

Elemental Intelligent Trial Model for Justifiable Defense Cases

-- Quantitative Analysis based on 507 Decisions

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Abstract

Clearly defining the limits of defense to awaken the 'dormant' system of justifiable defense is crucial for addressing the significant challenge in judicial practice: the difficulty in recognizing and the rigidity in applying defense. Through on-site visits to 27 courts and procuratorates in 11 provinces, the research identified four core challenges in judicial practice: rigid standards for recognition; the significant drawbacks of result-oriented theories; a large number of non-statutory factors influencing individual case judgments; and the lack of a unified standard for determining limits, with significant differences in the elements of judgment among the 27 courts. Quantitative research plays a crucial supporting role in qualitative research. Based on this, the concept of quantitative research is proposed, using the Logistic model and the CART algorithm to systematically identify numerous non-statutory factors. By processing 507 data sets from the Judgments Online and extensive judicial field research materials, a model database is established, summarizing and categorizing 21 elements across three major dimensions for determining defense limits. The AIS-ISS score, the degree of bodily harm score, and other quantification rules are used to assess the consequences of damage. The Logistic model and decision tree model are employed to measure the frequency of defense limit-related elements in individual cases. An innovative comprehensive quantification model is constructed to obtain the adjudication weights of each factor, forming a scoring system for the determination of justifiable defense limits. The data results confirm the conclusions of the preliminary research, indicating that the 9 widely applied practical elements are not explicitly defined statutory elements. Due to the high risk of defensive weapons, the rigid element of over-defense is prevalent in practice. Based on the model data, a defense limit judgment mechanism is established, along with legal principles and rules for this mechanism, to address the challenges of preliminary research. By qualitatively assessing the situation between defense and infringement, specific case facts are identified for each element's judgment. The comparative scoring criteria derived from the comprehensive quantitative model are used to assist in the 'defense-infringement' comparison results. The weight order and ratio scoring of 21 defense limit elements are defined according to the variable ranking scoring table. This process involves identifying and evaluating each element, achieving a comparative and strength comparison of the defense and infringement sides, providing a scientific and convenient tool for judicial authorities in case adjudication.

Keywords

Justifiable Defense; Logistic Model; Decision Tree Model; Comprehensive Quantitative Model; Limit Identification Factors.

1. Introduction

1.1. Research Background

1.1.1. The Real Controversy of Defense Limit

In recent years, the issue of justifiable defense has become a hot topic in judicial circles. Both legal practitioners and scholars have been actively exploring this area, handling a series of influential and representative cases of justifiable defense, which underscores the principle that 'the law must not yield to illegality.' Currently, in judicial practice, there is no clear standard for determining the limits of justifiable defense, and it largely depends on the judge's discretion. According to data from a research report published by the Supreme People's Procuratorate of the People's Republic of China, the success rate of justifiable defense is only 4%. Therefore, clarifying the limits of justifiable defense and establishing a unified and clear standard to reduce the negative impact of judges' subjective discretion has become a significant research issue.[1]

However, in judicial practice, due to the varying standards judges have for justifiable defense, their application of justifiable defense in judgments is relatively cautious. The 'Yu Huan case' in Liaocheng, Shandong, extensively debated three key points: whether Yu Huan's stabbing was defensive, whether it constituted special defense, whether it was excessive defense, and how to determine the charge and punishment. This led to a tortuous process where the first-instance court sentenced him to life imprisonment for intentional injury, but the second-instance court ruled that it constituted excessive defense and thus intentional injury. In the 'Yu Haiming case' in Kunshan, Jiangsu, Yu Haiming caused the death of an unlawful aggressor, and the dispute centered on whether the physical conflict between the two parties exceeded the limits of justifiable defense. After investigation and discussion, the court ultimately ruled that Yu Haiming's actions were justifiable defense and withdrew the case. In the 'Zhao Yu case' in Fujian, Zhao Yu's actions were deemed excessive defense. Considering his efforts to stop the unlawful aggression, the court decided not to prosecute Zhao Yu to encourage acts of bravery.

These cases have also sparked extensive academic discussions. For instance, in the Yu Huan case, Professor Chen Xingliang argued that Yu Huan acted in self-defense. Although he used a knife when the other party was unarmed, he did so to compensate for the numerical disadvantage and because the unlawful attack had been ongoing for a considerable time. If the defender did not use sufficiently effective means, it would not have been sufficient to stop the attack. Therefore, using a knife alone should not be considered a lack of justifiable defense. The academic debate centers on whether the defense 'obviously' exceeds the necessary limits. Clearly, the crux of these cases lies in whether the defendant's actions crossed the boundaries of justifiable defense.

1.1.2. The Theoretical Problem of Defense Limit

When interpreting Article 20, Paragraph 2 of the Criminal Law, two key conditions should be taken into account: "clearly exceeding the necessary limit" and "causing significant damage". The former focuses on the limit of the act, while the latter focuses on the limit of the result. Academic discussions on these two aspects have led to heated debates and become hot topics in the current judicial field.

