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Research on Tort Liability in Traffic Accidents Involving Self-Driving Cars

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Abstract. Artificial intelligence technology is accelerating the adoption of highly autonomous vehicles, but determining liability in traffic accidents presents challenges stemming from legislative, judicial, and technical factors. China's current laws are based on traditional driving practices and lack specific regulations to address the unique characteristics of autonomous driving. Traditional liability rules are insufficiently suited to this technology. In judicial practice, there is confusion regarding who should bear responsibility and what principles should apply, leading to inconsistent rulings in similar cases. Additionally, the opaque nature of algorithms and the system's ability to learn autonomously make it difficult to determine fault, establish causal relationships, and allocate responsibility. This paper uses the Sun Modi case as a starting point to analyze these legal barriers. Drawing on experiences from Germany, Japan, the United States, and the United Kingdom, which have implemented hierarchical regulations, insurance coverage, and data recording systems, the paper proposes establishing liability rules based on the level of automation, improving the framework for determining responsibility and attributing fault, and creating mandatory insurance and compensation funds. It also suggests adopting multiple legislative approaches to ensure that laws remain adaptable, thereby balancing technological innovation with the protection of victims' rights. This approach can help promote the safe and orderly development of autonomous driving while providing a legal foundation for such progress.

Keywords: Artificial Intelligence, Tort liability, Comparison method

1. Introduction

The rapid development of artificial intelligence technology is gradually pushing highly automated vehicles (hereinafter referred to as HAVs) from the technical research and development stage toward market-oriented application, becoming an important direction of transformation in the future transportation and mobility sector. Against this background, in July 2017, the State Council issued the "New Generation Artificial Intelligence Development Plan," proposing to accelerate the in-depth application of artificial intelligence and cultivate and strengthen the artificial intelligence industry, among which intelligent technology for autonomous unmanned systems is a key technology for the development of artificial intelligence. At present, autonomous unmanned system technology has been gradually applied to the automotive industry. Autonomous driving vehicles are also a key focus

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of the current automotive industry development, and technologies such as automatic braking assistance systems have already been applied to vehicles. Various automobile manufacturers have proposed to launch fully autonomous vehicles by 2020 [1]. Some scholars have pointed out that the autonomy of intelligent robots constitutes a challenge to the existing fault-based tort liability and product liability systems, and it is necessary to further reflect on the existing liability system.

[2]China's current models of ultra-high risk liability and labor dispatch liability are both unsuitable for HAV torts. Traditional traffic accident liability centers on driver fault, but the autonomous control of self-driving vehicles makes fault determination and the boundaries of takeover obligations blurred, making it difficult to identify the liable subject; product liability faces difficulties in defect determination and causation proof due to the complexity of system algorithms and the characteristics of autonomous learning, making it hard for victims to protect their rights; the application conditions for ultra-high risk liability are strict and cannot fully adapt to autonomous driving operation scenarios. At the same time, the academic debate over whether autonomous vehicles possess civil subject qualification further increases the complexity of liability determination.

Currently, although relevant research has been initiated in academia, a systematic and operable solution adapted to China's national conditions has yet to be formed. Against this backdrop, this paper selects the determination of tort liability in traffic accidents involving autonomous vehicles as its research subject, which holds significant theoretical and practical implications. From a theoretical perspective, the study can enrich the application of China's tort liability law in new technological fields and provide theoretical references for the improvement of the intelligent transportation legal system. From a practical standpoint, clarifying the liable subject, attribution principles, and liability distribution mechanisms can unify judicial adjudication standards, efficiently resolve accident disputes, effectively protect victims' interests, and simultaneously balance the rights of all parties involved, creating a favorable legal environment for the safe and orderly development of autonomous driving technology. Therefore, this paper focuses on the tort liability of autonomous vehicle traffic accidents as its research theme, analyzes existing legal application challenges, and explores reasonable liability determination rules, aiming to provide references for judicial practice and the improvement of related legislation.

