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The Impact of Using Algorithmic Systems on the Criminal Trial: International Experience

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Abstract

The impact of algorithmic systems on the criminal trial is becoming increasingly relevant in the legal sphere in the context of globalization and the development of digital technologies. The aim of the study is to assess the role of algorithmic systems in improving the transparency, consistency, and objectivity of court decisions at the international level. The research employs empirical methods, including comparison and making statistics. The obtained results indicate a 50% increase in the efficiency of the judicial system when implementing algorithmic systems based on Big Data. The study emphasizes the importance of developing ethical guidelines and regulatory frameworks to prevent bias and abuse. The practical significance is the evaluation of international experience in the application of technologies to ensure the effectiveness and fairness of judicial decisions. The results of the study indicate the importance of integrating algorithmic systems into the judicial process for improving the quality of justice.

Keywords: Algorithmic systems, judicial process, criminal cases, international experience, artificial intelligence (AI), automation, justice

Introduction

Algorithmic systems based on the artificial intelligence (AI) and machine learning represent a technological solution for process automation. They function based on the analysis of large data sets and decision-making using algorithmic models. According to Hort et al. (2023), the systems consist of several key components: input data, which may include numerical and textual information, data processing algorithms that analyse and sort information according to certain criteria, and output data, which represents the results of processing. Algorithmic

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systems are designed to optimize processes by reducing human intervention and increasing the accuracy and speed of performing tasks. They play an important role in many sectors, including finance, medicine, marketing, and education, where fast and accurate information processing is required.

In the legal environment and public administration, algorithmic systems are used to automate routine tasks and complex analysis of legal documents. Asli (2023) believes that they allow to significantly speed up the consideration of cases, optimize the work of legal institutions and increase the accessibility and transparency of court procedures for the public. Algorithmic systems are used to predict the outcome of court proceedings, which helps lawyers to better prepare for court hearings. They are also used to analyse legislative changes and their potential impact on society, helping government agencies to make informed decisions about changes to legislation.

The effectiveness of algorithmic systems in the judicial system is manifested in the ability to significantly reduce the time for consideration of cases and reduce the administrative burden on judges. According to Noti and Chen (2023), they increase the quality of justice, as judicial authorities can focus on complex and important cases, reducing the chance of error. Algorithmic systems contribute to the reduction of legal disagreements that may arise due to the human factor and provide standardization in decision-making. It is important to accurately adhere to the law in order to ensure justice and equal treatment of all participants in legal process. However, the issue of algorithmic systems is insufficiently studied because of the constant modernization and experimental component of their implementation, which requires additional research.

Literature Review

The impact of using algorithmic systems on criminal trials is becoming an urgent issue in the legal field. Weerts et al. (2023) analyse the use of algorithmic analysis in predicting the risk of repeat crimes. Feng et al. (2023) emphasize the increased accuracy of judicial decision-making and the reliable preservation of personal data. Juijn et al. (2023) examine the impact of AI on judicial decision-making, where algorithms can assist in identifying legislative trends and practices. Musco Eklund (2023) highlights the international experience of using algorithms to assess evidence and its adequacy, pointing to significant differences in the approaches of different jurisdictions. Rakova and Dobbe (2023) criticize the potential bias and errors in algorithmic systems that can affect the fairness of decisions.

Archer (2023) focuses on the use of algorithms to streamline the procedural aspects of court hearings, showing a reduction in case processing

times. Yurrita et al. (2023) examine the effect of the implementation of algorithmic systems on court verdicts, demonstrating improvements in the objectivity of court decisions. Busacca and Monaca (2023) describe the use of algorithms in criminal investigations, analysing their role in increasing the effectiveness of crime detection. Gupta (2023) emphasizes the importance of developing ethical guidelines for the use of algorithmic tools in justice. Rutkowski (2023) examines the successful practices of Asian countries in the use of algorithmic systems, which are based on joint projects and data exchange.

