

Research on Risk Regulation and Procedural Justice Protection Path of Artificial Intelligence Judicial Application in the Perspective of Digital Rule of Law

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ABSTRACT From the perspective of digital rule of law, artificial intelligence provides important technical support for judicial modernization by improving judicial efficiency, unifying judgment standards, optimizing litigation services, and strengthening trial management. However, the judicial application of AI also generates risks including algorithmic bias, data-security threats, ambiguous accountability, procedural alienation, weakened judicial subjectivity, and insufficient transparency. This study analyzes the development status, value functions, risk types, and generation mechanisms of AI judicial applications, and proposes an integrated regulatory path combining technical governance, legal regulation, ethical norms, procedural safeguards, and accountability. It further constructs a procedural justice protection mechanism involving algorithmic transparency, procedural participation, judicial experience, equality between prosecution and defense, and rights relief. The study expands procedural justice theory under digital conditions and provides a normative framework for AI-assisted judicial systems. Its engineering relevance lies in the transparent design of algorithmic decision pipelines and secure data-governance architectures.

INDEX TERMS digital rule of law, artificial intelligence, judicial risk regulation, procedural justice, algorithmic transparency

I. INTRODUCTION

A. RESEARCH BACKGROUND AND SIGNIFICANCE

THE application of artificial intelligence in the judiciary is a double-edged sword. While technology empowers the judiciary, it also triggers a series of new risks and challenges. The opaque decision-making process caused by algorithmic black boxes, judicial injustice caused by algorithmic biases, personal privacy violations caused by data breaches, weakened judicial subjectivity due to technological dependence, difficulty in accountability caused by ambiguous responsibilities, and the impact of procedural alienation on procedural justice are becoming increasingly prominent[1]. The traditional theory of judicial procedural justice focuses on “people” as the core, emphasizing core elements such as party participation, judge’s personal experience, procedural transparency, and clear rights and responsibilities. However, the automation, algorithmic, and data-driven features of artificial intelligence make the judicial decision-making process partially detached from the direct control of people, and the traditional mechanism for safeguarding procedural justice faces the dilemma of adaptability. At present, the application of artificial intelligence

in China’s judicial system is still in the stage of exploration and development. The risk regulation system is not yet sound, the mechanism for safeguarding procedural justice has shortcomings, the collaborative governance between technology and law is insufficient, and there is a lack of responsibility and ethical norms. It is difficult to effectively respond to the multiple risks brought by the application of technology, which restricts the standardized and rule of law development of artificial intelligence judicial application[2].

B. RESEARCH SIGNIFICANCE

Enrich the theoretical system of digital rule of law[3]. This study is based on the perspective of digital rule of law, focusing on the core scenario of artificial intelligence judicial applications in digital rule of law. It systematically explains the inherent relationship between digital rule of law and artificial intelligence judicial applications, analyzes the impact and challenges of technological applications on traditional rule of law theory and procedural justice theory, explores the innovative development direction of rule of law theory in the digital age, and provides practical support and theoretical supplements for the construction of the digital

rule of law theoretical system in the judicial field[4].

The connotation of innovative procedural justice theory. The traditional theory of procedural justice was formed in the industrial era and is difficult to fully adapt to the new scenarios and characteristics of artificial intelligence judicial applications in the digital age[5]. This study combines the characteristics of artificial intelligence technology and the laws of judicial operation to explore the new connotations, constituent elements, and guarantee mechanisms of procedural justice in the digital age, promote the transformation of procedural justice theory from traditional to digital age, and inject digital elements and technological dimensions into the innovative development of procedural justice theory[6].

C. CURRENT RESEARCH STATUS AT HOME AND ABROAD

The domestic academic community has conducted multidimensional research on the application of artificial intelligence in the judiciary, with fruitful results mainly focused on the following five directions:

One is the research on the value and scenarios of artificial intelligence judicial applications. Numerous scholars have affirmed the value of artificial intelligence in improving judicial efficiency, unifying judgment standards, optimizing litigation services, and strengthening trial management. They have reviewed its current application status in core scenarios such as filing, trial, evidence review, case retrieval, sentencing assistance, and document generation, and analyzed the practical effectiveness and development trends of technology empowering the judiciary[7].

The second is the research on the risks and challenges of artificial intelligence judicial applications. Scholars generally pay attention to risks such as algorithmic bias, algorithmic black boxes, data security, ambiguous responsibilities, program alienation, and weakened subjectivity of judges. They analyze the impact of technological applications on judicial fairness, procedural justice, and rights protection, and point out the institutional shortcomings and practical difficulties in current risk regulation[8].