2. The applicability dilemma of autonomous driving traffic accident liability

The practical challenges in determining liability for traffic accidents involving autonomous driving primarily manifest as legislative norms being outdated and lagging behind, judicial adjudication standards being inconsistent, and the difficulty in assessing technical faults. These three issues are interwoven, collectively forming the core obstacle that currently makes liability determination difficult to resolve.

2.1. At the legislative level

The rapid iteration and marketization of autonomous driving technology have increasingly highlighted the lag in its legal regulation. The current legal system of China has not yet formed a systematic response to the determination of tort liability for traffic accidents involving autonomous vehicle. There is a gap in special norms, and there is also a problem in the adaptation of existing rules and technical characteristics. Disputed cases in judicial practice also lack a clear basis for adjudication.

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First of all, China lacks legal provisions specifically for autonomous vehicle. China's current laws and regulations, such as the Road Traffic Safety Law and the Tort Liability Code of the Civil Code, all regulate the traditional manual driving mode, and do not respond to the special technical attributes of autonomous vehicle. In the case of Sun Moudi, the vehicle involved was in L3 level conditional autonomous driving mode. At the time of the accident, the system had issued a takeover request, but the driver failed to take over the vehicle in a timely manner, resulting in the accident. The current laws do not clearly stipulate the standard of the driver's duty of care, the specific content of the takeover obligation, and the legal consequences of not taking over in a timely manner for the determination of responsibility in such "human-machine co driving" situations, resulting in a lack of direct legal basis for case handling.

Furthermore, the existing rules in our country are not compatible with the characteristics of autonomous driving technology. Article 1208 of the Civil Code stipulates: "If a motor vehicle causes damage in a traffic accident, it shall bear the liability for compensation in accordance with the relevant provisions of road traffic safety laws and this Law." This article continues the traditional logic of determining the liability for motor vehicle traffic accidents, with the "motor vehicle party" as the responsible party. However, in the case of automatic driving, the law does not specify whether the "motor vehicle party" refers to the vehicle owner, user, or auto drive system provider. In the case of Sun Moudi, the court faced a dilemma when determining the responsible party: if the driver is found to be responsible, it does not match its "passenger like" status; If car manufacturers are held responsible, there is a lack of clear evidence of product defects.

2.2. At the judicial level

The lack of norms and inadequate adaptation at the legislative level directly transmitted to the field of judicial practice, leading to confusion in the judicial determination of tort liability for autonomous vehicle in traffic accidents. The lack of unified standards for determining the attribution of the responsible party and the selection and application of attribution principles has become a core challenge in the trial of such cases.

The determination of the responsible party is not unified, and there are significant differences in the determination of the responsible party by courts in different regions in the trial of the Sun case and similar cases. Some courts adhere to the traditional identification logic, taking the driver as the sole responsible party and determining that they should bear full responsibility for failing to fulfill their duty of care; Some courts are attempting to break through traditional frameworks and introduce product liability rules, requiring car manufacturers to bear partial responsibility; Some courts have adopted a "compromise" approach, sentencing drivers and producers to share responsibility in a certain proportion, but the determination of the proportion lacks clear basis. The phenomenon of different judgments in the same case seriously damages the credibility of the judiciary.

The confusion of the attribution principle is reflected in the Sun case, where the first instance court applied the fault liability principle and determined that the driver's failure to take over in a timely manner was at fault; The second instance court revised the verdict, stating that the principle of presumption of fault should be applied, and the driver should prove that they are not at fault; In the retrial procedure, there are also opinions advocating that product liability or no fault liability should be applied. The repeated changes in the principle of attribution reflect the vague understanding of the nature of liability for autonomous driving accidents in judicial practice - whether it is behavioral liability or object liability, fault liability or danger liability, judicial judgments have not formed a unified consensus.

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2.3. At the technical level

The technical characteristics and operation logic of the auto drive system make its fault identification face multiple obstacles, which has become the core technical problem of the division of tort liability.

