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Juvenile Offenders in Community Corrections: A Systemic Look at Risk Evaluation Methods to Implement UN Resolutions under the Chinese Legal System

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In recent years, juvenile offenders have made up an increasing number of all criminal suspects, and minor crimes are becoming a more serious social problem in most countries and regions around the world. While community correction occupies a very important position in the minor crime punishment system, current community correction risk assessments mainly depend on qualitative analysis or simple mathematical statistics using collected data. In combination with relevant theories and regulations, this paper offers a systematic look at the development and theories of community correction and the related risk assessment system and analyzes the characteristics of community correction risk assessment methods of juvenile offenders in different countries. Moreover, it discusses some new risk assessment technologies based on artificial intelligence theory for community correction risk evaluation of juvenile offenders. The effectiveness of the proposed community correction risk assessment method is verified using some real-world community correction assessments.

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I. INTRODUCTION

Nowadays, juvenile delinquency has become a serious social problem all over the world.[1] Some experts and scholars thus regard it with concern similar to environmental pollution and drug abuse, marking the three first major public hazards.[2] Due to continued social and economic development, as well as the increasing popularity of high-tech technologies such as the Internet, juvenile delinquency in China and other countries is becoming a critical social issue.[3] Juveniles are immature, yet they bear the future of themselves as individuals, their families, and at some levels, even the whole country.[4] Unfortunately, for juvenile offenders, severe punishment can negatively affect their personalities and social responsibility, even destroying their lives in some cases.[5] Therefore, most countries generally adopt a means of community correction education to help juvenile offenders. Community correction is a kind of behavior or measure in which an offender needs to perform specific actions on specific objects in a specific space and at a specific time to achieve the required goals. The lives, work, correction, and assessment of juvenile offenders are monitored in their communities through regular risk assessments. Also, standard corrective measures are adjusted for minors, so that they can be reintegrated into society in the future. Given the difference in outcomes between severe punishment and community correction for juvenile offenders,[6] many United Nations conventions and documents strongly promote the implementation of humanized noncustodial sanctions on juvenile delinquents,[7] which promotes the development of community correction as the first choice for the treatment of juvenile delinquency throughout the world.[8]

The essence of juvenile community correction is to provide minor offenders with ‘free’ opportunities to integrate into the community and undergo ‘normal’ learning and life on the basis of tolerance and forgiveness. This would help them correct criminal psychology and bad habits harming society, and ultimately return to the society smoothly. Correction education in the community has many advantages. First, it provides juvenile delinquents with a relaxed environment compared with the imprisonment penalty. Moreover, community correction offers juvenile offenders a wider range of choices and corresponding responsibilities to deal with all kinds

of problems in their daily lives, which reduces the offenders' cost to society and is more conducive to transforming such minors. In addition, correction work in the community is still a form of penalty. However, it effectively avoids the disadvantages of prison sentence executed in a detention center or prison environment which would makes negative influence with each other.[9] Finally, it can prevent crime and enhance social public security.[10]

Community correction plays a very important role in the punishment system of juvenile delinquency because of its restorative, mild, and social characteristics. It has attracted the attention of the education and legal departments of many countries.[11] Teenagers are the future of a country, and their healthy growth is critical to the political, economic, and cultural development of society as a whole. Therefore, how to help and educate delinquent minors through community correction has become the focus of education and legal departments in various countries. Among the many research issues in the field of community corrections, risk evaluation is a key interest area, as only an efficient risk evaluation method can allow for accurate community correction education decision-making regarding juvenile offenders. There are some evaluation tools that have been developed by different methods for use in corrective work, but they have various shortcomings, such as inaccurate, complicated processes and subjectivity.[12] In short, the scientific tools in community correction risk assessment are still relatively immature for use and a highly intelligent community correction risk assessment system has not yet been formed. At the same time, such new technologies as artificial intelligence and big data[13] are widely used in youth education and learning analysis,[14] achieving significant results.[15]

Given the successive new technologies in other fields of the youth education,[16] it is now necessary to combine existing modern technologies in order to establish a scientific and objective risk assessment method for juvenile community correction that accurately assesses the personal risk of minors and the possibility of recidivism. It is a very important task in the field of community correction.

The primary purpose of this research is to offer a systematic look at the theories of community correction and the related risk assessment system and analyzes the characteristics of community correction risk assessment methods of juvenile offenders in different countries. This paper will discuss some new risk assessment technologies based on artificial intelligence theory for community correction risk evaluation of juvenile offenders.

II. Development of Community Correction Education for Juvenile Offenders

It is generally believed that the US firstly implemented the concept of community correction in the modern sense.[17] In the early nineteenth century, the US set up a special legal committee.[18] In 1856, particularly, it established the first "halfway house" in Boston. At that time, John Augustus, the father of modern probation, proposed the idea of community correction risk assessment for the first time. He often entered the court to observe the judges' trials of various cases. After he pledged for the release of and supervised a criminal who drank and made trouble, the court allowed him to supervise more criminals. From 1841 to 1858, Augustus continually bounced between the police station and the court in Boston and released about 2,000 offenders.