The third is the research on the regulatory path of artificial intelligence judicial applications. Existing research proposes response strategies from the perspectives of legal regulation, technological governance, ethical norms, and regulatory mechanisms, emphasizing core measures such as clarifying AI assisted positioning, improving algorithm supervision, strengthening data governance, improving accountability, and promoting human-machine collaboration.

The fourth is the research on procedural justice of artificial intelligence judicial applications. Some scholars focus on the protection of procedural justice, analyzing the impact of artificial intelligence on traditional program participation, program openness, judicial experience, and equality between prosecution and defense, and proposing suggestions for procedural protection such as algorithm transparency, program selection rights, expert assistants, and cross examination mechanisms[9].

1) Current Research Status Abroad

The application of artificial intelligence in foreign judicial systems started earlier, with research focusing on technical applications, risk regulation, procedural safeguards, and legal improvement, resulting in a wealth of research achievements.

At the level of technological application, European and American countries focus on researching the application of artificial intelligence in evidence analysis, sentencing assistance, case management, litigation services, and other scenarios, exploring practical paths such as algorithm model optimization, data governance, and technical standard formulation, emphasizing the auxiliary and standardized nature of technological applications[10].

At the level of procedural justice, foreign research focuses on the impact of artificial intelligence on due process, emphasizing the protection of the parties' rights to participate in the process, to be informed, and to object. It proposes procedural protection mechanisms such as algorithm disclosure, program selection, judicial review, and expert evaluation to ensure that technological applications do not exceed the bottom line of due process[11].

At the level of legal improvement, European and American countries are promoting legislation related to artificial intelligence, clarifying the legal positioning, responsible parties, rights protection, and regulatory rules of artificial intelligence judicial applications, constructing a legal framework for technological applications, and providing legal support for risk regulation and procedural justice protection.

D. RESEARCH INNOVATION POINTS

Research system innovation. Constructing an integrated research system of "risk identification mechanism analysis principle establishment path construction guarantee improvement", studying risk regulation and procedural justice protection as an organic whole, breaking through the fragmented and one-sided shortcomings of existing research, and forming a systematic and comprehensive research framework.

Innovative path design. Based on China's judicial practice and the requirements of digital rule of law, a five in one risk regulation path of "technical governance+legal regulation+ethical norms+procedural guarantees+accountability" is proposed, as well as a procedural justice protection mechanism of "algorithm transparency+procedural participation+judicial experience+equality between prosecution and defense+rights relief". The path design is both theoretical, practical, and operable.

Theoretical integration and innovation. Promote the deep integration of digital rule of law theory, procedural justice theory, technological governance theory, and responsibility ethics theory, explore new connotations and guarantee mechanisms of procedural justice in the digital age, enrich the contemporary connotations of digital rule of law theory and procedural justice theory, and achieve the unity of theoretical innovation and practical innovation.

II. CORE CONCEPTS AND THEORETICAL FOUNDATIONS

A. DEFINITION OF CORE CONCEPTS

1) Digital Rule of Law

Digital rule of law is a new form of legal construction in the digital age. It is a legal model that uses data as a key production factor, digital technology as an important support, and the rule of law as the fundamental guarantee to achieve deep integration of digital technology and legal construction, promote the digital transformation of the legal system, and modernize governance capabilities. Its core connotation includes: firstly, digitalization of the rule of law, using digital technologies such as big data, artificial intelligence, and blockchain to promote the digital transformation of legislation, law enforcement, judiciary, and compliance, and improve the efficiency and accuracy of the operation of the rule of law; The second is the legalization of digital technology, which aims to improve laws and regulations, establish sound institutional norms, regulate the research and development, application, and governance of digital technology, safeguard digital space rights, maintain digital social order, and prevent digital technology risks; The third is to integrate and synergize technology to empower the rule of law and regulate technology, promote the mutual promotion and coordinated development of digital technology and rule of law construction, and build a legal ecology of good law and good governance in the digital age[12]. Digital rule of law is the fundamental principle for the application of artificial intelligence in the judiciary, providing value guidance, institutional framework, and guarantee system for technological applications[13].

Digital Rule of Law is not an independent new legal system, but a comprehensive legal form evolved and upgraded under the digital era. It takes data and digital technology as core support and takes the rule of law concept and system as the fundamental guarantee. It is mainly reflected in three dimensions: first, the digital transformation of traditional legislative, law enforcement and judicial systems; second, the institutional standardization of the research and application of digital technology; third, the coordinated integration of technological empowerment and rule of law regulation. It provides systematic value guidance and institutional framework for the judicial application of artificial intelligence, and runs through the whole logical demonstration of this research as the basic theoretical perspective.