On the one hand, the algorithmic black box nature of system decision-making makes fault tracing difficult. The core operation of the auto drive system relies on complex algorithms. Its collection, analysis and decision-making process of road condition data are highly closed and professional, and it is difficult for external agents to peep into the internal operation mechanism of the algorithm. As relevant research has pointed out, the algorithmic logic foundation of autonomous driving systems has uncertainty, and its learning process includes reasoning and deduction. The decision results may exceed the producer's preset, and this unpredictability makes it difficult to determine whether the system's decisions violate the reasonable duty of care after an accident occurs. It is also impossible to clarify the direct correlation between algorithm defects and damage results. For example, in the Uber self driving car death case, the system had multiple deviations in pedestrian recognition, but it was difficult to trace back through algorithms to determine whether the deviation was a design defect, data error, or an unforeseeable result caused by autonomous learning, thus making it impossible to accurately identify the system's fault.

On the other hand, the autonomous learning ability of the system leads to fuzzy attribution of faults. The auto drive system does not operate statically. It can collect real-time road conditions, user operating habits and other data through the Internet of Vehicles during use, constantly optimize algorithm rules, and form an independent decision-making mode that is independent of the original settings when leaving the factory. This characteristic suggests that system errors may stem from two aspects: firstly, algorithm omissions or data defects in the producer's design, which are considered as initial errors; The second is the decision deviation caused by data learning during system operation, which belongs to the fault formed later in life. The boundary between these two types of faults is difficult to distinguish. If the system changes the original algorithm logic due to self-learning and causes accidents, it is difficult to determine whether the producer had a foreseeable possibility of the fault or to attribute it to the user, leading to difficulties in identifying the fault subject. At the same time, it is extremely difficult to distinguish between system faults, human factors, and external environmental factors. Accidents may occur as a result of multiple factors such as system decision-making errors, user failure to take over in a timely manner, and sensor interference. Existing technological means are difficult to quantify the impact of each factor, further exacerbating the complexity of system fault judgment.

3. The challenge of autonomous vehicle infringement to the determination of accident liability

There are regulatory gaps and obstacles to the adaptation of rules in the legislation of infringement liability for autonomous driving. The phenomenon of inconsistent judicial standards and different judgments for the same case is prominent in the judiciary. In terms of technology, it is difficult to trace the fault and divide the responsibility. The combination of the three factors has led to the overall dilemma of determining infringement in autonomous driving accidents in China. The traditional infringement liability system is unable to cope with the special scenarios of autonomous driving, and there is an urgent need to establish a new type of collaborative liability determination rule.

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3.1. At the legislative level

3.1.1. The current law does not specifically stipulate the liability for infringement of autonomous driving

The current law does not specifically stipulate the tort liability of driverless vehicles, and China has not yet issued laws and regulations specifically for autonomous vehicle. Article 19 of the Road Traffic Safety Law only stipulates that "when driving a motor vehicle, one shall obtain a motor vehicle driving license according to law", which does not involve the legality of "driving" a vehicle by the auto drive system; The rules on motor vehicle traffic accident liability, product liability, and high-risk liability in the tort liability section of the Civil Code are all based on traditional technical conditions. This legislative gap has led to the dilemma of "no legal basis" for handling autonomous driving accidents.

3.1.2. There are obstacles to the application of the existing liability rules in the civil code

(1) The obstacles to the application of liability for motor vehicle traffic accidents are reflected in the fact that although Articles 1208 to 1217 of the Civil Code stipulate liability for motor vehicle traffic accidents, its core lies in distinguishing liability between motor vehicles and between motor vehicles and non motor vehicles/pedestrians. However, in the context of autonomous driving, the responsibility subject has expanded from a single "driver" to multiple parties including "driver system producer", and traditional standards of "operational control" and "operational benefits" are difficult to apply. The auto drive system actually controls the vehicle, but the system itself does not have legal personality; Vehicle users enjoy operational benefits, but may lack operational control; Producers master the core technology, but the autonomous learning of the system after the vehicle leaves the factory may lead to it being out of the control of the producer.