When the offenders sponsored by Augustus would return to the court after a period of community supervision, the judge would decide how to deal with it based on Augustus's penalty recommendations. Practice proved that Augustus's evaluation method of offenders was right. After 18 years, according to Augustus's evaluation method, only 4 of the 2,000 offenders who were released by him proved to be unworthy. Thanks to the efforts of John Augustus, Massachusetts promulgated the first probation law in the US in 1878[19] and, in 1925, the US government enacted the Federal Probation Law with corresponding systems. Nowadays, community correction education for juvenile offenders is widely used in most states of the US.

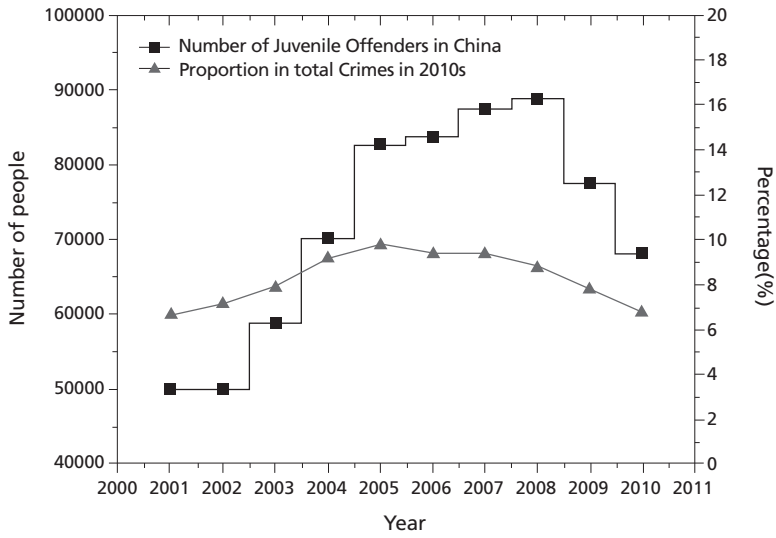
Meanwhile, in China, the correction of bad behavior for minors in communities was considered about 3,000 years ago in Xia and Shang Dynasties. Many sages said that through education, production, and labor, juvenile offenders could correct their thoughts and master relevant skills, thereby becoming personnel who abide by the law and respect social morality and good customs. However, due to the long-term influence of severe punishment in China, the application rate of probation and parole for juvenile offenders in China is far lower than that in developed countries.[20]

In particular, under the premise that parole has become a new trend of international justice, China has strictly controlled the parole of prisoners maintaining the rate of parole very low. According to the relevant literatures, as shown in Figure 1, China sentenced 49,883 juvenile criminals in 2001; 50,030 in 2002 and 58,870 in 2003, respectively. Since then, it has increased by 9.2 percent to 88,914 in 2008.[21] In terms of the proportion of juvenile delinquents in the total number of criminals in China,

the proportion remained between 6.6 percent and 10 percent from 2001 to 2010.[22] Still, with the increasing prevalence of juvenile delinquency in China, the demand for community correction education for minors is becoming more urgent.

In 2004, the PRC Ministry of Justice issued interim measures for community correction, which promoted juvenile offenders to return to society smoothly with the community correction of juvenile delinquency.[23] The effects of these measures can be seen in the Fujian Province as an example, which by the end of 2015 had established a total of 9 halfway houses, 84 county-level community correction centers, 253 education bases, 1,104 community correction declaration rooms, and 1,304 community service bases.[24] The Fujian Province has received a total of approximately 110,000 correctional personnel, of which a considerable number are minors. However, one urgent problem remains in both China and other countries: How to build an effective community correction risk assessment method to improve community correction data analysis and educational decision-making for juvenile offenders?

Figure 1: Number and proportion of juvenile offenders in China from 2001 to 2010[25]



The definition of juvenile delinquency is primarily based on the age of the offender. There is a minimum and maximum age for juvenile delinquency. People below the

minimum age who commit acts that seriously endanger society do not constitute juvenile delinquency, while people above the maximum age who commit serious harmful acts cannot be treated as juvenile offenders, as their acts constitute adult criminal offenses. Only between the minimum and the maximum age can people who commit criminal acts be called juvenile delinquents or juvenile offenders. Table 1 shows the minimum age, maximum age, the court of juvenile jurisdiction, and the maximum sentence for several countries.