(1) Limits of behavior: the criteria for determining whether a behavior "clearly exceeds the necessary limit" are different

In the domestic academic community, there is still a lack of a unified standard for determining the conditions and elements of the 'necessary limits' in justifiable defense. Scholars like Liang Genlin do not agree with the 'result-oriented theory' and the 'principle of weapon equivalence,' arguing that judicial decisions on justifiable defense should overcome rigid thinking and be based on the general understanding and possible reactions of the average person. [2] Professor Zhang Mingkai's viewpoint is particularly significant: in determining the conditions of defense

limits, a comprehensive approach should be adopted, analyzing from multiple angles such as the defender's capabilities and the strength of the weapon, and avoiding the one-sided thinking that negates the whole due to a single factor. [3]

Furthermore, the academic community has extensively studied and debated whether the defense action should be considered 'obviously' excessive. The prevailing view is that when assessing whether a defensive act is 'obviously' excessive, one should focus on the overall limits of the defense rather than the specific harm suffered by the defender. However, this perspective has not been accepted by scholars such as Li Hong and Jiang Tao, who argue that it is unrealistic to judge from an omniscient viewpoint and that a holistic approach is necessary to fully understand the defensive situation.[4]

The debate over the limits of acts in criminal law between Germany and Japan is varied. According to Article 32 of the German Criminal Code, justifiable defense requires both 'necessity' and 'desirability.' In contrast, Article 36 of the Japanese Criminal Code defines justifiable defense as an act taken 'out of necessity.' This definition includes two key elements: 'necessity' and 'appropriateness.'

(2) Result limit: the relationship between "causing significant damage" and "exceeding the necessary limit" is unclear

In the context of determining the limits of justifiable defense, the relationship between 'causing significant damage' and 'exceeding the necessary limit' is a hotly debated topic. The mainstream academic view adopts the dichotomy theory, which divides the conditions for the limits of behavior and the limits of results into two distinct dimensions for consideration. However, this dichotomy can only address extremely typical cases where the act is excessive but the result is not, or vice versa, and cannot be applied to more complex scenarios. In contrast, scholars like Professor Zhang Mingkai support the monism theory, which posits that only when significant damage is caused does it clearly exceed the necessary limit. The excessive defense behavior is the cause of significant damage, and significant damage is the basis for determining excessive defense; both are interdependent and indispensable.

(3) The current theory of the method of determining the limit of defense is complicated

In the field of determining the limits of justifiable defense, current academic theories vary widely. The prevailing view primarily uses legal provisions, case studies, and legal principles as key points for analysis. Some scholars have innovatively applied a critical factor analysis method, focusing on influential factors and refining the analytical approach accordingly. However, these methods are predominantly qualitative, heavily influenced by judicial discretion. In terms of quantitative analysis, only a few scholars have conducted data statistics on cases. Among them, very few have used the 'regression analysis + interview method' to quantitatively study the weight of influencing factors in the determination of defense limits.

In summary, the process of determining the limits of justifiable defense faces three major controversies: the ambiguity of the standard for 'clearly exceeding the necessary limit,' the unclear relationship between the 'significant damage' and the over-limit behavior, and the complex and varied methods used to determine these limits. As a result, although the issue of determining the limits of justifiable defense has long been a topic of heated debate, it remains a significant challenge in judicial practice.

Based on the aforementioned contentious issues, the article addresses each one. Regarding the issue of the limits of action, the article quantifies the elements of justifiable defense, addressing the inconsistency in standards. For the issue of the limits of outcome, the article employs decision tree and Logistic regression models to establish a mechanism for determining the limits of justifiable defense, thereby avoiding the conflicts and contradictions between the dichotomy and the unity theories. Concerning the research methodology, while existing mainstream analyses primarily focus on qualitative research methods, data analysis methods

are still in a developmental stage. Therefore, the article opts for data quantification analysis, using rigorous statistical tools to present specific case data, which helps reduce the influence of subjective judgment and fills a gap in the field of justifiable defense limits, a frontier interdisciplinary area.

1.2. Research Methods

1.2.1. Literature Research Method

In the early stages of the project, the article gathered a substantial amount of theoretical material through legal searches on the Judgments Online and PKU Law, as well as literature collection from CNKI. During the project, the article integrated field research materials to develop a systematic framework of variables and indicators. Additionally, the article focused on comparing the theoretical differences in the determination of justifiable defense limits between the judicial and academic communities, aiming to bridge the gap between theory and practice.

1.2.2. Survey Method

Considering the overly formalized argumentation in structured judicial documents, the article conducted field investigations and designed detailed interview outlines for relevant factors. It conducted in-depth interviews with staff from courts, procuratorates, and other judicial bodies at all levels across the country, collecting 56 offline interview materials and 627 online survey materials, which supplemented information not covered in the judicial documents. The interviews were conducted in a semi-structured manner to gain a comprehensive understanding of the respondents' actual considerations and mental states during the case adjudication process.

1.2.3. Empirical Research Method

The article systematically analyzes the factors that determine the limit of defense in each case, sets the influencing factors and the ruling result of justifiable defense as independent variables and dependent variables respectively, and processes the data into dummy variables for regression analysis. The Logistic model is used to measure the frequency and influence degree of the elements involved in the determination of the limit of justifiable defense in each case.

