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THE USE OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN CONTEMPORARY CRIMINOLOGICAL RESEARCH: METHODOLOGICAL APPROACHES AND PRACTICAL OPPORTUNITIES

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Abstract: This article examines the theoretical, methodological, and practical potential of using artificial intelligence technologies in the organisation and conduct of contemporary criminological research. Artificial intelligence is considered as a methodological tool capable of supporting data collection and systematisation, forecasting crime trends, assessing risk factors, identifying criminogenic areas, and developing evidence-based preventive decisions. Particular attention is given to the national "Criminology AI" platform currently being developed in Uzbekistan, which is evaluated as a promising scientific and practical solution for organising contemporary criminological research on a digital, empirical, and predictive basis.

Keywords: contemporary criminological research, artificial intelligence, digital criminology, "Criminology AI", criminological methodology, crime forecasting, Big Data, Geographic Information Systems, data mining, risk factors, criminogenic areas, evidence-based approach, crime prevention.

ZAMONAVIY KRIMINOLOGIK TADQIQOTLARDA SUN'IY INTELLEKT TEXNOLOGIYALARIDAN FOYDALANISH: METODOLOGIK YONDASHUVLAR VA AMALIY IMKONIYATLAR

Annotatsiya. Mazkur maqolada zamonaviy kriminologik tadqiqotlarni tashkil etish va amalga oshirishda sun'iy intellekt texnologiyalaridan foydalanishning nazariy-metodologik hamda amaliy imkoniyatlari tahlil qilingan. Maqolada sun'iy intellekt texnologiyalari kriminologik tadqiqotlarda ma'lumotlarni yig'ish, tizimlashtirish, jinoyatchilik dinamikasini prognoz qilish, xavf omillarini baholash, kriminogen hududlarni aniqlash va profilaktik qarorlarni ilmiy dalillar asosida ishlab chiqishga xizmat qiluvchi metodologik vosita sifatida ko'rib chiqiladi. Shuningdek, O'zbekiston sharoitida ishlab chiqilayotgan milliy "Criminology AI" platformasi zamonaviy kriminologik tadqiqotlarni raqamli, empirik va prognozli asosda tashkil etishga xizmat qiluvchi istiqbolli ilmiy-amaliy yechim sifatida baholanadi.

Kalit so'zlar: zamonaviy kriminologik tadqiqotlar, sun'iy intellekt, raqamli kriminologiya, "Criminology AI", kriminologik metodologiya, jinoyatchilikni prognoz qilish, katta hajmdagi ma'lumotlar, geografik axborot tizimi, data mining, xavf omillari, kriminogen hudud, dalillarga asoslangan yondashuv, huquqbuzarliklar profilaktikasi.

Introduction

Contemporary criminology is no longer limited to explaining crime solely through statistical indicators such as the number of offences committed, fluctuations in crime rates, territorial distribution, or classifications by type of offence. Crime is increasingly becoming a complex, multifactorial, and rapidly evolving socio-legal phenomenon. Its development is shaped by the combined influence of individuals' socio-demographic characteristics, economic pressures, family and domestic

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environments, urbanisation, migration, digital technologies, the information environment, territorial criminogenic conditions, mechanisms of social control, and the effectiveness of crime-prevention systems. Under these circumstances, criminological research should move beyond the mere description of crime and focus increasingly on identifying causal mechanisms, assessing risk factors, and forecasting potential future trends [1; 2].

In Uzbekistan, strengthening scientific approaches to crime control and the prevention of offending, improving the practical effectiveness of criminological research, and providing public authorities with scientifically grounded analytical support have become matters of particular importance. In recent years, specific legal and organisational foundations have been established to support scientific and applied research in criminology, enhance public safety, and develop crime-control activities on a stronger scientific basis. These developments reinforce the need to advance criminological research to a new stage by integrating contemporary research methods, digital analytics, and evidence-based decision-making [3].

Traditional criminological research relies extensively on statistical data, criminal case materials, investigative and judicial documents, crime-prevention reports, sociological surveys, and expert assessments. However, as the volume and complexity of such information continue to increase, processing it solely through manual methods or conventional statistical tables is becoming increasingly insufficient. Contemporary crime-related data are characterised by their large volume, diversity of sources, rapid updating, and multilayered structure. Artificial intelligence technologies can therefore provide criminological research with new opportunities to identify latent relationships within data, detect risk indicators, and strengthen the empirical basis of scientific conclusions [4; 5].