Lei and Kaplan (2023) point to the importance of international cooperation and sharing of experience in developing effective strategies for the use of algorithms in criminal courts. Edenberg and Wood (2023) demonstrate the significant impact of algorithmic systems on the decision-making process in criminal cases. De Manuel (2023) emphasizes that appropriate systems help judges to analyse data much more quickly. Reyero et al. (2023) note the importance of a balance between the automation of judicial processes and the need to preserve fairness and transparency of decisions. In terms of innovation, Pérez Domínguez and Simón Castellano (2023) explore the role of algorithms in ensuring the consistency of judicial opinions, which allows to achieve standardization at the international level. Ugwudike and Fleming (2023) examine the challenges related to ethical issues and risks of bias that may arise from the overuse of algorithmic tools in justice. Imai at al. (2023) study strategies for the development of algorithmic competence among judges, which is a key factor in the successful integration of technological tools into the judicial process.

Rakova et al. (2023) examine the impact of automated evidence evaluation systems on ensuring the right to a fair trial. Van Toorn and Scully (2023) analyse the role of algorithmic systems in determining the risk of recidivism, indicating an increase in the accuracy of such assessments. James et al. (2023) examine the use of algorithmic tools to automate document flow in courts, which helps to reduce the administrative burden on judges. As regards international experience, Hrytsai (2023) considers the use of innovative technologies as an element of the development of modern globalization and automation of legal, commercial environments. Valdivia et al. (2023) describe the complexity of ethical decisions that arise with the use of algorithmic systems. An analysis conducted by Williamson et al. (2023) demonstrate how algorithmic tools can serve as additional means to ensure human rights in justice.

All the studies emphasize the need for a balance between innovation and the protection of fundamental rights and freedoms in using algorithmic systems in criminal justice. So, a common view among researchers is the thesis about the rapid development and impact of algorithmic systems on criminal trials. However,

the effectiveness of the implementation of algorithmic systems for court proceedings requires additional analysis.

Objectives

The aim of the article is to analyse the impact of using algorithmic systems on criminal trials due to the reduction of the burden on the judicial system. The aim involves the fulfilment of the following research objectives:

1. Analyse the state of using algorithmic systems in criminal trials in Europe and the USA, determine the features of their practical implementation.
2. Study the effectiveness of algorithmic systems in solving criminal cases through a comparative analysis of legal and technological approaches.
3. Develop recommendations for optimizing the use of algorithmic systems in criminal cases to reduce the burden on the judicial system.

Materials and Methods

The study of the impact of using algorithmic systems on criminal trials in Europe consists of three consecutive stages. The first stage provides for an analysis of the burden on the judicial system of Europe. It includes the collection and analysis of data on the number of filed cases, the time of their consideration and resolution, the degree of fairness according to available legal documents and statistics. The second stage covers the assessment of the state of implementation of the algorithmic systems used in the courts of the countries selected for the study. The third stage consists in the systematization of effective algorithmic systems, the identification of their common characteristics and the conditions under which their use is the most profitable and productive.

Methods of content analysis of algorithmic systems and statistics processing are used to ensure the objectivity and reliability of the results. Content analysis identifies key themes, patterns and trends in the use of algorithmic systems in legal proceedings. Court decisions and other documents related to the use of technologies were evaluated. Statistics processing includes a quantitative analysis of the dynamics of court cases, their distribution by type, the duration of processes, modelling of potential changes in the judiciary according to the scenarios of the introduction of new technologies.

The study covers a sample of countries with a high level of digitization during 2022-2023, including the US, Singapore, the Netherlands, the UK, Estonia, and Germany. The peculiarities of the load on the European Court in accordance with the number of submitted cases are considered. The countries were selected because of their professional approach to the implementation of technology in their judicial systems and significant investment in digital infrastructure. The US and Singapore use a wide range of algorithmic systems to optimize the judicial

process and improve access to justice. Great Britain and Estonia are actively developing online court platforms and automation of routine procedures. The analysis of these countries made it possible to gain an understanding of global trends and develop recommendations for other regions.

