and restorative engagement for the harmed party[6].

2.1 Structural Components

1. Data Integrity and Ethics Layer

[6] IMPUNITYWATCH, https://www.impunitywatch.org/wp-content/uploads/2025/01/Overview-Paper-Report-Artificial-Intelligence-and-Transitional-Justice-Framing-the-Connections-Impunity-Watch-Jan-2025.pdf, (last visited on Oct. 20, 2025)

This component ensures that AI models use ethically sourced, anonymized, and bias-audited datasets when processing victim information. It prevents secondary victimization caused by data exposure or insensitive classification. Algorithms must transparently explain outcomes to victims to maintain procedural fairness[7].

2. Human Rights and Dignity Layer

Drawing from victim-centered restorative practices, this layer underscores the protection of autonomy, confidentiality, and consent in digital interactions. Machine learning applicationssuch as predictive risk models and chatbotsmust be designed to uphold the victims' agency in decision-making, echoing responsive and realist legal theories that prioritize lived experiences over abstract norms[8].

3. Algorithmic Accountability Layer

To reinforce trust, the framework includes mechanisms for human oversight, explainable AI (XAI), and impact assessments on vulnerable populations. Key performance indicators should include fairness, non-discrimination, and victim satisfaction rather than efficiency alone[9][10].

4. Restorative Learning Loop

Inspired by restorative justice theory, this loop enables the AI system to continuously adapt based on victim feedback and contextual case data. Feedback-based model retraining helps address hidden biases and enhances sensitivity toward emotional, psychological, and cultural dimensions of victim experiences[11].

5. Policy and Governance Interface

The outer layer integrates with legal structures and institutional policies, ensuring compliance with victim rights frameworks like the EU Victims' Rights Directive and national AI

[7]Idat Mustari Sutarya, SuryoPrastiono, Ahmad Jamaludin, *The Law's Protection Against Children as Victims of Exploitation Artificial Intelligence-Based Cyberpornography*, 5 JOURNAL OF LAW, POLITICS AND HUMANITIES 3473-3487, (2025)
[8]*Ibid*.
[9] Guido Vittorio Travaini, Federico Pacchioni, Silvia Bellumore, Marta Bosia, Francesco De Micco, Machine Learning and Criminal Justice: A Systematic Review of Advanced Methodology for Recidivism Risk Prediction, 19 INT J ENVIRON RES PUBLIC HEALTH, (2022)
[10]*Ibid*.
[11] Dena M. Gromet, Tyler G. Okimoto, Michael Wenzel, John M. Darley,

governance models. Transparency reports and multidisciplinary audits—recommended by the OECD and UN initiatives—form the governance backbone[12][13].

6. Framework Visualization

Conceptually, the model can be visualized as a multi-layered architecture:

Inner core: Victim Data Empowerment (ethical collection and consent)

Middle rings: Human rights alignment, fair-learning algorithms, and restorative adaptation

Outer ring: Institutional governance, legal oversight, and policy feedback mechanisms

2.2 Theoretical Foundation

This framework blends responsive legal theory (law adapting to social change) with AI for Good ethics, positioning ML as an empathetic collaborator rather than a mere analytical mechanism. Its goal is not only to safeguard victim rights but also to redefine justice delivery as a participatory, transparent, and humane process in the era of intelligent systems[14].

Machine Learning (ML), which is one of the fundamental subfields of Artificial Intelligence (AI), can be defined as the computational methods that would allow systems to infer knowledge based on data, discover patterns, and render decisions or predictions with the minimum human intervention. ML is being applied in the criminal justice system in crime detection, predictive policing, case management, and decision support. Nevertheless, its use is not confined to offender-centric usage, it can be utilized in a transformative impact regarding the promotion of the rights of victims as well. Being an ethical design, the ML systems can help justice organizations to recognize at-risk people, anticipate the growth of violence, and provide immediate and individualized help to crime victims[15].