(2) Articles 1202 to 1203 of the Civil Code stipulate product liability, but the particularity of the auto drive system makes it difficult to apply the rule directly: first, the identification standard of "defects" is unclear. Traditional product defects include manufacturing defects, design defects and warning defects, but whether the algorithm defects and data defects of the auto drive system belong to product defects is not clear in the law. Secondly, proving causal relationships is difficult. The system has deep learning capabilities, and autonomous learning after leaving the factory may change the original algorithm settings, leading to a break in the causal chain between accident causes and product defects. Thirdly, there are doubts about the grounds for exemption. It is still controversial whether the "development risk defense" stipulated in Article 41 of the Product Quality Law (where the scientific and technological level at the time of putting the product into circulation cannot find the existence of defects) can be applied to the unpredictable auto drive system.

(3) Article 1236 of the Civil Code stipulates the responsibility of high risk, but there are differences in the academic circles whether autonomous vehicle are "engaged in high risk operations". It is definitely believed that autonomous driving has unpredictability and conforms to the highly dangerous characteristics; The negation theory holds that autonomous driving aims to improve safety and should not be classified as highly dangerous. In addition, the application of high-risk liability will increase the burden on producers, may inhibit technological innovation, and contradict the policy goal of encouraging the development of autonomous driving.

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3.2. At the judicial level

The current legislation in our country has not yet formed a unified tort liability judgment rule that adapts to the characteristics of autonomous driving technology, resulting in significant differences in the judgment results of similar cases in judicial practice, seriously affecting the uniformity and authority of legal application.

On the one hand, there are obvious gaps in current legal norms. Core laws and regulations such as the Road Traffic Safety Law and the Civil Code on Tort Liability all focus on traditional manual driving as the regulatory core, without making specific provisions for the technical specificity of autonomous driving. They do not clarify the responsibility attribution logic of vehicles with different levels of automation, nor do they define specific judgment criteria for "human factor participation" and key issues such as the boundary of fulfilling takeover obligations. For example, for accidents caused by failure to take over in a timely manner in L3 level conditional autonomous driving mode, some courts order the user to bear full responsibility based on the driver's duty of care clause in the Road Traffic Safety Law, while others invoke the product liability rules of the Civil Code to require the producer to share responsibility. The selection of judgment basis lacks unified guidance. On the other hand, there are adaptation barriers between existing liability rules and the characteristics of autonomous driving technology. The traditional attribution logic of motor vehicle traffic accident liability based on "driver's fault" is difficult to meet the demand for liability determination in highly automated scenarios such as "human-machine co driving" or "unmanned operation"; The standard for "defect identification" in product liability is vague, and for accidents caused by algorithm defects and data dependencies, it is difficult for victims to prove the causal relationship between product defects and damage results, leading to differences in the court's application of product liability; The scope of application of high-risk liability is also not clearly defined. Some courts include highly autonomous driving accidents in the category of high-risk liability, while others insist on applying fault liability, further exacerbating the confusion of judgment standards. The lack of rules and inadequate adaptation at the legislative level has led to a lack of unified basis for courts to handle similar autonomous driving traffic accidents, and the frequent occurrence of different judgments in similar cases has seriously damaged judicial credibility and legal predictability.

3.3. At the technical level

The technical characteristics of autonomous vehicle make the behavior of the three parties, namely, people (users, remote security officers, managers, etc.), vehicles (vehicle hardware carriers), and systems (autonomous driving algorithms and data modules), intertwined after the accident, which makes it difficult to clearly define the boundary of responsibility in judicial practice, and the attribution of responsibility is in trouble.