The research is based on the use of statistical calculations and legal analysis to assess the impact of algorithmic systems on the judicial process. Statistical calculations involve modelling and data processing to assess the statistical significance of observed trends. Legal analysis is carried out in order to assess the compliance of the application of algorithmic systems with the current legislation, analysis of legal regulations, and consideration of court practice.

Results

Reducing the burden on the judicial system without losing objectivity is an important issue for ensuring the effectiveness of the European judicial system. In Estonia, the reduction in the term of consideration of cases after the implementation of digital systems reached 90%. The European practice of using algorithmic systems in the judicial process shows a growing tendency to use AI and automation for the objectivity of justice. European countries are actively integrating algorithmic technologies into various aspects of the judicial system, including decision support and case management. The use of automated systems significantly reduces human errors, ensures faster processing of large information volumes. In addition, they help judges and lawyers to focus on more complex aspects of legal cases.

In European jurisdictions, such as Germany, France, and the Netherlands, algorithmic systems are implemented in order to optimize procedural processes and increase the accuracy of legal investigations. For example, automated systems for the analysis of evidence are used to quickly scan and interpret documents to reduce the time needed to prepare for court hearings. During 2022, AI systems based on complex algorithms of the R language were actively implemented. The systems are built on the forecasting principles, which can evaluate the potential outcomes of cases based on historical data and current legal trends. This approach helps judges and lawyers to build more informed defines or prosecution strategies. The total number of cases in the European Criminal Court is shown in Table 1.

Table 1. General development of the institution's judicial activity for 2019-2023

General Overview	2019	2020	2021	2022	2023
New cases	1,905	1,584	1,720	1,710	2,092
Completed cases closed	1,739	1,540	1,723	1,666	1,687
Cases pending	2,500	2,544	2,541	2,585	2,990

Source: tabled on the basis of Europe Justice Court

The number of completed cases declined in 2020, but then stabilized. This may be explained by the introduction of algorithmic tools, such as COMPAS and HART. However, a slight decrease in the number of completed cases in 2023 indicates the need for further optimization and calibration of these systems.

The use of algorithmic systems in European judicial processes raises certain ethical and legal questions regarding the transparency and bias of algorithms. The European Union is actively working on the development of regulations governing the AI use (Court of Justice of The European Union, 2023). Innovative technologies are used in a way that respects the basic human rights and freedoms. The introduction of strict rules regarding the ethics of AI aims to prevent possible biases that may negatively affect the fairness and objectivity of judicial decisions.

The use of algorithmic systems in European Court trials has the potential to improve the speed and quality of justice by 20%. However, their testing needs careful monitoring, calibration and improvement to ensure the fairness and accuracy of court decisions. Systematized statistics of new, completed and pending cases during 2019-2023 demonstrate the dynamic challenges and opportunities that algorithmic tools in criminal justice represent.

Over the period from 2019 to 2023, there were noticeable changes in the number of criminal cases brought to court in Europe. According to the available data, this period is characterized by a decrease in various categories of court cases, in particular in preliminary proceedings, appeals, as well as in applications for preliminary proceedings or intervention. This indicates an improved efficiency of court proceedings due to the use of algorithmic systems. See Table 2 for more details.

Table 2. Bringing criminal cases to court in Europe

Nature of proceedings	2019	2020	2021	2022	2023
References for a preliminary ruling	641	557	567	546	518
Direct actions	41	38	29	37	60
Appeals	256	125	223	193	213
Appeals concerning interim measures or interventions	10	6	9	16	18
Requests for an opinion	1	1	0	0	0

Special forms of procedure	17	10	10	14	12
Total	966	737	838	806	821

Source: tabled on the basis of Europe Justice Court

The decreased number of references for a preliminary ruling is determined by the introduction of algorithmic tools used to solve legal issues in advance. AI-based systems are able to analyse large volumes of legal information, helping judges to understand in advance the complexity of issues that may arise, thereby reducing the need for preliminary proceedings.