2. The Current Situation of Investigation

A review of 507 relevant judicial documents revealed that the rate of justifiable defense being established is less than 1%. In the judicial opinions, 202 documents (40%) analyzed cases where justifiable defense was not established using a single factor; 228 documents (45.2%) used a dual-factor analysis; and less than 15% considered multiple factors comprehensively in the defense process. This indicates that the recognition rate of justifiable defense is low, and the consideration of factors related to the defense process is relatively simplistic, posing a significant challenge in judicial practice. Judicial practice often relies on a single criterion for determination, leading to mechanized and one-sided judgments. Interviews revealed that judicial practices typically use a single element as the standard, rarely considering multiple factors. During the research phase, interviews were conducted with over ten judicial authorities in Shandong Province. More than half of the institutions, represented by the Gaotang County People's Court, generally accept the 'danger level of defensive weapons' as the sole criterion for determining whether defense has exceeded limits, widely believing that the danger level of weapons used by the defendant in conflict is positively correlated with the likelihood of an excessive defense being recognized. Numerous research cases indicate that to avoid public opinion risks and trial pressures from inconsistent judgments in similar cases, judicial authorities tend to favor easily operational single criteria. However, directly recognizing excessive defense based on a single factor can easily lead to mechanized and one-sided

judgments. The sole focus on outcomes has significant drawbacks, as it overlooks the legitimacy and rationality of defensive actions. Practical experience shows that the 'sole focus on outcomes' approach in judicial practice is notably problematic. In the courts surveyed across various regions and levels, over 65% indicated that they tend to prioritize damage outcomes over the specific defensive actions. 'The survey data and results indicate that practices such as 'the deceased is the priority 'and' the injured are to be appeased' to maintain social stability and mitigate public opinion have a significant impact on the current determination of defenses, leading to a more rigid approach. Non-statutory factors often blur the boundaries of judicial practice, leading to discrepancies between public perception and judicial decisions. Research indicates that in recent years, the role of non-statutory factors in determining justifiable defense has grown, causing the public's understanding of the legal standards for justifiable defense to become increasingly unclear. This ambiguity undermines the guiding role of law as a behavioral norm. Furthermore, according to the survey data, two key factors influencing the determination of justifiable defense are whether the defender recognizes their actions as excessive (anticipatory possibility) and whether the victim can reasonably avoid the unlawful attack (retreat possibility). However, in judicial practice, other significant non-statutory factors affecting the determination of justifiable defense include whether the defender was prepared in advance and the cause of the defensive action. Consequently, the discrepancy between public perception and judicial practice has become a major challenge in determining justifiable defense. The lack of a unified standard for recognizing justifiable defense poses a significant challenge to judicial credibility. The 12th batch of guiding cases on justifiable defense, released by the Supreme People's Procuratorate, all advocate that judicial personnel should make contextual and case-specific judgments on justifiable defense. According to the survey results, the recognition of justifiable defense in judicial practice often lacks a unified theoretical standard, leading to an increasingly severe 'different cases, different judgments' phenomenon. The survey found that 27 judicial authorities have different criteria for recognizing the limits of justifiable defense.

3. Quantitative Research on the Elements of Defense Limit Identification

3.1. Data Source and Quantitative Processing

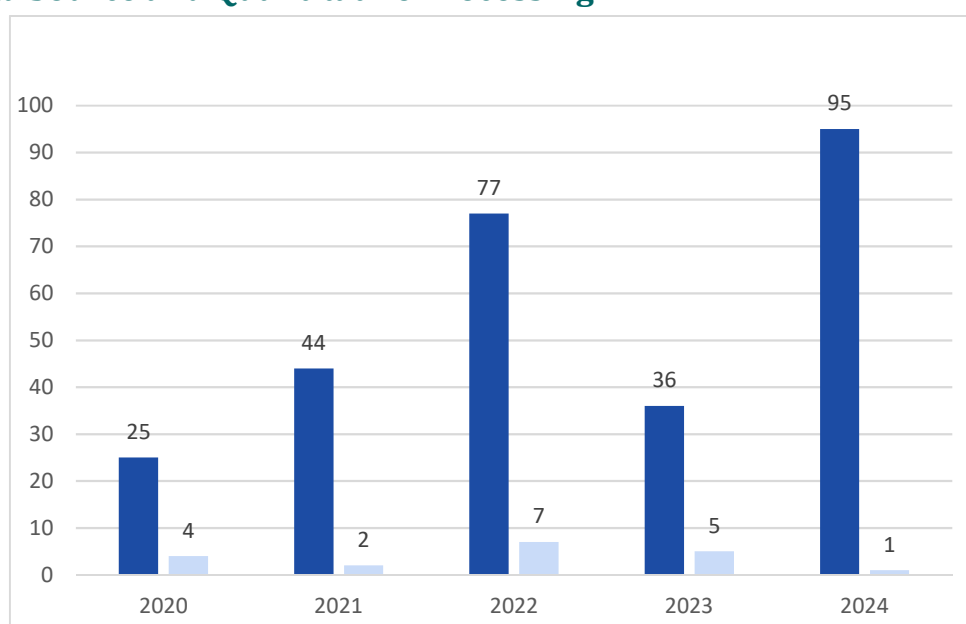


Figure 1. Comparison of the number of cases decided by judges on excessive defense and justifiable defense (first instance)