2) Application of Artificial Intelligence in Justice

Artificial intelligence judicial application refers to the practical activity of applying artificial intelligence technology (including machine learning, deep learning, natural language processing, big language models, intelligent agent technology, etc.) to the entire judicial process of filing, case division, trial, evidence review, case retrieval, sentencing assistance, document production, execution management, litigation services, trial supervision, etc., providing intelligent assistance, decision support, and service optimization

for judicial activities[14]. Its core positioning is auxiliary, that is, artificial intelligence can only provide reference, assistance, and support for judicial personnel, and cannot replace judicial personnel in exercising core judicial powers such as trial and prosecution. Judicial judgments are always made by judicial personnel, and judicial responsibilities are ultimately borne by judicial personnel. The application of artificial intelligence in the judiciary is a concrete practice of digital rule of law in the judicial field, and an important technological means to promote judicial modernization and improve judicial quality and efficiency[15].

III. THE DEVELOPMENT STATUS AND VALUE FUNCTIONS OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS

A. DEVELOPMENT HISTORY OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS IN CHINA

The application of artificial intelligence in China's judiciary began in the early 21st century, and with the gradual progress of smart court construction and judicial reform, it has roughly gone through three stages of development:

Phase One (2010-2016): Exploration and Initial Stage. At this stage, based on judicial informatization, the simple application of artificial intelligence technology in the judicial field is preliminarily explored, mainly focusing on basic links such as electronic files, trial records, and document retrieval. The technology application is relatively single and has not yet formed a systematic application system. In 2016, the "Rui Judge" intelligent judgment system entered the Beijing High People's Court, marking the official entry of artificial intelligence technology into the core field of justice and opening the exploration path of artificial intelligence judicial applications[16-17].

Phase 2 (2017-2021): Pilot promotion phase. At this stage, artificial intelligence judicial applications have entered a period of rapid development, and courts across the country have launched pilot explorations. The "206" criminal case intelligent assistance system has been launched and operated in Shanghai, and core functions such as case retrieval, sentencing assistance, and intelligent document generation are gradually being implemented. The Supreme People's Court has issued a series of policy documents to promote the application of artificial intelligence in the judiciary from pilot projects to the whole country. The application scenarios of technology are constantly expanding, and the application effects are gradually becoming apparent[18].

Three stages (2022 present): comprehensive deepening stage. At the end of 2022, the Supreme People's Court issued the "Opinions on Standardizing and Strengthening the Judicial Application of Artificial Intelligence", clarifying the basic principles, application scope, regulatory requirements, and responsibility mechanisms of artificial intelligence judicial application, marking a new stage of standardized and comprehensive development of artificial intelligence judicial application in China. At present, artificial intelligence has been deeply embedded in the entire judicial process, and

the national court unified case handling platform, similar case retrieval system, and intelligent auxiliary case handling system have been comprehensively promoted. New technologies such as generative artificial intelligence and intelligent agent technology have begun to be piloted and applied, and the application of artificial intelligence in the judiciary is developing in depth towards full process, intelligence, and standardization[19].

B. CORE SCENARIOS OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS

1) Intelligentization of Litigation Services

The application of artificial intelligence in the field of litigation services effectively enhances the convenience and intelligence level of litigation services[20]. Through the People's Court Litigation Service Network, 12368 Service Hotline, Self service Terminal, Lawyer Service Platform, Online Mediation Platform and other online and offline integrated service systems, we have achieved "one-stop" and "mobile" litigation services such as filing applications, material submission, fee payment, case inquiry, document delivery, online mediation, legal consultation, etc., reducing the burden of litigation for parties and improving the efficiency and experience of litigation services, as shown in Table 1 below.

TABLE 1. Main Application Scenarios and Functional Orientation of Artificial Intelligence in Judiciary

Application Scenarios	Specific Intelligent Functions	Service Objects	Functional Orientation
Intelligent Litigation Service	Online filing, document delivery, legal consultation and case inquiry	Litigants and legal workers	Simplify litigation procedures and reduce litigation burden
Trial Auxiliary Decision	Case assignment, case retrieval, sentencing reference and judicial document generation	Judges and judicial staff	Reduce trivial work and unify judgment standards
Judicial Case Management	Process supervision, quality early warning, data statistics and performance evaluation	Judicial management departments	Refine trial management and standardize judicial operation
Intelligent Enforcement	Property inquiry, credit supervision, enforcement early warning and closed-loop management	Enforcement organs	Solve enforcement difficulties and guarantee creditor's rights

2) Intelligent Trial Management

Artificial intelligence assists in the transformation of trial management from the traditional "person to person" and "case to case" models to intelligent, precise, and dynamic. Through functions such as big data analysis, intelligent monitoring, and risk warning, the entire process of case supervision, automatic evaluation of case handling quality and efficiency, real-time warning of judicial risks, and in-depth analysis of trial data can be achieved, improving the level of fine trial management and ensuring judicial integrity and case handling quality and efficiency.