The significance of artificial intelligence technologies for criminological research lies primarily in their capacity to process large volumes of information within a relatively short period, identify recurring patterns, generate territorial risk maps, forecast crime dynamics, and support the targeted planning of preventive measures. In particular, machine-learning algorithms may assist in identifying relationships among factors associated with criminal behaviour; Natural Language Processing (NLP) technologies can be used to analyse meaningful features contained in investigative documents, citizens' applications, explanatory statements, and crime-prevention materials; and Geographic Information Systems (GIS) can facilitate the mapping and analysis of criminogenic areas. Such an approach makes it possible to move beyond merely responding to offences after they have occurred towards anticipating potential risks and directing preventive interventions at an earlier stage [8; 18].

In this context, the development of the national **"Criminology AI"** technology is of particular scientific and practical significance. The platform may contribute to adapting the capabilities of artificial intelligence to the specific legal, social, and criminogenic conditions of Uzbekistan. By conducting an integrated analysis of the type of offence, place and time of commission, characteristics of the offender, circumstances of the victim, socio-economic environment, territorial criminogenic situation, and other relevant factors, such a system could help transform criminological research from a predominantly descriptive model into a **digital, empirical, and predictive analytical framework** [9; 10].

At the same time, the use of artificial intelligence technologies introduces new methodological and ethical requirements for criminological research. Findings generated through AI should not be treated as absolute or self-sufficient truths, but rather as supplementary analytical outputs designed to strengthen scientific inquiry. Particular attention must be paid to algorithmic errors, imbalances and biases within datasets, misclassification, the protection of personal data, the risk of discriminatory outcomes, and the need for meaningful human oversight. This is especially important in criminological research involving personal information, criminal case materials, and sensitive data

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concerning victims and offenders, where legality, confidentiality, information security, and ethical standards must be strictly observed [11; 12].

From this perspective, the principal aim of this article is to analyse the methodological foundations, scientific and practical opportunities, and potential limitations associated with the use of artificial intelligence technologies in contemporary criminological research. The article examines AI technologies as methodological instruments for processing criminological data, identifying risk factors, developing criminological forecasts, supporting preventive decision-making, and enhancing the practical value of research findings. At the same time, it argues that **human oversight, expert assessment, legal safeguards, and methodological verification** must remain essential conditions for the responsible integration of artificial intelligence into criminological research [12; 14].

Research Methods

This article employs a **comprehensive methodological approach** to examine the use of artificial intelligence technologies in contemporary criminological research. The methodological premise of the study is that artificial intelligence should not be regarded as an autonomous decision-making entity within criminological research, but rather as an analytical instrument for conducting in-depth data analysis, identifying latent relationships, generating forecasts, and strengthening scientific conclusions with empirical evidence [14; 15].

First, the study applies the **systems analysis method**. This method makes it possible to examine artificial intelligence technologies not as an isolated technical component of criminological research, but as part of an integrated system encompassing the formulation of the scientific problem, the development of databases, methodological design, analytical procedures, forecasting, practical recommendations, and the verification of research findings. Such a systems-based perspective enables the role of AI to be assessed within the broader structure and logic of criminological inquiry [15].

The article also employs a **scientific and methodological analysis**. This approach is used to examine how the scientific problem, research questions, hypotheses, data sources, algorithmic models, analytical criteria, and procedures for evaluating results should be formulated in criminological studies involving artificial intelligence. From this perspective, AI-based research requires clear answers to such questions as: “What data are being analysed?”, “Which algorithm is being applied?”, “According to which criteria does the model generate its conclusions?”, and “How are the resulting outputs interpreted from a criminological perspective?” Such methodological transparency is essential for ensuring the scientific validity and interpretability of AI-assisted criminological research [15; 22].