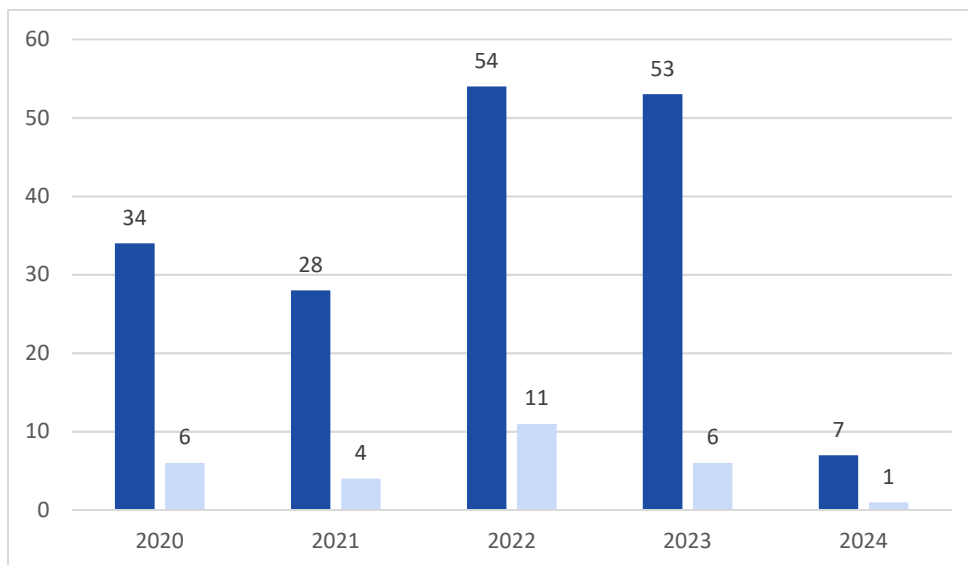


Figure 2. Comparison chart of the number of cases decided by the judges on excessive defense and justifiable defense (second instance)

Due to the complexity of justifiable defense cases, the standardization of judicial documents is relatively low, and they involve a significant amount of subjective value assessment. The article can only achieve data tracking and analysis through manual reading of sample cases. As of August 2024, only 507 justifiable defense cases met the sample requirements. By statistically analyzing the judgment outcomes of these cases, the article provides an overview of the recognition of justifiable defense in China over the past five years.

Table 1. Factors for determining defense limits

limit of defense Elements of determination	Limit of results Elements of determination	extent of damage	The number of minor and serious injuries and deaths on both sides	
	Limits of behavior Elements of determination	The part of the body hit	The importance of the part hit	
		Defense force comparison	physical quality	
			Methodological contrast	
			Victims of violence	
			The numbers compare	
		Defensive psychological factors	Source of defensive tools and defensive premeditation	
			Whether there was a dispute before	
			Whether there is a cause of fault	
			Whether to call the police afterwards	
		other factor	Whether the defender was forgiven afterwards	
	Reasons for dispute (economic, personal, mixed economic and personal)			
	The retreat of defensive space			
Defensive positions	Defender security in general and special places			

The framework for determining the factors affecting justifiable defense is based on judicial interpretations, guiding cases, and other sources, summarizing the court's approach to making such determinations. The article employs methods such as literature review, interviews, and questionnaire surveys to analyze the 'necessary limits' theory of justifiable defense both domestically and internationally, forming a theoretical framework for identifying the elements of these limits. Subsequently, the article conducted field research in 11 provinces and municipalities, 27 cities, and their legal institutions, including the People's Congresses, People's Procuratorates, and People's Courts, through semi-structured interviews, collecting 130,000 words of interview data on the determination of justifiable defense limits. This data was then comprehensively organized to identify three core dimensions and 21 influencing factors that affect the determination of defense limits, resulting in the following table of factors for determining defense limits.

After the data information is organized, it is imported into SPSS. The sample data is standardized using the Z-Score method to obtain normalized data. Effective data preprocessing provides a solid foundation for subsequent model building, which helps analyze and judge the conditions for determining the limits of justifiable defense, identify significant influencing factors, establish quantitative relationships, and ultimately construct judgment rules.

3.2. Improvement and Innovation of Sampling Design and Modeling Method

Most of the quantitative studies take judicial documents as the sample data source, and there are many problems in sample extraction and data processing.

First, there is a deviation in the sample range of the sampling data of judicial documents. In previous studies, the selection of categories of judicial documents is mostly mixed with the "guiding cases" issued by the Supreme Court and the Supreme Procuratorate and the typical cases published in the judicial documents network, so the sample set obtained has the characteristics of "typical cases"

Second, the handling of documents in justifiable defense cases is overly simplistic. In past research, elements such as defense timing and intent are often considered when identifying the limits of justifiable defense, leading to complex data processing. Additionally, simply using binary regression analysis to check for correlations fails to effectively identify and exclude the interference from false variables.

The article has made the following improvements in sampling and data analysis:

First, for criminal cases published on the Judgments Network that are defended as justifiable defense and have been ruled as excessive defense or justifiable defense, exclude those cases that are fundamentally categorized as intentional injury or murder, which do not meet the criteria for justifiable defense. By doing so, we can avoid the complexity and systematic errors caused by the redundancy of sample data, and focus on the key cases involving the determination of defense limits.

Second, clarify the time threshold for 'effective defense.' This involves dynamically and comprehensively reflecting the power dynamics between the parties during the defense process. In specific defense scenarios, factors such as the acquisition of weapons through armed robbery, changes in the number of participants over time, and other variables can cause the balance of power to fluctuate dynamically. These fluctuations are crucial for determining whether the defense has exceeded the scope of the infringement.

Third, static data cannot accurately measure the balance of power between the parties during a defense. Therefore, it is necessary to consider both the number of factors and the difficulty of quantification. The article defines the timing of 'effective defense' as a critical moment in the defense process, where the threshold for 'effective defense' often marks the core and turning point of the defense situation. During this time, the number of attackers and defenders may

change due to the easing or tension of the situation, and weapons are often seized and exchanged at this point.