3) Intelligent Execution of Work

The application of artificial intelligence in the field of execution effectively solves the problem of "difficult execution". The intelligent inspection and control system realizes automatic inquiry, freezing, and deduction of the property of the executed person; Intelligent management and exposure of the list of dishonest persons subject to enforcement; Intelligent supervision of case execution process; Intelligent generation of execution documents; Implement intelligent risk warning, improve execution efficiency and accuracy, and ensure the realization of the parties' rights and interests in winning the lawsuit.

4) Judicial Research and Intelligent Social Governance

Artificial intelligence conducts in-depth mining and analysis of massive judicial data, carries out judicial statistics, case analysis, legal application research, and dispute trend prediction, providing data support for judicial decision-making, legal improvement, and social governance. At the same time, relying on judicial big data to analyze the characteristics and laws of social conflicts and disputes, we will assist in grassroots social governance, diversified resolution of conflicts and disputes, and promote the modernization of judicial services for social governance.

C. VALUE FUNCTIONS OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS

Artificial intelligence provides judges with accurate reference and judgment standards for similar cases through functions such as case retrieval, intelligent push of judgment rules, and deviation warning, effectively reducing the phenomenon of "different judgments for similar cases", regulating the exercise of judges' discretion, and promoting the unity of legal application and the realization of judicial fairness.

Artificial intelligence achieves intelligent, precise, and dynamic trial management, real-time monitoring of case processes, evaluation of case quality and efficiency, early warning of judicial risks, improving the level of precision in trial management, preventing non-standard judicial behavior, ensuring judicial integrity and case quality and efficiency, and enhancing judicial credibility.

The application of artificial intelligence in the judiciary is the core practice of digital rule of law in the judicial field, promoting the digitization of judicial processes, intelligent judicial decision-making, convenient judicial services, and refined judicial management, assisting in the construction of smart courts and the transformation of judicial modernization, and providing practical support and innovative power for the construction of digital rule of law in the judicial field.

IV. RISK TYPES AND GENERATION MECHANISMS OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS

A. RISK TYPES OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS

1) Technical Risks

Algorithmic black box risk. Currently, judicial artificial intelligence mostly adopts complex machine learning and deep learning models, and the decision-making process is opaque and unexplainable, forming an “algorithmic black box”. Judicial personnel and parties have difficulty understanding the logic, basis, and weight of artificial intelligence decision-making, resulting in a lack of transparency in the decision-making process, which undermines the principle of procedural openness and triggers a crisis of trust.

This paper supplements typical practical cases such as AI sentencing deviation, judicial platform data leakage, and inconsistent judgment in similar cases in China’s judicial practice. On the basis of specific practical cases, it analyzes the practical manifestations and hidden dangers of algorithmic bias, data security risks and procedural alienation, making the risk induction and regulatory path no longer limited to theoretical deduction, and enhancing the practical persuasion and targeted feasibility of the research.

The risk of artificial intelligence “illusion”. Generative artificial intelligence may generate false or erroneous legal information, case references, or judicial recommendations, leading to misjudgments by judicial personnel and affecting judicial fairness. Especially in complex legal issues and handling of new types of cases, the risk of artificial intelligence “illusion” is more prominent, as shown in Table 2.

TABLE 2. Classification and Manifestations of AI Judicial Application Risks

Risk Category	Core Performance	Internal Hazards	Risk Level
Algorithmic Technical Risks	Algorithm bias, black-box operation, technical loopholes and AI illusion	Distorted judgment logic and wrong auxiliary suggestions	High
Legal Normative Risks	Blurred subject liability, inadequate right protection and alienation of judicial authority	Legal vacuum and difficulty in right relief	High
Ethical and Moral Risks	Lack of humanistic care, value deviation and judicial credibility damage	Imbalance of reason and emotion in judicial adjudication	Medium
Procedural Justice Risks	Weakened procedural participation, weakened judicial experience and insufficient procedural openness	Break through the bottom line of due process	Very High

2) Legal Risks

One is the risk of responsibility identification. The application of artificial intelligence in the judiciary involves multiple parties such as developers, operators, users, and regulators. When judicial injustice or damage to the rights and interests of parties is caused by algorithm errors, data deviations, and system vulnerabilities, the responsible parties are difficult to clarify, the division of responsibilities is vague, and the accountability mechanism is lacking, forming a “responsibility vacuum”.

The second is the risk of safeguarding rights. The application of artificial intelligence may infringe upon the

legitimate rights of the parties involved, such as the right to know, the right to participate, the right to object, and the right to privacy. For example, algorithmic black boxes result in parties being unable to know the basis for decision-making, technological dependence weakens parties’ procedural participation, data collection infringes on personal privacy, and affects the protection of parties’ rights and the realization of procedural justice.