The **criminological analysis method** constitutes one of the principal methods of the study. It is used to assess the capacity of artificial intelligence technologies to examine crime not merely as a collection of numerical indicators, but as a complex phenomenon associated with causes and facilitating conditions, criminogenic factors, individual behaviour, territorial risk levels, and the broader social environment. This approach makes it possible to evaluate AI-generated results in terms of their criminological meaning rather than relying exclusively on statistical associations [23].

The study further applies the **comparative analysis method**. Through this method, traditional approaches to criminological research are compared with the analytical opportunities provided by artificial intelligence, machine learning, predictive analytics, and evidence-based decision-making. The comparative analysis demonstrates that while classical criminological methods remain essential for explaining the theoretical, social, and legal dimensions of crime, AI technologies offer additional capabilities for rapidly processing large volumes of information, identifying recurring patterns, and estimating the probability of future risks. Accordingly, traditional criminological methods and AI-based analytical approaches should be regarded as complementary rather than mutually exclusive [18].

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The **legal and regulatory analysis method** is employed to determine the legal boundaries governing the use of artificial intelligence technologies in criminological research. AI-based criminological studies may involve the processing of personal data, criminal case materials, investigative and judicial documents, crime-prevention records, and information relating to individuals or groups considered to be at heightened risk. Consequently, the use of such technologies must be assessed within the framework of applicable legal requirements concerning data protection, confidentiality, security, and the protection of individual rights [11; 12].

An **empirical approach** is also established as a distinct methodological criterion. The quality of AI-assisted criminological research depends, first and foremost, on the reliability, completeness, and relevance of the data on which the analysis is based. For this reason, official crime statistics, criminal case files, investigative and judicial documents, crime-prevention reports, sociological surveys, expert interviews, information concerning territorial criminogenic conditions, and digital databases should be analysed in an integrated manner. The reliability of AI-generated findings is therefore directly connected to the quality of the underlying empirical evidence [16; 17].

The article also substantiates the necessity of using **expert assessment**. Results generated through artificial intelligence technologies should not automatically be accepted as final scientific conclusions. Rather, they should be reviewed and interpreted by criminologists, law-enforcement professionals, prevention inspectors, investigative and judicial practitioners, sociologists, psychologists, and specialists in digital technologies. Expert assessment makes it possible to determine whether AI-generated outputs correspond to actual criminological conditions, possess practical value, and carry a risk of erroneous or overly simplified interpretation [14].

Overall, the combination of systems, scientific-methodological, criminological, comparative, legal-regulatory, empirical, digital, expert, and verification-based approaches employed in this article enables a comprehensive assessment of the role of artificial intelligence technologies in contemporary criminological research. The integration of these methods allows AI to be evaluated not merely as a technological innovation, but as a methodological instrument capable of supporting an in-depth understanding of crime, anticipating criminogenic risks, and providing a scientific basis for preventive decision-making [14; 15].

Results

The findings of the study demonstrate that the use of artificial intelligence technologies can bring the content, methodology, and practical effectiveness of contemporary criminological research to a qualitatively new level. In this context, AI technologies should not be regarded as instruments that replace human reasoning in criminological research, but rather as **analytical and methodological tools** that support the in-depth analysis of large volumes of data, the identification of latent relationships, the assessment of risk factors, and the development of a scientific basis for preventive decision-making [4; 14].

1. Artificial Intelligence as a Tool for Expanding Criminological Research Methodology. Traditional criminological research generally examines crime through statistical indicators, criminal case materials, investigative and judicial practice, crime-prevention reports, sociological surveys, and expert assessments. Although these sources remain essential, as the volume and complexity of such information increase, conventional statistical or descriptive analysis may no longer be sufficient to reveal the complex causal structure of crime. Artificial intelligence technologies become particularly significant where territorial risk, individual behaviour, the social environment, economic factors, the digital sphere, and the effectiveness of preventive measures need to be analysed simultaneously [14].

According to the findings of the study, AI technologies provide the following major methodological opportunities for criminological research [6; 8]:

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first, integrating large volumes of data obtained from different sources into a unified analytical system;

second, identifying recurring patterns and latent relationships associated with crime;

third, automatically identifying and classifying risk factors associated with offending;

fourth, assessing criminogenic risks across territories, time periods, types of crime, and social groups;

fifth, forecasting potential future criminogenic trends;

sixth, evaluating the targeting and effectiveness of preventive measures.