3.3. Model Establishment -- Logistic Multiple Regression Model

The article employs a Logistic stepwise regression model to conduct a quantitative analysis of the criteria for recognizing justifiable defense. As a typical nonlinear regression model, Logistic regression is particularly suitable for analyzing binary classification data. After preprocessing the sample dataset from judicial documents, the Logistic regression model is used to analyze the results of justifiable defense judgments in relation to multiple influencing factors, thereby exploring the impact and effectiveness of these factors in determining the limits of justifiable defense.

In the Logistic multiple regression model, the dependent variable Y represents the result of justifiable defense, which is a binary variable. The independent variables x_1, x_2, \dots, x_i represent various factors β_i influencing the determination of justifiable defense. P denotes the probability that a sample case is determined to be a justifiable defense. The partial regression coefficient in Logistic regression indicates how much the likelihood of a justifiable defense changes when one unit of a specific factor is altered, while all other factors remain constant. The Logistic model can be expressed as:

$$P = \frac{\exp(a + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i)}{1 + \exp(a + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_i x_i)} \quad (1)$$

$$Y = \begin{cases} 1 & (P > 0.5) \\ 0 & (P < 0.5) \end{cases} \quad (2)$$

In the process of model building, 21 possible influencing factors such as damage results, physical fitness and defense tools were included in the model for regression processing. The significance of each influencing factor and its influence on the identification result were output by the model.

The logistic regression model uses maximum likelihood estimation for parameter estimation. Wald statistics are used to test the significance of the estimated coefficients, and likelihood ratio tests and Hosmer-Lemeshow goodness-of-fit tests are employed to assess the model's fit, ensuring that the model's results are statistically significant. During the training process, parameters are continuously optimized to enhance the model's performance, ultimately achieving an accuracy rate of 90.3% in the binary classification problem of determining justifiable defense limits.

3.4. Model Establishment -- CART Algorithm Decision Tree Model

The article employs a decision tree model to assist in establishing rules for determining the limits of justifiable defense. By ranking the importance of its features, it further explores the factors that influence the determination of justifiable defense. As a widely used multi-level classification method in machine learning, the decision tree classification method includes a root node, a series of internal nodes, and leaf nodes. The decision tree model performs a top-down, step-by-step division of the data set until it achieves the desired level of classification satisfaction.

The decision tree algorithm chosen for this article is CART (Classification and Regression Tree). Due to the constraints of actual court rulings and other objective factors, the dataset collected from judicial documents shows a significant imbalance, with significantly fewer positive

samples (those recognized as justifiable defense) compared to negative samples (those recognized as excessive defense), indicating a risk of data skew. The CART algorithm can handle both ordered and unordered categorical data and highly skewed or multi-modal numerical data, making it highly suitable for the simulation of the judicial process in determining the limits of justifiable defense in this study.

The factors that significantly influence the determination of justifiable defense limits, identified through univariate analysis, are incorporated into the decision tree model. The CART algorithm selects the attribute with the smallest Gini coefficient as the test attribute. A smaller Gini value indicates higher sample purity and better partitioning performance. The sample data set of judicial documents is used as the classification object, and it is divided layer by layer according to the structure of the decision tree. The internal nodes of the decision tree record the factors influencing the division criteria and the case sample information involved in the calculation, while the leaf nodes record the final classification results (justifiable defense or excessive defense). The maximum number of layers in the decision tree is set to 5, and cross-validation is used to evaluate the classification performance of the decision tree.

3.5. Model Establishment

To achieve a comprehensive and coordinated analysis of the global significance and local interaction effects in the elements for determining the limits of defense, this study innovatively developed a comprehensive quantitative model that integrates Logistic regression with CART decision trees. By combining the global statistical significance from Logistic regression with the local interaction effects from decision trees, the importance of each independent adjudicative factor is quantitatively assessed. This scoring system achieves a comprehensive evaluation through dynamic balance across three dimensions: first, it evaluates the independent influence of individual adjudicative factors on the determination of whether self-defense has exceeded its limits, using statistical tests to determine their impact on the comparison between defense and the result of aggression; second, it analyzes the synergistic effects of various material elements when they appear together in specific cases, calculating how the mutual interactions and exclusionary differences among multiple elements enhance the accuracy of the judgment when they occur together, and uses the normalization of the maximum value of prominent elements to eliminate dimensional differences; finally, it introduces a logarithmic transformation of the frequency of interaction among adjudicative factors, reflecting the common occurrence of adjudicative factors in the adjudication sample database while avoiding the dominance of high-frequency factor combinations, such as 'serious injury,' which could lead to a 'result-oriented' adjudication dilemma.

First, the Wald statistics for each influencing factor are calculated using a Logistic regression model. In determining the limits of justifiable defense, the marginal effects of factors such as the urgency of the attack and the danger level of the defensive tool are quantified through regression coefficients. To avoid interference from dimensional differences in assessing the importance of these factors, standardized Wald values are used to represent the overall significance of each factor. This metric reflects the independent impact of each factor on the judgment outcome. The formula for calculating Wald values is as follows:

$$Wald_i = \left(\frac{\beta_i}{SE(\beta_i)} \right)^2 \quad Wald_i = \left(\frac{\beta_i}{SE(\beta_i)} \right)^2 \quad (3)$$

Among β_i β_i them, (regression coefficient) comes from the frequency statistics of defense x elements x in the data of judicial documents. For x example x , if the coefficient of a certain

element is 2/, it means that the probability of excessive defense increases by 2/ for each level of improvement of the element.