Another similarity that victim-based approach to ML has with technology is that technology is more of an empowerment tool and not a tool of surveillance and control. An example is that the patterns of re-victimization or domestic abuse can be determined through the

[12] GOV. UK, https://www.gov.uk/government/publications/ai-action-plan-for-justice/ai-action-plan-for-justice (last visited on Oct. 21, 2025)
[13] COUNCIL ON CRIMINAL JUSTICE, https://councilоncj.org/the-implications-of-ai-for-criminal-justice/ (last visited on Oct. 21, 2025)
[14] *Ibid*.
[15] Brandon L. Garrett & Cynthia Rudin, *The right to a glass box: rethinking the use of artificial Intelligence in criminal justice*, 109 CORNELL LAW REVIEW 561- 527, (2024)

application of early warning systems based on ML and with past case data, patterns can be determined. The spread of cases requiring emergency protection measures can be prioritized with the help of risk assessment tools, and the victims may be assisted in overcoming the legal process by chatbots-based support sites, which will also notify the victims of their rights and address them to support services. Evidence based decision making is also known to encourage consistency of institutional response, responsiveness to needs of the victim and sensitivity hence reducing the use of subjective or biased assessment[16].

The victim-based model of justice is grounded on three pillars namely dignity, privacy and participation. Dignity entitles the victim with a respectful and humane treatment throughout the legal process, privacy gives them the confidentiality of their personal and cases related information, and participation allows the victim to play an active role in the course and the decision-making process in which the victim is part of. Inclusion of this aspect of the principles in the design of the ML systems will ensure that the technology will not ignore human emotions and the justness of the law, but rather, they will complement each other[17].

Ethical ML governance is an attempt to bridge the rights protection and innovation. Defining ethical ML governance as a set of standards, policies and accountability control is aimed to achieve transparency, fairness, and responsibility of the AI technology deployment. It implies machine audits, explainability, use of data and human-based decision-making based on consent. Such systems of governance are able to introduce technological advancement into correspondence to the main points of the justice system, moreover, it can ensure that the use of ML in the criminal justice system should not undermine the rights of the victims, on the contrary, this tool can provide protection to them.

3. MACHINE LEARNING APPLICATIONS IN PROTECTING VICTIM RIGHTS

In the criminal justice and social welfare systems, machine learning (ML) is becoming more and more important in protecting and empowering victims through data-driven resource

[16]Hadjimatheou, K., Quiroz Flores, A., Weir, R. & Skevington, T., *Using unsupervised machine learning to find profiles of domestic abuse perpetrators*. 18 POLICING: A JOURNAL OF POLICY AND PRACTICE, (2024)

[17] POLICECHIEF, https://www.policechiefmagazine.org/using-ai-victim-response/?ref=d6a0f8068ea2455f73188056eefb791d (last visited on Oct. 24, 2025)

management, intelligent support, and predictive analysis. The applications can be broken down into four key areas that are pertinent to the protection of victim rights.

3.1 Predictive Risk Analysis

Risk of re-victimization, recurrence of intimate-partner violence and domestic homicide are now predicted with ML models using structured police and behavioural data. Algorithms like elastic net logistic regression, random forests, and super learners are used to regulate the variables such as the time of the previous incidents, intensity and the patterns of contact among the variables to predict the possible recurrence of violence. The systems can help police departments provide early warning and focus protection work, minimizing the amount of manual error that is inherent in human-only appraisals. As an example, the Domestic Homicide Forecasting Initiative in the UK showed that ML-based models are better than the current risk-rating instruments in predicting high-threat cases much earlier. These tools can therefore be used as risk vigilantes by law enforcers as they can help them intervene before it goes out of hand[18][19][20].