The third is the risk of judicial power alienation. If the boundaries and positioning of artificial intelligence applications are unclear, it may lead to improper transfer of core judicial powers, weaken the subject status and independent judgment power of judicial personnel, trigger the risk of judicial power alienation, and undermine the principle of judicial independence.

3) Ethical Risks

One is the risk of a lack of humanistic care. Artificial intelligence, with data and algorithms as its core, lacks emotional cognition, value judgment, and humanistic care capabilities. When dealing with cases involving personal rights, emotional disputes, and special group protection, it is difficult to balance the unity of reason, reason, and law, resulting in a lack of warmth in judicial decision-making and violating judicial ethics.

The second is the deviation of fairness and justice from risk. Algorithm bias and data bias may lead to AI decisions deviating from the bottom line of fairness and justice, discriminating against specific groups and cases, violating the principle of equality before the law, and damaging judicial ethics and social fairness.

The third is the risk of damaging judicial credibility. Problems such as algorithmic black boxes, decision-making errors, and ambiguous responsibilities may lead to doubts from parties and the public about the application of artificial intelligence in the judiciary, reduce judicial credibility, and undermine judicial authority.

4) Program Risk

One is that the program participates in mitigating risks. The automation and algorithmic decision-making of artificial intelligence may weaken the parties’ right to participate in the program, making it difficult for them to effectively verify, debate, and object to AI decisions, which may undermine the principle of program participation.

The second is the risk of weakening judicial experience. The principle of direct verbal communication and judicial experience are the core elements of procedural justice. Artificial intelligence assisted decision-making may lead judges to overly rely on technical conclusions, reduce firsthand judgments on parties’ statements and evidence review, weaken judicial experience, and affect the fairness of judgments.

The third is the risk of insufficient program disclosure. The algorithmic black box makes it difficult for the decision-making process of artificial intelligence to be made public,

making it difficult for the parties involved and the public to supervise, violating the principle of procedural transparency, and forming a shortcoming in the protection of procedural justice.

The fourth is the risk of imbalance between the equality of prosecution and defense. If one party can obtain artificial intelligence assisted support while the other party cannot, it may lead to an imbalance of status and unequal rights between the prosecution and defense, violate the principle of equality between the prosecution and defense, and affect the realization of procedural justice.

B. MECHANISM OF RISK GENERATION IN ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS

In the practical application of artificial intelligence in the judiciary, there exists a value bias that prioritizes efficiency over fairness. Some judicial authorities excessively pursue the efficiency improvement brought by technological applications, neglecting the core values of judicial justice and procedural justice, and paying insufficient attention to the prevention of technological risks and the improvement of procedural safeguards; Some technology developers focus on technological innovation and efficiency improvement as their core goals, neglecting judicial fairness, rights protection, and ethical norms, resulting in technology applications deviating from the track of the rule of law. Value imbalance is an important source of value for risk generation. Although algorithmic black box and AI illusion lead to unexplainable technical deviations, the legal subject and liability of trial adjudication always belong to judicial judges. This paper constructs a triple mechanism of algorithm review, manual recheck and result circuit breaker, which standardizes the application boundary of AI, avoids judges' over-reliance on technical results, and reasonably solves the logical conflict between AI auxiliary positioning and judicial accountability.

In practice, there are problems with poor human-machine collaboration and insufficient ability adaptation in the application of artificial intelligence in the judiciary. Firstly, the positioning is unclear, and in some scenarios, there is a phenomenon of artificial intelligence offside replacing the core decision-making of judicial personnel, and the principle of "human host assistant" is not fully implemented; Secondly, there is a lack of capability, with judicial personnel lacking in technical application ability, algorithm understanding ability, and risk identification ability, making it difficult to effectively manage artificial intelligence technology and prevent technological risks; Thirdly, there is a lack of deep integration, insufficient integration of technology and judicial services, difficulty in accurately adapting artificial intelligence systems to judicial needs, and insufficient quality and reliability of decision-making; The fourth issue is inadequate security measures, such as technical operation and maintenance, data governance, security protection, and personnel training, which make it difficult to support technical security and standardized applications. The practical weakness is the direct practical root of risk

generation, as shown in Table 3.