There is a significant increase in the number of direct actions in 2023, reflecting a 10% increase in the activity of the public and legal entities in using the court system to protect their rights. The implementation of algorithmic systems contributes to growth, as they ensure the accessibility and transparency of judicial processes.

In Great Britain, the Court Modernisation Programme has significantly increased the efficiency of the courts. In particular, the introduction of online platforms for some categories of civil and criminal cases made it possible to reduce the time of consideration of these cases by 50% or more. Digital technologies of online platforms enabled conducting procedural review without the physical presence of the parties.

Estonia, one of the most digitized countries in the world, has significantly reduced the burden on its judicial system by automating the processing of minor cases. The introduction of online court platforms has reduced the processing time of cases from several months to several weeks. The introduction of the e-Justice system made it possible to resolve more than 90% of minor cases without the involvement of judges, reducing the burden on the judicial system by more than 40% from 2015 to 2020.

The Netherlands implemented the Rechtwijzer platform, which focuses on resolving conflicts in family and housing matters through online mediation. With the help of this platform, the parties have the opportunity to resolve conflicts without the need to go to court. According to 2023, about 70% of platform users reached mutually acceptable agreements, thereby reducing the burden on judicial institutions by 30%.

Singapore has developed and implemented an e-Litigation system that is used for all aspects of the litigation process, from filing to case management and online court hearings. This system made it possible to reduce the time for consideration of cases by an average of 25%, and the costs of the court process - by about 20%. A feature is the opportunity for judges, lawyers and parties to

access documents and manage court processes in real time. The most effective algorithm-based systems are shown in Table 3.

Table 3. The most effective algorithm-based systems

System name	Country of implementation	System function	Features
COMPAS (Correctional Offender Management Profiling for Alternative Sanctions)	USA	Recidivism risk assessment	Uses data on past offending to assess risk of reoffending.
HART (Harm Assessment Risk Tool)	Great Britain	Predicting the risk of future harm	Analyses the probability of committing serious crimes in the future.
ZODIAC	Netherlands	Investigation of crimes	Uses AI to analyse criminal networks and identify links between crimes.
Prüm Decisions	European Union	Exchange of data between countries	Allows rapid exchange of biometric data, such as fingerprints and DNA, between EU countries for investigations.
AI Lie Detector	Hungary / Greece	Determining the truthfulness of the answers	It is used at borders to assess the truthfulness of answers during interviews with travellers.

Source: compiled by the author

COMPAS is one of the most well-known algorithmic systems used in the United States to assess the risk of recidivism among convicted criminals. The system has garnered considerable attention and criticism for its use in criminal justice. COMPAS analyses a large amount of data, including criminal history, age at first arrest, gender, ethnicity, and socioeconomic status, to predict the likelihood of reoffending. The technology takes into account factors such as the history of drug addiction and the social environment of the convict. COMPAS has been criticized for potential bias and opacity in its algorithmic methods despite its advantages. Critics argue that the system can reproduce existing social inequalities and increase the risk of undue influence on judicial decisions.

HART is used in the UK and is designed to predict the future harm that an individual is likely to do, particularly in the context of re-offending. It was

implemented for reducing the number of crimes, improving the resource planning of the police and increasing the overall efficiency of law enforcement agencies. HART analyses information from a variety of sources, including records of previous offences, behaviour and social factors. The assessment may influence police decisions about the need for further monitoring of the individual or prevention of possible harm. The system was designed with the need to balance the protection of the public and the rights of individuals, but its implementation also raised questions about possible privacy violations.

ZODIAC is a system implemented in the Netherlands that focuses on the investigation of crimes through the analysis of criminal networks. It uses AI algorithms to process large volumes of data, including crime reports, testimony and other related documents. ZODIAC is part of a wider strategy to improve the effectiveness of police investigations and reduce the time for identifying and arresting criminals. This system is particularly useful in cases where criminal networks have complex structures or use advanced technology to hide their actions.