Accordingly, artificial intelligence makes it possible to transform criminological research methodology from a conventional model of "data collection — statistical description — general conclusion" into a more advanced model of "data integration — algorithmic analysis — risk assessment — forecasting — preventive decision-making" [14; 18].

2. Principal Areas of AI Application in the Processing of Criminological Data. The effective use of artificial intelligence in contemporary criminological research requires the establishment of a complete data-processing cycle. Such a cycle may include the following stages:

data collection — cleaning — anonymisation — classification — digitisation — algorithmic analysis — expert assessment — formulation of practical conclusions [12; 15].

At the first stage, information on crime is collected from various sources, including official statistics, criminal case materials, investigative documents, judicial decisions, crime-prevention reports, citizens' applications, mahalla-level data, sociological surveys, and open digital sources. At the second stage, the data are assessed for duplication, completeness, accuracy, and logical consistency. At the third stage, personal data are anonymised in accordance with applicable legal requirements. At the fourth stage, the information is classified according to such criteria as type of crime, territory, time, offender, victim, cause, condition, factor, and preventive measure [11; 12; 15].

AI technologies can substantially increase the efficiency of criminological analysis within this process. For example, machine-learning algorithms can identify relationships among similar criminal incidents; Natural Language Processing technologies can extract meaningful units relating to causes and facilitating conditions from textual documents; and Geographic Information Systems can support the mapping of criminogenic areas. As a result, criminological research can be enriched not only by statistical indicators, but also by **internal patterns within data, spatial concentrations of risk, and analytically significant relationships among relevant factors** [7; 8].

3. The Role of the "Criminology AI" Platform in Contemporary Criminological Research. The national **"**Criminology AI" platform envisaged for development in Uzbekistan has particular scientific and practical significance for contemporary criminological research. The platform should be regarded not merely as a technical software product, but as a **national digital infrastructure for criminological research** designed to support the collection, analysis, forecasting, and practical interpretation of crime-related data [9; 10].

The scientific and practical potential of the "Criminology AI" platform may be reflected in the following areas [9; 10]:

first, integrating diverse crime-related datasets into a unified digital database;

second, automatically classifying the causes and conditions of crime;

third, assessing territorial levels of criminogenic risk;

fourth, forecasting potential upward or downward trends across different types of crime;

fifth, generating targeted recommendations for crime-prevention actors;

sixth, linking criminological research findings with management and policy decisions.

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Such a platform could elevate criminological research from the level of descriptive reporting to that of an analytical system capable of supporting practical decision-making. In particular, "Criminology AI" could serve as an important tool for assessing territorial criminogenic conditions, identifying groups exposed to elevated risks, allocating preventive resources more effectively, and detecting risks at an early stage at the mahalla level [9; 10; 19; 20; 21].

4. Opportunities for AI-Based Criminological Forecasting. The findings of the study indicate that one of the most significant capabilities of artificial intelligence lies in forecasting the potential future development of crime. Whereas traditional criminological analysis focuses primarily on offences that have already occurred, AI-assisted analysis can help assess **where, when, under the influence of which factors, and in relation to which types of crime** future risks may increase [6; 14; 18].

Forecasting may be conducted in several principal directions [18]:

spatial forecasting — identifying the districts, mahallas, or public places in which criminogenic risks may increase;

temporal forecasting — assessing the time periods, seasons, or other temporal intervals during which particular forms of crime may become more frequent;

crime-specific forecasting — identifying the potential dynamics of fraud, theft, cybercrime, family and domestic violence, or other types of crime;

risk-factor forecasting — assessing how factors such as unemployment, migration, family conflict, digital illiteracy, drug-related problems, youth employment, or other circumstances may influence crime trends;

forecasting the effectiveness of preventive measures — estimating in advance how particular interventions may affect crime indicators [2; 18; 19].

On this basis, AI technologies create opportunities for criminological research to move from a reactive to a proactive approach. In other words, research is no longer limited to explaining crime after it has occurred, but may also support the early identification of crime risks and the timely targeting of preventive interventions [19; 21].