TABLE 3. Comparison Between Traditional Judicial Mode and AI Collaborative Judicial Mode

Comparison Dimension	Traditional Judicial Mode	AI Collaborative Judicial Mode	Core Differences
Decision Logic	Human value judgment and case-by-case discretion	Data-driven algorithm analysis and standardized screening	Conflict between judicial logic and technical logic
Procedural Operation	Emphasize judge's personal experience and party's procedural participation	Automated processing and intelligent auxiliary deduction	Weakened procedural interaction and openness
Efficiency Orientation	Focus on judicial fairness and procedural rigor	Balance judicial fairness and administrative efficiency	Value imbalance between efficiency and justice
Responsibility Bearing	Single judicial subject with clear power and responsibility	Multiple coexisting subjects of R&D, operation and application	Difficult division of liability attribution

V. THE BASIC PRINCIPLES AND VALUE ORIENTATION OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATION IN THE PERSPECTIVE OF DIGITAL RULE OF LAW

A. BASIC PRINCIPLES OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS

1) Principle of Safety and Legality

Artificial intelligence judicial applications must adhere to the bottom line of security and legality, not harm national security, public safety, and social order, not infringe on the legitimate rights and interests of citizens, legal persons, and other organizations, strictly comply with laws and regulations such as the Data Security Law, the Personal Information Protection Law, and the Civil Code, and ensure data security, network security, system security, and application legality.

2) Principle of Fairness and Justice

The application of artificial intelligence in the judiciary must ensure non discrimination, non bias, and not affect the fairness of the trial process and results due to technological intervention, data or model bias. It must ensure the universal inclusiveness and equal opportunities of intelligent judicial services for all types of users, uphold the principle of equality before the law, and safeguard the realization of judicial fairness and justice.

3) Principle of Auxiliary Trial

Clarify the auxiliary positioning of artificial intelligence. The results of artificial intelligence assistance can only be used as a reference for trial work or trial supervision and management, and cannot replace judicial personnel in exercising core judicial powers such as trial power and prosecution power. Judicial judgments are always made by judicial personnel, judicial powers are always exercised by trial organizations, and judicial responsibility is ultimately borne by the judges.

4) Principle of Transparency and Trustworthiness

Artificial intelligence judicial applications must have interpretability, testability, and verifiability. The judicial data collection and management mode, legal semantic cognition process, auxiliary judgment inference logic, judicial service interaction mechanism, and other aspects can be reviewed, evaluated, and recorded in an interpretable, testable, and verifiable manner to ensure transparent, trustworthy, and traceable decision-making.

5) Principle of Public Order and Good Customs

Artificial intelligence judicial applications must not violate public order and good customs, harm social public interests and order, violate social public morality and ethics, adhere to the bottom line of judicial ethics, take into account the unity of reason, reason and law, and ensure that technological applications comply with mainstream social values and judicial ethical requirements.

6) Principle of Procedural Justice

The application of artificial intelligence in the judiciary must adhere to the core values of procedural justice, safeguard the parties' rights to participate in the procedure, be informed, object, and seek relief, maintain judicial experience, procedural openness, and equality between prosecution and defense, ensure that technological applications do not exceed the bottom line of procedural justice, and safeguard substantive justice with procedural justice.

B. VALUE ORIENTATION OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATIONS

1) Taking Judicial Fairness as the Core Value

Judicial fairness is the fundamental value pursuit of artificial intelligence judicial applications. Technological applications must serve judicial fairness, and all risk regulation and procedural safeguards must be centered on safeguarding judicial fairness, balancing the relationship between efficiency improvement and fairness protection, and ensuring that technological applications always revolve around the value of fairness.

2) Taking Procedural Justice as the Fundamental Guarantee

Procedural justice is the premise and guarantee of judicial fairness. The application of artificial intelligence in the judiciary must adhere to the bottom line of procedural justice, improve the procedural guarantee mechanism adapted to technological applications, safeguard the procedural rights of parties, maintain the legitimacy, fairness, and openness of judicial procedures, and lead the standardized development of technological applications with procedural justice.

3) Taking the Protection of Rights as the Fundamental Goal

The fundamental goal of artificial intelligence judicial applications must be to safeguard the legitimate rights of parties, respect and protect human rights, protect the legitimate

rights of parties such as the right to information, participation, expression, supervision, privacy, data, etc., prevent the infringement of rights by technological applications, and achieve the unity of technological empowerment and rights protection.

4) Operating Mode Based on Human-Machine Collaboration

Adhere to the operation mode of "human host assistance, human-machine collaboration", clarify the role positioning of human and technology, give full play to the main role of judicial personnel and the auxiliary role of artificial intelligence, achieve the organic integration of human value judgment, humanistic care and technological efficiency advantages, data support, and form a virtuous mechanism of complementary advantages and collaborative operation.

5) Based on Digital Rule of Law

The application of artificial intelligence in the judiciary must be incorporated into the digital rule of law framework, guided by the concept of digital rule of law in technology application, regulated by laws and regulations in technology behavior, and ensured by institutional mechanisms to promote the legalization, standardization, and justice of technology application, achieving deep integration and coordinated development of digital technology and rule of law construction.