3.2 Automated Victim Assistance Systems

Smart chatbots and virtual assistants that are powered by AI have risen to become key elements in digital victim support systems. Examples of such projects include the ISEDA Chatbot in Europe and AI-based assistants discussed in the U.S. Office of Victims of Crime, both offer 24/7 information, and link victims to local legal, medical, and counselling services safely. Such chatbots fill the knowledge gap in non-availability of staff and provide trauma-informed and privacy-sensitive communication to the victims who need anonymity before they are revealed. Ethically designed engagements are aimed at being emotionally sensitive, protecting data, and providing non-judgmental advice whereas certain systems are also capable of storing digital evidence to be used in court under stringent ethical governance frameworks[21][22][23][24].

[18] PMC, https://pmc.ncbi.nlm.nih.gov/articles/PMC9751313/ (last visited on Oct. 24, 2025)
[19] Verrey, J., Ariel, B., Harinam, V. et al. *Using machine learning to forecast domestic homicide via police data and super learning*, 13 SCITIFIC REPORT, (2023).
[20] PMC, https://pmc.ncbi.nlm.nih.gov/articles/PMC10268549/ (last visited on Oct. 24, 2025)
[21]POLICE CHIEF MAGIZINE, https://www.policechiefmagazine.org/using-ai-victim-response/?ref=d6a0f8068ea2455f73188056eefb791d (last visited on Nov. 3, 2025)
[22]GOVERNMENT TECH, https://www.govtech.com/public-safety/how-ai-could-help-victims-of-domestic-violence-other-crimes, (last visited on Nov. 3, 2025)

3.3 Data Management and Evidence Analysis

Machine learning improves forensic investigations by automating the study of complicated digital and biological data. It accelerates and improves the accuracy of exams by processing high-dimensional datasets from DNA interpretation, fingerprint analysis, digital forensics, toxicology, and crime scene reconstruction. By examining previous testimony and digital communications to identify corroborating trends, AI also reduces duplicate interviews in victim statements, minimizing traumatization during repeated questioning. This analytical accuracy improves victim protection in court cases as well as investigation dependability[252627].

3.4 Resource Allocation and Service Optimization

ML applications are also transformational for managing constrained support resources. Algorithms assess service consumption data to forecast demand for shelters, counselling, or legal aid, allowing governments and non-governmental organizations to prioritize high-need situations and assign workers more efficiently. Data-driven solutions may automatically match victims with relevant care providers based on case type, urgency, and location, as well as identify underserved areas to improve infrastructure design. Integrating these decision-support tools promotes equitable and data-driven resource delivery to both urban and rural victims[2829].

4. LEGAL AND ETHICAL IMPLICATIONS

[23]Hanna Mielismäki and Marita Husso, *Ethical Implications of AI-Driven Chatbots in Domestic Violence Support*, 13 SOCIAL INCLUSION 1-23 (2025)

[24]RESEARCH ONLINE, https://researchonline.gcu.ac.uk/ws/portalfiles/portal/86215955/86183391.pdf (last visited on Nov. 3, 2025)

[25]Vodanović M, Subašić M, Milošević DP, Galić I, Brkić H. *Artificial intelligence in forensic medicine and forensic dentistry*. 41 J Forensic Odontostomatol, 30-41 (2023)

[26] Jiya Bhardwaj, Khushboo Goyal, Malsawmzuali C, Dr. Aashna Narula, Revolutionizing Forensic Science: The Role of Artificial Intelligence in Evidence Analysis, 3 International Journal of Interdisciplinary Approaches in Psychology (IJIAP) 101-116, (2025)

[27]Muhammad Arjamand1, Areeba Saleem, Abdul Basit, Subha Iftikhar, Muhammad Sharif, Muhammad Shahid Cholistani, Muhammad Farhan, Shumail, Bakht Ameer Khan, Zeeshan Ali, Bilawal Shahid, Muhammad Hasnain, *The Role of Artificial Intelligence in Forensic Science: Transforming Investigations through Technology*,10 INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH AND PUBLICATIONS 67-70, (2025)

[28]VICTIM SUPPORT EUROPE, https://victim-support.eu/uncategorized/using-ai-to-support-victims-and-youth-strengthening-all-crime-generic-victim-support-services/ (last visited on Nov. 3, 2025)