5. An AI-based scientific and practical model for contemporary criminological research. Based on the findings of the study, the following scientific and practical model may be proposed for the use of artificial intelligence technologies in contemporary criminological research:

scientific problem → database → data preparation → AI analysis → criminological interpretation → expert assessment → forecasting → practical recommendation → implementation → effectiveness evaluation.

Within this model, AI technologies occupy an intermediate analytical stage of the research process. Artificial intelligence does not independently define the scientific problem, formulate final criminological conclusions, or make practical decisions on its own. Rather, it supports the in-depth processing of data, the identification of significant relationships, and the assessment of potential risks. Final scientific conclusions should therefore be formed on the basis of criminological interpretation, expert assessment, and applicable legal and regulatory criteria [11; 12; 14].

The principal advantage of this model is that it envisages the integration of AI technologies into criminological research not in an uncontrolled or purely mechanical manner, but through their combination with scientific methodology, a reliable empirical foundation, meaningful human oversight, and measurable practical effectiveness [12].

Discussion

The use of artificial intelligence technologies in contemporary criminological research is not only scientifically relevant, but also methodologically and ethically complex. Although AI provides

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substantial opportunities for processing large volumes of data, forecasting crime trends, and identifying risk factors, it cannot fully replace human reasoning, criminological theory, or socio-legal interpretation in explaining crime. The central issue, therefore, is not whether artificial intelligence should or should not be used, but rather **under what methodological boundaries, legal safeguards, and forms of scientific oversight it should be applied** [14].

The first issue for discussion concerns the **status of AI technologies within criminological research**. Some approaches tend to regard artificial intelligence as an autonomous technological system capable of making independent decisions in the analysis of crime. Such an approach may be problematic. Crime cannot be reduced to a collection of numerical indicators, statistical trends, or algorithmic probabilities. It is a complex phenomenon shaped by human behaviour, the social environment, legal order, moral values, economic conditions, and institutional mechanisms. Accordingly, AI should not be treated as an autonomous decision-maker in criminological analysis, but rather as an **auxiliary analytical instrument that enhances human expertise** [18].

The second issue concerns the **reliability of AI-generated results**. Regardless of their technical sophistication, artificial intelligence algorithms operate on the basis of the quality of the data provided to them, the selected model, initial classifications, and training datasets. If the underlying data are incomplete, inaccurate, or biased, the resulting algorithmic conclusions may likewise be inaccurate or incomplete. This issue is particularly significant in criminological research because erroneous risk assessments may lead to biased decisions concerning particular territories, groups, or individuals. Therefore, the quality of AI-generated results should not be evaluated solely by the technical complexity of an algorithm, but by the quality of the underlying data, methodological oversight, and expert validation [17].

The third issue concerns the **balance between predictive analysis and human rights**. Criminological forecasting creates important opportunities for the prevention of crime. However, predictive systems must not become instruments for prematurely labelling an individual as "dangerous," unjustifiably categorising a territory as "criminogenic," or reinforcing biased stereotypes concerning particular social groups. Accordingly, AI-assisted criminological research should clearly recognise that predictive results are probabilistic rather than determinative, do not constitute a final legal assessment, and must be subject to meaningful human review before being translated into practical decisions [14].

The fourth issue concerns the **relationship between artificial intelligence and classical criminological methods**. AI technologies can demonstrate considerable effectiveness in statistical analysis, document processing, spatial mapping, and forecasting. Nevertheless, they cannot independently provide a comprehensive theoretical explanation, causal interpretation, social contextualisation, or legal assessment. For example, AI may identify an increasing crime risk in a particular area, but a human researcher is required to determine whether the underlying social causes relate to unemployment, family conflict, educational problems, migration pressures, or weaknesses in the crime-prevention system. For this reason, the most appropriate approach is the **integrated use of AI technologies and classical criminological methods** [23].

The fifth issue concerns the **adaptation of the "Criminology AI" platform to national conditions**. Various digital systems are used internationally to forecast crime, allocate policing resources, and identify high-risk areas. However, the direct transplantation of such systems into Uzbekistan may not produce equivalent results. The social roots of crime, the role of the mahalla institution, the structure of the crime-prevention system, legal arrangements, demographic conditions, and mechanisms of public administration differ from one country to another. Therefore, while drawing on relevant international technological experience, the national "Criminology AI" platform should be

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designed specifically for the legal, social, institutional, and criminological environment of Uzbekistan [18].