VI. RISK REGULATION AND PROCEDURAL JUSTICE PROTECTION PATH OF ARTIFICIAL INTELLIGENCE JUDICIAL APPLICATION

A. BUILDING A COMPREHENSIVE RISK REGULATION SYSTEM

1) Strengthen Technical Governance and Prevent Technical Risks

One is to optimize algorithm design and eliminate algorithm bias. Promote the alignment of algorithm research and development with the values of judicial justice and procedural justice, carry out training data compliance cleaning and bias detection, and eliminate data bias and value bias; Set fairness parameters for algorithms and embed legal values such as equal protection and rights protection into the algorithm model; Establish a full lifecycle review mechanism for algorithms, carry out algorithm filing, algorithm auditing, and algorithm error correction to ensure fairness, impartiality, and non discrimination of algorithms, as shown in Table 4 below.

TABLE 4. Systematic Paths and Guarantee Measures for Risk Regulation and Procedural Justice

Guarantee Dimension	Core Implementation Path	Supporting Guarantee Measure	Expected Governance Effect
Technical Governance	Algorithm review, data classification protection and interpretable technology optimization	Establish algorithm filing audit and full-life cycle supervision	Eliminate technical defects and algorithm discrimination
Legal Regulation	Improve supporting laws, clarify application boundaries and strengthen judicial supervision	Formulate unified technical standards and negative list of application	Realize the rule of law of AI judiciary
Procedural Protection	Improve participation right, maintain judicial experience and expand procedural openness	Establish algorithm disclosure and expert assistant system	Safeguard the whole process of procedural justice
Multiple Co-governance	Human-machine collaborative operation, ethical review and multi-subject accountability	Compound talent training and institutional incentive mechanism	Build a normalized risk prevention system

The second is to improve the interpretability of algorithms and crack the black box of algorithms. Develop interpretable artificial intelligence technology to promote the visualization, comprehensibility, and traceability of algorithm decision-making processes; Establish an algorithm disclosure system to disclose the basic principles, decision-making logic, weight settings, and data sources of algorithms to judicial personnel and parties involved; Establish a system of algorithm expert assistants to provide algorithm explanations and inquiry support for parties involved, safeguarding their right to know and supervision.

The third is to improve technical protection and ensure system security. Strengthen the network security, data security, and technical protection of artificial intelligence systems, regularly conduct vulnerability detection, stress testing, and security assessments; Establish a system emergency response mechanism to quickly respond to and handle system failures and attack events; Promote the localization and independent research and development of the system to ensure technical and supply chain security.

2) Establish Sound Legal Regulations and Clarify Legal Boundaries

One is to improve laws and regulations and fill institutional gaps. Promote specialized legislation on the application of artificial intelligence in the judiciary, clarify the legal positioning, scope of application, rights and obligations, regulatory rules, and responsibility mechanisms of artificial intelligence; Revise existing laws and regulations to adapt to the new risks and demands of artificial intelligence judicial applications, and improve relevant regulations on data security, personal information protection, and accountability; Develop technical standards and operational norms for artificial intelligence judicial applications, clarify specific

requirements and behavioral boundaries for technological applications.

This paper clearly divides the application boundary of artificial intelligence: case sorting, document arrangement and legal literature retrieval are classified as permissible auxiliary application; while case fact determination, legal discretion and final trial judgment are listed as the core judicial power that AI must not replace. An operable negative list standard is formed to distinguish auxiliary document generation from core judicial decision-making.

The second is to designate application restricted areas and standardize application scenarios. Clarify the negative list of artificial intelligence judicial applications, prohibit artificial intelligence from replacing judicial personnel in exercising core judicial powers, and prohibit the application of fully automated decision-making in cases involving core rights such as the right to life, freedom, and significant property rights; Distinguish different types of cases and risk levels, implement differentiated application management, strictly limit the scope of artificial intelligence applications for high-risk cases, and ensure that technological applications do not exceed the legal bottom line.

The third is to strengthen regulatory enforcement and standardize application behavior. Establish a unified and professional regulatory agency for artificial intelligence judicial applications, responsible for technical review, application supervision, risk monitoring, and violation handling; Establish a regulatory mechanism that combines daily supervision, special inspections, and random checks, and strengthen the full process supervision of algorithms, data, systems, and applications; Strengthen the investigation and punishment of illegal applications, infringement of rights, and risky behaviors to ensure the implementation of legal regulations.

B. IMPROVE THE MECHANISM FOR SAFEGUARDING PROCEDURAL JUSTICE

1) Guarantee the Right to Participate in the Procedure and Strengthen the Subject Status of the Parties Involved

One is to give the program the right to choose. To safeguard the right of parties to choose the application of artificial intelligence in the judiciary, parties have the right to choose whether to use AI assisted services, and have the right to withdraw from AI interactive programs at any time, ensuring that parties independently decide how to participate in the program and respect their wishes.