[29] SUSTAINABILITY DIRECTORY, https://sustainability-directory.com/question/how-might-ai-enhance-victim-support-services/ (last visited on Nov. 3, 2025)

AI-driven criminal justice systems have legal and ethical ramifications that include issues with privacy, data security, algorithmic bias, discrimination, accountability, explainability, human oversight, due process, and victim rights. These issues are governed by legal and ethical standards like the EU GDPR, India's IT Act, the DPDP Act 2023, and criminal justice ethics[30][31][32][33].

4.1 Data Protection and Privacy Laws

In India, the Information Technology (IT) Act sets civil remedies on the mishandling of sensitive personal data, and the Digital Personal Data Protection (DPDP) Act 2023 provides extensive financial fines in the event of a breach, opens up transparency, express consent, and rights of data principals, and follows international principles in safeguarding digital personal data[34][35][36].

DPDP Act is directly connected with the state regulation; it requires the presence of due process, especially when it is necessary to protect the interests of the citizens with the help of the access regulation of the data[37].

Focusing on the ethical use of AI in criminal justice, the GDPR of the EU focuses on legal consent, transparency, accountability, and data minimization.

Both regimes also mandate organizations to perform impact assessment, have strong security measures and ensure that data handling procedures are documented as a way of ensuring privacy and public confidence.

4.2 Algorithmic Bias and Discrimination

[30] LAWYER WORLDWIDE, https://www.lawyersworldwide.com/wp-content/uploads/Digital-Personal-Data-Protection-Act-2023.pdf (last visited in Nov. 4, 2025)
[31] EY COM, https://www.ey.com/en_in/insights/cybersecurity/decoding-the-digital-personal-data-protection-act-2023 (last visited on Nov. 4, 2025)
[32] Wang X, Wu YC, Ji X, Fu H., *Algorithmic discrimination: examining its types and regulatory measures with emphasis on US legal practices*. FRONT ARTIFICIAL INTELIGENCE 1-12, (2024)
[33] JOHNS HOPKINS UNDERGRADUATE LAW REVIEW, https://jhulr.org/2025/01/01/algorithmic-justice-or-bias-legal-implications-of-predictive-policing-algorithms-in-criminal-justice/ (last visited on Nov. 4, 2025)
[34] PWC, https://www.pwc.in/assets/pdfs/consulting/risk-consulting/the-digital-personal-data-protection-act-india-2023.pdf (last visited on Nov. 4, 2025)
[35] *Ibid*.
[36] EY, https://www.ey.com/en_in/insights/cybersecurity/decoding-the-digital-personal-data-protection-act-2023 (last visited on Nov. 4, 2025)
[37] *Ibid*.

Legal provisions make the distinction between explicit and implicit discriminatory intent in algorithm-based decisions taking into account both intentional and unintentional biases. Accountability usually requires an intent to be shown, but increased acceptance of the impact criterion is becoming more common, and structural discrimination can be recognized without bad intent[3839].

The predictive policing tools have a high potential to enhance the historical biases, strengthening the unfair results ("digital redlining"). The judiciary is becoming more cautious when it comes to the adoption of such tools, noting the necessity of the transparency, fairness, and mitigatory regulation to avoid the replication of the existing inequities by the algorithms[40].

4.3 Accountability and Explainability

AI systems in criminal justice pose concerns regarding explainability and accountability, as opaque algorithms can jeopardize defendants' rights to a fair trial and judicial review[41].

Ethical frameworks promote transparent decision-making, explicit documentation of algorithmic rationale, and the ability to conduct independent audits and challenges, all of which serve as the foundation for trustworthy and equitable criminal justice applications[42].

4.4 Human Oversight and Due Process

Human monitoring is critical for protecting due process, avoiding erroneous decisions, and upholding individual rights. The DPDP Act, GDPR, and court norms prioritize human review, contestability, and the opportunity to appeal algorithmic determinations[43].