The sixth issue concerns **human resources and interdisciplinary cooperation**. AI-based criminological research cannot be effectively conducted solely by legal professionals or solely by software developers. Such research requires cooperation among criminologists, legal scholars, sociologists, psychologists, data analysts, GIS specialists, information-security experts, and practitioners. Accordingly, the establishment of interdisciplinary research teams, specialised educational modules, and professional competencies in digital criminological analysis will be of particular importance for the future development of this field [12].

The eighth issue concerns the **practical implementation of AI-based criminological research findings**. If AI analysis ends only with the publication of an academic article or research report, its practical value remains limited. Analytical findings should lead to concrete outputs such as criminogenic risk maps, systems of risk indicators, preventive intervention algorithms, early-warning mechanisms at the mahalla level, regulatory proposals, or management decisions. Only under such conditions can artificial intelligence technologies contribute to tangible practical effectiveness in criminological research [19; 20].

Conclusion

The analysis conducted in this study demonstrates that the use of artificial intelligence technologies in contemporary criminological research is not merely a technological innovation, but an important scientific and practical issue associated with the need to qualitatively modernise the methodology through which crime is studied. The increasingly complex and multifactorial nature of crime, shaped by territorial, social, economic, and digital factors, requires criminological research to move beyond statistical description towards more advanced forms of analysis, forecasting, risk assessment, and the development of practical preventive decisions [18].

Based on the findings of the study, the following scientific and practical recommendations are proposed.

First, a specialised **scientific and methodological guideline for the use of AI technologies in contemporary criminological research** should be developed. Such a guideline should clearly regulate procedures for data collection, cleaning, anonymisation, classification, algorithmic analysis, expert assessment, and the practical implementation of research findings [15].

Second, a **national criminological database** should be established within the framework of the "Criminology AI" platform. This database should integrate official crime statistics, criminal case materials, investigative and judicial documents, crime-prevention reports, information concerning territorial criminogenic conditions, sociological survey data, and expert assessments [10].

Third, a **data quality protocol** should be introduced for AI-based criminological research. Each study should clearly indicate the source, periodicity, completeness, reliability, limitations, updating procedures, and level of anonymisation of the data used [17].

Fourth, expert review of artificial-intelligence outputs should be established as a **mandatory methodological requirement** in criminological research. Although AI can process crime-related data, it cannot independently provide a complete causal explanation, social contextualisation, legal assessment, or preventive recommendation without meaningful human expertise [14].

Fifth, the "Criminology AI" platform should incorporate the principles of **Explainable Artificial Intelligence (XAI)**. The system should not only indicate the level of risk, but should also explain which indicators contributed to a particular result, what data the model relied upon, and what limitations apply to the generated output [12; 22].

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Sixth, the results of AI-based criminological forecasting should be directly connected to **crime-prevention practice**. Predictive outputs should specify not merely a general level of risk, but also the territory concerned, the relevant time period, the type of crime involved, the responsible crime-prevention actor, and the preventive measures that should be undertaken [21].

Seventh, **interdisciplinary research teams** should be established to support the use of AI technologies in criminological research. Such teams should include criminologists, legal scholars, sociologists, psychologists, data analysts, GIS specialists, information-security experts, and practitioners from relevant law-enforcement and crime-prevention agencies [12].

Eighth, a mechanism should be developed for **evaluating the effectiveness of AI-based criminological research findings**. This mechanism should provide for the regular monitoring of how preventive decisions based on AI analysis affect crime indicators, the dynamics of high-risk areas, the effectiveness of preventive measures, and the accuracy of management decisions [21].

Overall, the use of artificial intelligence technologies creates significant opportunities for contemporary criminological research. However, the effective use of these opportunities requires AI technologies to be integrated with **sound scientific methodology, reliable empirical data, meaningful human oversight, legal safeguards, expert assessment, and measurable practical effectiveness**. Only under these conditions can national digital platforms such as **"Criminology AI"** become genuine scientific and practical instruments for achieving a deeper understanding of crime, identifying criminogenic risks at an early stage, and developing evidence-based preventive decisions.

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