From the perspective of "people", the subject identity and obligations of people in different operating modes exhibit diversified characteristics. In some modes, users have dual identities as passengers and potential receivers, and the degree of fulfillment of their reasonable use obligations and safety switching obligations is difficult to quantify. For example, the fault determination of users who fail to respond in a timely manner after the system issues a takeover request lacks clear time standards and behavioral norms; The boundary between the assistance obligation and emergency control obligation of remote security personnel in unmanned mode is blurred, making it difficult to determine whether they are at fault in the occurrence of accidents and how to define the degree of fault in judicial practice.

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From the perspective of "vehicle" and "system", as the core link connecting people and vehicles, the system's self-learning and data dependence have led to technical difficulties in responsibility tracing. System defects may stem from design oversights by producers, component failures by hardware manufacturers, or unpredictable decisions formed through data learning during operation. Judicial authorities find it difficult to distinguish whether the cause of accidents is hardware failures, algorithm defects, or data anomalies through technical appraisal, thus failing to clarify the responsibility boundaries of vehicle producers, system developers, and data providers. For example, in highly automated driving accidents, if the system fails to execute the minimum risk strategy in a timely manner, it may be due to the imperfect algorithm design of the producer, the failure of remote safety personnel to assist in a timely manner, or abnormal external data transmission. The behavior of the three parties is interrelated and difficult to distinguish, which leads to numerous obstacles for judicial authorities in determining causal relationships and dividing responsibilities, making it difficult to accurately define the scope and proportion of responsibility of each party, and ultimately resulting in inaccurate responsibility determination or responsibility shifting.

4. Legislation and practice reference on the determination of tort liability of autonomous vehicle abroad

The mature experience of clarifying the responsible parties outside the domain and providing insurance and data recording support can provide direct reference for China to solve the problem of infringement liability in autonomous driving. China should base itself on local practices, absorb reasonable rules from outside the region, and construct a tort liability system that is adapted to technological characteristics and balances victim relief and industrial development.

4.1. Typical legislation of civil law countries

Civil law countries focus on written law, pay attention to the systematic and logical nature of legislation, and present the characteristics of "detailed rules and clear responsibilities" in the regulation of tort liability for autonomous vehicle.

4.1.1. Germany

As a strong country in the automotive industry, Germany has established a responsibility rule system adapted to autonomous driving technology through the revision of the Road Traffic Law. The core legislative content includes: clarifying the alertness obligation and takeover obligation of drivers in autonomous driving mode, requiring drivers to intervene in vehicle control in a timely manner when the system issues takeover instructions or predicts risks; Establish a dual liability structure of "no fault liability of the car owner+producer product liability", where the victim can directly claim compensation from the car owner, and the owner can recover from the driver at fault after assuming responsibility, while the producer only assumes responsibility when the vehicle has product defects; Establish compensation limits for producers, specifying a maximum compensation limit of 10 million euros for deaths caused by highly automated vehicles and a maximum compensation limit of 2 million euros for property losses; [3]Mandatory requirement for vehicles to install "black boxes" to record vehicle operation data and store it for at least six months (three years after the accident), providing technical support for identifying the cause of the accident and determining responsibility. In addition, German legislation does not endow autonomous vehicle with independent legal

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personality, and always regards them as legal objects, avoiding the interference of subject qualification disputes on liability determination.

4.1.2. Japan

Japan has established a targeted legislative framework with the dual goal of promoting technology application and ensuring security. Through laws and regulations such as the Roadmap for the Popularization of Automatic Driving and the Road Test Guide for autonomous vehicle, the road test standards for driverless vehicles, the qualification of test institutions and the responsibility of remote monitors are defined; Include remote monitoring personnel in the responsibility system, requiring them to pass professional assessments before carrying out their work, and assume corresponding responsibilities for accidents during the testing period; In terms of insurance system, Tokyo Marine Nikko Fire Insurance Company has taken the lead in including traffic accidents during autonomous driving in the scope of insurance compensation, achieving pre emptive relief channels; At the same time, Japan's legislation focuses on the construction of supporting systems and has established strict road testing review procedures [4].The police station in the jurisdiction where the testing road is located is responsible for assessing on-site assessment officers and remote monitoring personnel, issuing testing permits with a validity period of no more than 6 months to ensure the synchronous promotion of technology application and risk prevention and control.