Due process must be safeguarded by allowing impacted individuals to understand and contest AI-generated choices, especially in sensitive circumstances such as sentencing or risk evaluations[44].

4.5 Victim Consent, Autonomy, and Re-traumatization

[38] *Ibid.*
[39] *Ibid.*
[40] *Ibid.*
[41] *Ibid.*
[42] *Ibid.*
[43] *Ibid.*
[44] *Ibid.*

Criminal justice AI systems that use victim-related data require clear and informed consent and guarantee control of personal data.There is a need to minimize the possibility of re-traumatization, preserve confidentiality, and ensure that the victims are not subjected to unnecessary harm during automated procedures or data breaches to ethical deployment.Both the law and DPDP Act provide that referred to as redressal of grievance mechanisms must be provided (e.g. Appellate Tribunal) where the victim information.

5. FINDINGS AND DISCUSSION

The review shows that machine learning can have a strong potential to empower the rights of all victims in the criminal justice system, especially predictive risk assessment models, computer-controlled victim notification systems, and investigator and prosecutor decision-support tools. ML-based applications may be used to support early detection of habitual criminals, trends of domestic violence enhancement, and the severity of threats, enhancing safety measures against victims. Nevertheless, it is also true that, when designed improperly, algorithmic systems can also exacerbate biases, in particular, those related to marginalized groups; they can also result in new types of opacities to prevent access to transparency and procedural fairness by victims. Thus, although ML can potentially contribute to dignity, safety, and involvement of the victim, the lack of standardized ethical principles, inefficient victim information security conventions, as well as lacking the mutualization of ML developers and victim rights systems creates a significant policy-practice gap.In contrast to India, the comparative reports of the UK, Canada, and Australia show a higher level of digital victim-support integration. This calls for moderate policy changes, victim-focused AI standards, and cross-institutional governance to ensure that ML becomes a tool that enhances rights rather than a mechanism that diminishes them.

6. RECOMMENDATIONS

1. Provide an ethical AI/ML infrastructure to support victim service (e.g., by addressing the victim-rights tenets of dignity, privacy, informed-consent and participation).
2. Bring in measures through legal means to ensure algorithms get audited, biased, and that they are explainable before they are implemented in criminal justice.

3. Capacity-building programmes of police, prosecutors, and victim service agencies - educating them on how to understand the output of ML-based tools in a responsible way and not to be over-reliant on automation.
4. Create institutional control models like AI Ethics Boards, independent regulatory authorities and reporting standards on the use of ML in investigations.
5. Make sure that victim advocates and civil society representatives are also consulted during the design phase - in order to ensure that ML systems take into consideration lived experience, gender sensitivity, and psychological needs.
6. Develop safe information management models on the treatment of victim data - such as high levels of anonymisation, encryption, and limited access control.
7. Pilot test ML tools prior to full implementation - to determine actual implications on victim protection results.
8. Promote the cross-jurisdictional learning in those countries that have already implemented AI victim support models (UK, Canada, Australia) in order to be adjusted to the Indian context.

7. CONCLUSION

Machine learning can be used as a transformative method to enhance victim protection under the criminal justice system. When applied effectively, ML can assist in predicting the risk of victims and enhancing institutional receptiveness and aiding more equitable case management in the light of the available empirical trends instead of personal biases. Nevertheless, this is not an automatic promise. In the absence of robust ethical norms, algorithmic disclosure, as well as rights-based governance concepts, the ML systems are likely to generate discrimination, lack of transparency and privacy - thus undermining rather than strengthening protection of victims. Thus, the key issue is not whether or not ML should be used but how it is implemented. It is important to align the development of the ML with the legal protection and institutional responsibility and victim-centric design concepts. ML can become an empowering tool that supports a judgment that is sound, and a justice process in which the dignity, safety, and participation of victims are maintained through responsible integration, capacity building and ongoing auditing to make it happen.