$SE(\beta_i)$ (Standard error) is calculated by the maximum likelihood estimation method to reflect the statistical significance of the factor. For example, the standard error of "retreat possibility" is 0.12, indicating that the coefficient estimation error within ± 0.24 has a 95% confidence degree.

Secondly, the CART decision tree algorithm is used to extract the partial interaction features of defensive situation elements. During ΔG the splitting process of decision tree nodes, the decrease value of gini impurity at the defense time critical point quantifies the influence synergy of element combination on the judgment result. The formula is as follows:

$$\Delta G_i = G_{parent} - (p_{left} \cdot G_{left} + p_{right} \cdot G_{right}) \quad \Delta G_i = G_{parent} - (p_{left} \cdot G_{left} + p_{right} \cdot G_{right}) \quad (4)$$

Among,

Parent node Gini ΔG_{parent} value: it represents the degree of confusion in case classification. The lower the Gini value, the more concentrated the judgment results are in this category, indicating that the judgment of such cases (under a combination of specific characteristics) is highly consistent in judicial practice.

Sub-node purity improvement: When two elements appear at the same time and the Gini value decreases, it indicates that the combination of these elements significantly improves the certainty of the referee's result.

Collaborative judgment rules: ΔG if x a node splits after $>$, the x probability of excessive defense is increased by 2

For example, when the number of infringers changes together with the situation of weapon transfer, the algorithm reveals the special influence of such compound situations on the determination of excessive defense through recursive partitioning. The statistical quantity of the number of splits maps the frequency of reference of elements in complex judicial reasoning from the perspective of procedural law.

The final comprehensive scoring system employs a multiplicative integration mechanism, where the three dimensions are organically combined through multiplication. This ensures that the final score not only captures the core role of key elements but also reflects the interactive effects in complex scenarios, while controlling the interference from unconventional cases, thus forming a robust quantitative scoring mechanism.

3.6. Empirical Results and Model Data Analysis Conclusions

3.6.1. Empirical Results and Analysis

In this study, the Logistic regression model of the conditions for determining the limit of justifiable defense was estimated by SPSS software, and the likelihood ratio was used to test the overall fitting effect of the model, and the judgment probability was set at 0.02.

The decision tree model is used to assist in the construction of the rules for determining the limits of justifiable defense.

3.6.2. Model Data Analysis Conclusions

The judicial identification standard is single, the result-only theory has obvious disadvantages, and there is a serious deviation between judicial practice and social cognition.

According to the model's output, the level of danger posed by weapons and defensive damage significantly influence the determination of justifiable defense. Additionally, 16 factors, including whether the defender was prepared in advance, the severity of the vital area struck, and whether the defendant had prepared tools (including their source), significantly impact the

determination of justifiable defense. However, in legal practice, to avoid public opinion risks and judicial pressure from inconsistent judgments, a single, easily operable standard is often adopted. As a result, judicial practice tends to rely on a single criterion for determination, rarely considering multiple factors comprehensively, leading to mechanical judgments and reducing the scientific accuracy and precision of judicial decisions.

The judicial practice defaults to a standard for assessing the danger level of defensive weapons, which significantly deviates from public perception. Interviews and data analysis show that in judicial practice, it is commonly accepted that the danger of using weapons in conflict gradually decreases, thereby reducing the likelihood of excessive defense. However, in specific cases, relying solely on the 'preparation of defensive weapons' is insufficient to prove that the defender had the intent to fight or kill. In most justifiable defense cases, defensive weapons are often obtained spontaneously by the defender when facing an attack. Therefore, the type and danger level of defensive weapons should only be considered as one of the factors in determining the limits of defense. Directly labeling a defense as excessive due to the high danger level of the defensive weapon is overly mechanical and one-sided. This single criterion is also a source of controversy in cases such as the 'Yu Huan insult her mother case' and the 'Kunshan counter-killing case,' which have sparked significant public debate.

The impact of the damage caused by the defense on the determination of the limits of justifiable defense far exceeds the legal stipulated standard. When evaluating this element, the severity of the damage and other related factors should be considered equally. However, model data shows that factors such as the number of attackers and defenders, and whether the defensive measures were lethal, which are highly correlated with the outcome of the defense, do not significantly affect the determination of justifiable defense. The role of 'damage consequences' far outweighs the legal stipulated standard, sometimes even overshadowing the importance of other factors. The high impact of the damage consequences on the defense directly confirms the 'result-oriented' bias in judicial practice, which overly emphasizes the damage results and reflects the practical concepts of 'the dead are paramount' and 'the injured seek peace,' aimed at maintaining stability and minimizing social impact. The compromise of judicial fairness and justice has, to some extent, sparked public dissatisfaction with the judicial practice of prioritizing personal relationships and emotions, disrupting the balance between legal dignity, judicial credibility, and public perception.

(1) Non-statutory factors interfere with judicial decisions

According to the analysis of the data model, among the 21 factors, the influence of non-statutory provisions is relatively significant. For example, whether the defender can choose their weapon, whether the defender has the option to retreat, whether the defender has made prior preparations, and whether the perpetrator has previously harmed the defender are not explicitly stated in legal texts or judicial interpretations. However, these factors are widely applied in judicial practice, with their frequency and importance surpassing those of statutory provisions such as the number of attackers and the location of the attack. The widespread application of non-statutory elements in practice undoubtedly undermines the public guidance effect of the law, leading to a growing confusion among the public regarding the abstract legal standards for recognizing justifiable defense.