4.2. Typical legislation of anglo american legal system countries

Anglo American legal systems are based on case law, supplemented by specialized legislation, with a legislative style that emphasizes flexibility and practicality, and emphasizes balancing the interests of all parties through diversified mechanisms.

4.2.1. The United States

The United States adopts a dual regulatory model of "federal legislative guidance+state legislative refinement". At the federal level, the Autonomous Driving Act has established core rules: clarifying that federal legislation takes precedence over state legislation, requiring states to refine rules based on federal standards and not lower than the product quality requirements set by the federal government; A highly autonomous vehicle advisory committee was set up to provide professional advice on accident liability division and insurance expense bearing. At the state level, differentiated rules are formulated based on local technological development. For example, California's Road Testing Act stipulates accident handling in road testing: manufacturers must first submit detailed information about their vehicles and testing procedures to local authorities; When autonomous technology causes a collision and a malfunction is detected, the manufacturer will be held responsible for the damage caused by their autonomous driving HAV. The US Department of Transportation and the autonomous vehicle Act of Congress take the accident data record as an important factor in the safety assessment standard of autonomous vehicle, so that the relationship between manufacturers and vehicles can be clearly defined; [5]New York State has refined the insurance limit requirements for test vehicles, forming a regulatory framework of "unified bottom line+local characteristics". In terms of liability determination, US courts have gradually established the principle of "product defect priority" through precedents. When accidents are caused by technical problems such as system algorithm defects or data processing errors, product liability is

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given priority in pursuing producer responsibility. However, when the driver intentionally intervenes or fails to take over in a timely manner, they are held responsible accordingly.

4.2.2. The UK

The UK prioritizes victim relief, and in February 2017, the UK's Automotive Technology and Aviation Act included mandatory insurance for autonomous vehicles in the scope of motor vehicle insurance. In the event of an accident in autonomous driving mode, the insurance company shall bear the liability for compensation. The insured parties of compulsory liability insurance can be extended to developers, producers, and users, and through different stages of liability insurance, they can jointly cover infringement risks [6].The infringed party can directly request compensation from the compulsory liability insurer of the autonomous vehicle, and the insurer has the right to recover from the existing legal liability subject. The legislative highlight lies in expanding the coverage of compulsory motor vehicle insurance, clarifying that insurance companies are the primary compensation subjects for autonomous driving accidents, and victims can directly claim compensation from insurance companies without the need to first confirm the infringing liability subject; Granting the insurance company the right of subrogation, and after fulfilling the compensation obligation, it can recover from the vehicle manufacturer, user, or third party who is at fault; Require vehicle owners to purchase compulsory liability insurance. In the event of an accident involving an uninsured vehicle, the victim may directly claim full compensation from the owner. In addition, the UK legislation does not specifically set compensation limits for producers, but rather disperses liability risks through insurance mechanisms, which not only guarantees sufficient relief for victims but also avoids a single entity bearing excessive responsibility.

4.3. The Chinese road of the tort liability system of autonomous vehicle

4.3.1. Establish responsibility rules for hierarchical classification

Drawing on the experience of classification regulations in Germany and Japan, China should establish differentiated liability rules based on the level of autonomous driving automation (L0-L5). For L1-L3 level low and medium automation vehicles, strengthen the driver's duty of care and takeover, and clarify their fault responsibility for failure to fulfill their obligations; For L4-L5 level high and fully automated vehicles, a responsibility structure of "producer product responsibility as the main responsibility, user fault responsibility as the auxiliary" shall be established. When the vehicle is in a completely autonomous operation state and no human factors are involved, the producer's product responsibility shall be prioritized. At the same time, we should learn from the German "black box" system, mandate the installation of data recording devices on all autonomous vehicles, unify data storage, extraction, and interpretation standards, provide technical support for liability determination, and solve the problem of proving causal relationships.