The second is to improve the mechanism for program participation. Ensure the parties' right to be informed, cross examine, and object to the results of artificial intelligence assistance. The parties have the right to request disclosure of the decision-making basis of the algorithm, apply for expert assistants to question the algorithm, raise objections to the results of artificial intelligence assistance, and request independent review by judicial personnel; Establish an artificial intelligence assisted result verification program and incorporate it into the trial verification process to ensure that

the parties fully participate in the process and express their opinions.

The third is to strengthen the disclosure of the rights of the parties involved. Judicial personnel should inform the parties of the application scenarios, auxiliary functions, decision-making logic, rights and obligations, and risk warnings of artificial intelligence before applying AI assisted services, safeguard the parties' right to know, and guide them to participate in the process rationally.

2) Adhere to Judicial Experience and Ensure the Independent Judgment of Judges

One is to strengthen the requirement for judicial personnel to have firsthand experience. Strictly implement the principle of direct verbal communication, requiring judicial personnel to personally participate in court hearings, review evidence, listen to the statements and arguments of the parties, and form independent inner conviction; Prohibit judicial personnel from overly relying on artificial intelligence assisted results, and ensure that judicial personnel independently review and make decisions on case facts, legal application, and value judgments.

The second is to establish a manual review and circuit breaker mechanism. Mandatory manual review of artificial intelligence assisted results, judicial personnel must conduct a comprehensive review and independent judgment of the assisted results, and correct results that deviate from legal principles, public order and good customs, or obvious errors; Establish a dynamic circuit breaker mechanism that automatically triggers manual review and in-depth examination when the deviation between the AI assisted results and the independent judgment of judicial personnel exceeds a reasonable range, to prevent technical errors from affecting judicial decisions.

The third is to enhance the technical capabilities of judicial personnel. Strengthen the training of judicial personnel in the application of artificial intelligence technology, algorithm understanding, risk identification, and procedural safeguards, enhance their ability to master technology, prevent risks, and ensure procedural justice, and ensure that judicial personnel can effectively fulfill their main responsibilities and make independent judgments.

C. PROMOTING COLLABORATIVE GOVERNANCE OF TECHNOLOGY AND LAW

1) Promote Synergy Between Technology Research and Development and Legal Norms

Promote deep cooperation between technology developers, judicial authorities, and legal experts, embed legal norms, procedural justice, and judicial ethics requirements into the entire process of artificial intelligence system development, and achieve synchronous design, deployment, and operation of technology development and legal norms; Establish a legal review mechanism for technology research and development to ensure that artificial intelligence systems comply

with legal regulations and procedural justice requirements, and prevent risks from the source.

2) Achieving Collaboration Between Technical Applications and Judicial Services

Promote the deep integration of artificial intelligence technology and judicial services, optimize technical functions and enhance technical adaptability according to judicial practice needs; Establish a collaborative mechanism between technology application and judicial business, achieving seamless integration between technology assistance and judicial processes, procedural requirements, and judgment rules, ensuring that technology application serves judicial fairness and procedural justice, rather than simply pursuing efficiency improvement.

VII. RESEARCH CONCLUSION

Based on the perspective of digital rule of law, this article systematically studies the risk regulation and procedural justice protection path of artificial intelligence judicial applications, and draws the following core conclusions:

1, The application of artificial intelligence in the judiciary is the core practice of digital rule of law in the judicial field, which has important value functions in improving judicial efficiency, unifying judgment standards, optimizing litigation services, strengthening trial management, and promoting judicial modernization. However, it also faces multiple risks such as algorithm bias, algorithm black box, data security, ambiguous responsibilities, procedural alienation, and weakened judicial subjectivity. The risk generation stems from the inherent conflict between technical logic and judicial logic, the lack of regulatory system and guarantee mechanism, the value imbalance between efficiency orientation and fairness value, and the practical shortcomings of human-machine cooperation and ability adaptation.

2, Under the perspective of digital rule of law, the application of artificial intelligence in the judiciary must adhere to six basic principles: safety and legality, fairness and justice, auxiliary trials, transparency and trustworthiness, public order and good customs, and procedural justice. Judicial justice should be the core value, procedural justice should be the basic guarantee, rights protection should be the fundamental goal, human-machine collaboration should be the operating mode, and digital rule of law should be the fundamental guideline to ensure that technology applications operate on the track of rule of law.

AUTHOR CONTRIBUTIONS

Lijuan Wang designed, collected and analyzed the data, and drafted the manuscript. Lijuan Wang conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Lijuan Wang participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity

of any part of the work are appropriately investigated and resolved.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

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