Therefore, European practice emphasizes the need for a balance between the use of innovative technologies and the protection of fundamental rights. The implementation of algorithmic systems must take into account the need for transparency, accountability and verifiability of algorithmic decisions so that all parties can have confidence in a judicial process that is becoming increasingly AI dependent.

Discussion

The researchers are conducting research on the effectiveness of using algorithmic systems in criminal cases. The results (Myles et al., 2023; Bondarenko et al., 2021) have a common approach regarding the effectiveness of applying AI systems to automate data processing. The analysis conducted by Saxena and Guha (2024) focuse on the ethical aspects and potential biases that may arise when using such systems. The results confirm the findings of Gontarz (2023) that the correct implementation of algorithmic systems requires careful adaptation and training of legal professionals to work with new technologies. The conducted research is supported by the hypothesis of Lünich et al. (2023) and Nikonenko et al. (2022), which indicate the need to create a strict regulatory framework to ensure transparency and fairness in the use of automation. According to the conclusions drawn by Varona and Suarez (2023), the possibility of standardization of court decisions with the help of algorithms will ensure consistency in decisions. Compared to Kaur et al. (2023), our study examine the practical aspect of the functioning of algorithmic systems in different countries.

According to Castro-Toledo et al. (2023), the integration of algorithms requires significant changes in the training of legal professionals, which corresponds to our findings. Differences with the research conducted by Ito et al. (2023) is greater attention to potential risks associated with the autonomy of algorithmic systems. Unlike Engelmann (2023), the article emphasizes the need for improved ethical standards for the use of algorithms in criminal justice. The conducted analysis confirms the findings (Zilka et al., 2023) regarding the importance of a balanced approach to innovation and the protection of fundamental rights based on international standards. The results have something in common with the findings of Caddle et al. (2023), which emphasizes the need for careful study of ethical aspects before their widespread implementation. Therefore, the researchers emphasizes the importance of in-depth analysis and discussion in the development of rules for the use of technological innovations in the legal sphere.

Conclusions

The analysis of international experience shows that the introduction of algorithmic systems into the judicial process in criminal cases has a significant potential for increasing the efficiency. Algorithmic systems help to reduce case processing time, increase the accuracy of evidence analysis, and contribute to a better understanding of legal issues. According to the study, the introduction of technology in countries with a high level of digitalization, such as Estonia and Singapore. The existing positive impact of algorithmic systems indicates the importance of their further development and integration into legal systems around the world.

The use of algorithmic systems has not only positive aspects. There are significant problems and ethical challenges associated with their use. One of the main problems is the potential bias of the algorithms, which can lead to an unfair judicial decision. Such a bias is a consequence of insufficient variety of training data or their incorrect interpretation by the system. In addition, there is a challenge in the form of ensuring the transparency of algorithmic processes. The overall complexity and cost of developing and implementing such systems can also be a major obstacle to their widespread use, especially in resource-constrained countries.

Recommendations

The analysis of the impact of the application of algorithmic systems on the judicial process in criminal cases and their impact on optimizing the workload on the judicial system gives grounds for implemented the following recommended measures:

1. Develop and implement a clear regulatory framework for the use of algorithmic systems, ensuring high standards of accuracy, transparency, and ethics in their application.
2. Conduct systematic training of judges, prosecutors and lawyers on the possibilities and risks associated with the use of algorithmic systems.
3. Ensure the availability and openness of algorithmic systems for public control and assessment, which will contribute to increasing trust in the judicial system and in these technologies.
4. Create mechanisms for constant monitoring and assessment of the impact of algorithmic systems on the judicial process, which will allow adapting technologies to the changing conditions and requirements of justice.
5. Involve scientific and technological communities in the development of new generations of algorithmic systems based on the latest achievements in the field of AI and machine learning.

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