4.3.2. Improve the system of responsible parties and attribution principles

Referring to the recognition of the status of legal object in civil law countries, China's legislation should clearly deny the independent legal personality of autonomous vehicle, define them as legal objects with intelligent attributes, and avoid disputes over subject qualifications interfering with the distribution of responsibilities. In terms of the principle of attribution, the "no fault liability+product liability" of the civil law system and the "flexibility of fault determination" of the common law

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system can be integrated, and the no fault liability principle can be applied to L4-L5 level vehicles, with the producer bearing responsibility for accidents caused by technical risks; Adopt the principle of fault liability for L1-L3 level vehicles and introduce the rule of fault presumption to reduce the burden of proof for victims. In addition, Germany's compensation limit system can be used as a reference to set reasonable liability limits for producers, balancing their innovation pressure and compensation liability.

4.3.3. Strengthen the coordination of supporting systems

Drawing on the design of the insurance system in the UK and Japan's road testing regulatory experience, China should establish a dual risk sharing mechanism of "mandatory insurance+social compensation fund". Expand the scope of compulsory motor vehicle insurance coverage, including producers and vehicle owners as policyholders, and extend the coverage to passengers and drivers inside the vehicle; Establish a social compensation fund for autonomous vehicle. The fund sources include producer fees, fine income and special government funds to make up for damage that cannot be covered by insurance. At the same time, the market access and road testing regulatory system should be improved, clarifying the insurance limit for testing vehicles, the qualification requirements for testing personnel, and the standards for defining testing areas, to achieve full process regulation of technology application and risk prevention and control.

4.3.4. Maintain the openness and adaptability of legislation

Referring to the model of "federal and state tiered legislation" in the United States, China can adopt a diversified legislative path of "specialized legislation+judicial interpretation+departmental regulations". The Standing Committee of the National People's Congress will formulate a special Law on Safety Management of autonomous vehicle to establish core responsibility rules and institutional framework; The Supreme People's Court has issued judicial interpretations to unify judicial judgment standards and clarify the judgment criteria for key issues such as product defect identification and causal relationship proof; The Ministry of Transport, Ministry of Industry and Information Technology, and other departments have formulated departmental regulations to refine specific operational rules such as road testing standards, data management, and privacy protection. At the same time, legislation should reserve flexible space and set up dynamic adjustment mechanisms to address new issues such as algorithm defects and data security that arise in technological development, ensuring that laws and technological development are adapted synchronously.

5. Conclusion

While autonomous driving technology is reshaping the transportation pattern, the difficulty of determining infringement liability has become a key constraint on the implementation of technology and the protection of rights and interests. Conducting this research is not only an extension and expansion of the theory of infringement liability law, but also a response to the practical needs of judicial practice and industrial development. Taking the case of Sun Moudi as a typical example, it clearly demonstrates the multiple difficulties in the determination of infringement in autonomous driving traffic accidents in China, including legislative norms gaps, inconsistent judicial judgment standards, and difficulties in tracing technical errors and assigning responsibilities. Through analysis from the perspectives of legislation, judiciary, and technology, it is revealed that current laws lack

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specialized regulations, traditional liability rules are difficult to adapt to, and algorithmic black boxes and self-learning exacerbate the blurring of liability boundaries. The legislative practices of countries such as Germany, the United States, and the United Kingdom have provided useful references for China in terms of hierarchical regulation, liability reconstruction, insurance support, and diversified legislation. Based on China's national conditions, only by constructing classification responsibility rules according to automation levels, improving the subject and attribution system, strengthening supporting measures such as insurance and data supervision, and maintaining legislative openness and adaptability, can we solve the problem of identification. In the future, we should balance technological innovation with risk prevention and control, unify judicial standards, fill legal loopholes, and protect the rights and interests of victims with a sound infringement liability system, laying a solid legal foundation for the orderly development of intelligent transportation safety.

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