The presence of numerous non-regulatory factors leads to a lack of public and unified standards in the trial process by local judicial authorities, exacerbating the phenomenon of 'different judgments for the same case.' The exposure and publicity of such cases make the public particularly sensitive to the fairness and transparency of judicial proceedings, easily leading to public opinion questioning the reasonableness of the law and the fairness of the judiciary. This also further complicates the issue of excessive social interference with the independent trial procedures.

(2) Other non-statutory factors such as the cause of the case have a certain influence on the identification result

Data analysis indicates that, in addition to the legal requirements for justifiable defense and other factors clearly defined by law, judicial authorities typically consider whether there are any past disputes between the parties and the cause of the case when determining the limits of defense. Judicial authorities exhibit a 'moral puritanism' in recognizing justifiable defense. This means that public opinion significantly influences the determination of the limits of justifiable defense, and people tend to limit the scope of justifiable defense based on moral flaws in the behavior. Furthermore, data shows that if the defender has a higher degree of fault in the incident, judicial authorities, due to their 'moral puritanism,' are more likely to impose punitive measures, which can increase the likelihood that the defender's reasonable defense will be deemed as intentional injury or other illegal infringements.

"The possibility of retreat" is one of the rules constructed by judicial judgment, which affects the determination of justifiable defense

In data analysis, the possibility of retreat is highly significant for the determination of the limit of justifiable defense. That is, if the defendant has the conditions to avoid the illegal infringement but does not avoid it and still takes defensive measures, the judicial organs will assume that the counterattack of the defender is a deliberate attack due to the existence of moral puritanism.

This means that the judicial system has established a 'duty of retreat' for defenders, with minimal restrictions on its application. This conflicts significantly with the common public perception and the mainstream academic theory in our country, which holds that 'even if a defender can avoid harm or seek help from the judicial system, they can still engage in justifiable self-defense.' The traditional concept of 'tolerance' is prevalent in the judicial practice, and the judicial system's moral puritanism 'often deems even citizens who use force reasonably for self-defense as having moral flaws and thus illegal. The stringent 'retreat requirement' established by judicial practice inadvertently increases the burden of defense costs and obligations on the public.

(3) The factor of "whether the defender is prepared in advance" should have a certain effect on preventing justifiable defense

The non-statutory element of 'whether the defender was prepared in advance' has a much greater impact than statutory elements. The law does not explicitly restrict defenders from preparing for potential unlawful attacks in advance, but data shows that legal authorities often mechanically interpret the defender's preparation as an active confrontation or even a deliberate attack. Interviews also indicate that if a defender has time to prepare defensive tools, they can foresee and avoid the conflict in advance. In such cases, if the defendant prepares tools, it may be seen as an active confrontation and generally cannot be recognized as justifiable defense. If the damage is severe, it may even be considered intentional injury. Such unclarified and rigid criteria are widely present in judicial practice.

4. Construction of Defense Limit Determination Mechanism

4.1. Establishing the Legal Basis for Determining the Limit of Justifiable Defense

The determination of justifiable defense and excessive defense should be based on the specific circumstances in which the defender acted, aiming to fully reconstruct the defensive situation. This involves systematically reviewing the case's overall course, considering the causes of the incident, the faults of both parties, and the transfer of weapons, among other key factors. It is also important to evaluate the emergency responses that a person would likely make in similar

situations, using the general public's psychological state as a benchmark. Avoiding the pursuit of a single, easily operational standard to reduce the risk of public opinion and judicial pressure from inconsistent judgments in similar cases, ensuring that the system meets the expectations of national law and the public regarding justifiable defense.

This article establishes a quantitative rule for the factors influencing the determination of the limits of justifiable defense, based on the hierarchical and weight order of elements considered in judicial practice. The factors affecting the determination of the limits of justifiable defense are categorized into numerical variables and categorical variables. Categorical variables are represented by (0,1), and numerical variables are established through AIS-ISS scores to measure damage outcomes, providing specific evaluation criteria and quantitative scoring for the determination of justifiable defense in judicial practice. However, due to the dynamic nature of judicial decisions, the determination of the limits of defense must still be based on the specifics of each case.

4.2. The Judgment Rules of the Mechanism for Determining the Limits of Justifiable Defense

4.2.1. Qualitative Judgment

The primary qualitative factor in determining justifiable defense is the balance of power between the defender and the unlawful aggressor. However, this assessment of power dynamics is not about supporting or upholding a result-based approach. Instead, it involves a targeted comparison of situations based on the dynamic and complex nature of the defense process. Therefore, in judicial proceedings, justifiable defense cases should be divided into several stages, with specific judgments made for each scenario to form an overall comprehensive evaluation, rather than simply comparing the damage suffered by both parties to assess the strength of the defense.

4.2.2. Investigate the Evaluation Weight and Judging Order of Core

By examining and analyzing the output results of the Logistic multiple regression model and the decision tree model, the project comprehensively evaluates the various factors influencing the determination of justifiable defense. It assesses the significance of each factor to help establish rules for judging the limits of justifiable defense. Given that the upper-level factors in the decision tree model are prioritized in category classification, the project considers the levels of these factors in defensive scenarios.

To systematically evaluate the elements of defense limit determination, this study constructs a comprehensive scoring model based on three dimensions. First, using the Logistic regression model, the independent impact weights of each discretionary element are extracted, and Wald values are used to quantify these elements' influence on the limits of justifiable defense. Z-score standardization is applied to eliminate the dimensional differences between the danger of defensive tools (numerical variables) and whether the defender was pre-prepared (fuzzy variables). Second, the recursive binary splitting algorithm of the decision tree model is employed to analyze the interaction effects of elements by calculating the decrease in Gini impurity for combinations of scenario elements. This method focuses on capturing the dynamic impacts of scenario combinations such as 'weapon transfer and hit location risk credibility' and 'number change and injury escalation.' When multiple elements meet the conditions for splitting, the collaborative weight of the element combination is determined, and the recursive partitioning mechanism simulates the complex scenarios where multiple factors, including the ratio of people, weapon danger, case cause, and physical fitness, intersect and combine in specific cases. Finally, the frequency of reference to discretionary elements in judicial documents is introduced as an empirical correction term. A logarithmic function is used to weaken the marginal effect of high-frequency elements, quantifying the empirical preferences of judges' free evaluation into calculable parameters. The three elements are then nonlinearly

integrated to construct a robust and stable comprehensive scoring mechanism with strong resistance to interference.

As shown in Table 2, the importance scores of each output variable are ranked according to their importance:

Table 2. Order of importance of model input variables

Order of importance of input variables	
input variable	Variable importance scores
Defensive damage results	0.243703
Whether the defender has the intention to harm	0.153269
Whether the defender had a cause of fault (An error that is vulnerable to negative evaluation based on general social perceptions)	0.114152
The defendant could have avoided it but did not (there was a possibility of retreat)	0.094278
Degree of vital strike	0.067869
Whether the parties have a prior dispute	0.053316
Whether the degree of infringement is criminal	0.051182
The level of danger of a defensive weapon	0.044268
Whether the defenders were prepared in advance	0.037733
First, is the attacker a defender?	0.033568
Whether the defender used lethal force	0.032624
Physical fitness for defense	0.027096
Comparison of the number of people on both sides	0.019831
Sources of defensive tools	0.012194
Whether the injured party forgives afterwards	0.008050
Whether the defender received a threat in advance	<0.0001
Defense time day or night	<0.0001
Whether the defensive place is a public place	<0.0001
Infringement of property or personal freedom	<0.0001
Whether the defender called the police afterwards	<0.0001

Based on the variable ranking scoring table, the weight order and ratio of 21 reasonable factors affecting the defense limit can be clearly defined in judicial adjudication. The essence of the application of the table is to identify and score each of the 21 defense limit factors one by one, so as to realize the situation comparison and power contrast between the defense and the infringement.

In the process of adjudicating actual cases, first, the scoring sheet should be strictly followed to comprehensively record all influencing factors in the case and obtain specific facts (such as "weapons of both parties" and "injury assessments of both parties") that serve as the basis for qualitative and quantitative judgments on elements such as the "danger level of defensive weapons" and whether there was a prior dispute between the parties. Second, using criteria like AIS-ISS scoring, the numerical variables should be quantified and qualitatively assessed to determine whether there was a prior dispute between the parties, leading to a comparison of the impact factors of both sides in the "defense-infringement" scenario. Finally, by referring to the importance ranking table of input variables, the importance scores of each influencing

factor are obtained, and the impact factors of both sides in the "defense-infringement" scenario are quantitatively scored. The final judgment on justifiable defense or excessive defense is made by comparing the total scores of the defense limit factors of both sides.

4.2.3. Auxiliary Judgment

The article establishes specific quantitative scoring criteria for the numerical factors influencing the determination of justifiable defense limits, to facilitate the quantification of various elements in the initial model construction and subsequent model operations. In the mechanism for judging the limits of justifiable defense established by the article, these scoring criteria serve as a tool to assist in the identification and scoring of 21 defense limit elements.

For the damage outcomes, the AIS-ISS scoring system is used to quantify the severity of individual injuries. The criticality of the struck area is quantified by categorizing body parts into head, neck, face, chest, and abdomen, establishing scoring rules to calculate the criticality score for each part of the body. Additionally, common weapons are categorized into nine types, and scoring rules are established based on research findings to quantify the danger level of weapons. Furthermore, numerical factors such as 'physical fitness of both parties in defense' and 'the criticality of the struck area' are scored according to corresponding standards.

Table 3. Body parts vitality rating scale (abbreviated version)

Body part category	head	neck	face	chest	belly	upper limb	lower limbs
Score value	1.789	1.314	1.682	1.451	1.693	1.699	1.374

Table 4. Weapon Hazard Rating Scale (abbreviated version)

Weapons types	fist	Bite or bind	Stones, bottles or household appliances	club	Iron bar or metal strip	Axes and other slashing tools	Blunt force tools	fire	Guns or explosives
Score value	1.11	1.478	1.614	1.612	1.717	2.072	2.074	2	3.889

5. Practical Effect and Application Prospect

To verify the accuracy and applicability of the rules for determining the limits of justifiable defense, the article randomly selected several cases from a data set of judicial documents and applied the judgment rules to 507 cases in the data set, achieving a classification accuracy rate of 92.3%. The article also retrieved and selected all 83 recently published cases concerning the limits of justifiable defense (the sample period was from August 1, 2024, to February 2025). The constructed defense limit judgment model achieved an accuracy rate of 90.9% when applied to the new case data set.

The ROC curve shows that the discriminant rule performs well in the binary classification problem of justifiable defense. All selected cases showed consistent output results with the correct outcomes after being judged using the established justifiable defense limit judgment rule. This demonstrates that the justifiable defense limit judgment rule constructed in the article is universally applicable in real cases.

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