Table 1: Juvenile Justice Comparison between Countries[26]

Countries and regions	Minimum age of criminal responsibility	Maximum age of criminal responsibility	Court of juvenile jurisdiction	Maximum sentence for juvenile
Australia	10	16-17	Children's court	2-7 years
Canada	12	18	Youth court	10 years
UK	10	18	Youth court	2 years
France	13	18	Children's tribunal; Youth court of assizes	Half of adult sentence
Italy	14	18	Separate juvenile court	1/3 of adult sentence
Japan	14	20	Family court	Life imprisonment
China	12	18	Youth court	Death sentence suspended for two years
USA	In 14 states it is 6-10 years old; the other 36 states have no minimum age, but 7 years old can be considered as the minimum age	In 3 states it is 15 years old. In 10 states it is 16 years old, and in the other 37 states the maximum age is 17.	Youth court	Life imprisonment; death penalty

In Australia and the UK, the minimum age of criminal responsibility is 10; the minimum age in Canada and China is 12; and, in Italy and France, it is 14. However,

the US does not have a uniform minimum or maximum age across all its states. In 14 states, the minimum age is 6-10 years old, whereas the other 36 states have no official minimum age, so that 7 years old can generally be considered as the minimum age.[27] According to some UN agreements, 18 is the most widely recognized age for adult criminal responsibility.[28] The countries with the most severe penalties for juvenile delinquency are the US, China, and Japan. In the US, the maximum sentence for juvenile offenders is life imprisonment or the death penalty. In China and Japan, it is the death sentence suspended for two years and life imprisonment, respectively.[29]

Community correction occupies a very important position in criminal justice in many countries,[30] with probation and parole being the two most typical forms of community corrections. In contemporary societies, most countries generally implement probation and parole for juvenile offenders.[31] Table 2 gives the number of juveniles put on probation and parole in 1998, 1999, and 2000 in several countries and regions according to the Seventh United Nations Survey on Crime Trends and Operations of Criminal Justice Systems conducted in 2002.[32]

Table 2: Number of Juveniles Put on Probation and Parole in 1998, 1999, and 2000[33]

Countries and regions	Number of juveniles put on probation			Number of juveniles put on parole		
	1998	1999	2000	1998	1999	2000
Belarus	4,245	4,082	3,807	604	749	811
Ukraine	4,019	4,224	5,112	1,144	1,290	1,381
Spain	-	2	3	25	20	25
Estonia	409	771	801	34	18	14
Hong Kong, China	910	878	811	1,456	1,315	1,203
Japan	39,054	39,433	48,823	5,813	6,423	6,977
South Korea	11,755	13,630	16,672	654	740	855
Mexico	634	798	959	1,763	1,189	816

Since the community correction is a very suitable concept for the education and rescue of minors, it has been fully and rapidly developed to educate young people

in many countries including China. In fact, community correction has become the primary form of minor correction measures throughout much of the world. The essence of juvenile community correction risk evaluation is to assess the risk of minor offenders and correct their criminal psychology and bad habits; then, those who pass the evaluation are allowed to 'freely' reintegrate into the community. Thus, accurate risk evaluation is very critical in community corrections.

III. Definition and Significance of Community Correction Risk Assessment

The term 'risk' has been used for a long time. The word originated from the Italian '*risicare*' which then became '*risqué*' in French. In the middle of the 17th century, English borrowed from *risqué* and formed the word 'risk,' which means "danger that may occur." The basic attributes of risk include 'target,' 'uncertainty,' and 'impact,' among which uncertainty is the core attribute of risk.[34] Without uncertainty, there is no risk, so that all certain probabilities are not considered risks. In addition, risks must happen in the future. The target is the goal that needs to be achieved when doing something, while impact is the consequence of the uncertainty of the risk on the goal. Risk has also found a broader and deeper meaning in modern societies, which can be divided into categories such as natural risks, social risks, and political risks according to its cause.[35]

Risk evaluation means to determine the possible degree of impact or loss caused by a certain risk factor on residents, society, property, etc. The concept of risk assessment first appeared in the US in the 19th century. At that time, the development of American railways produced bonds. In order to study the safety of issuing bonds, risk assessment techniques were created. The core of risk assessment is to apply certain theories or engineering techniques to analyze the inherent or potential hazards in a system. The results of risk assessment can provide information to help people make decisions and take certain measures to ensure the safety of the entire system.[36]

After identifying and assessing risks, there is the concept of "risk management." For example, in the field of financial investment, in order to reduce errors and risks, a wealth of information and data is often used to conduct detailed risk assessments on investment projects to complete a set of scientific project reports and adopt

corresponding measures and ways to avoid risks.[37] To assess the recidivism risk of minors in community corrections, the danger they bring to society during and after correction is determined according to the offender's family, personal background, growth experience, living conditions, social factors, etc. These various factors also lead to the personal endangerment of juvenile offenders. Personal hazard analysis has been used in the field of criminology to study the personal characteristics of offenders, where the possibility of committing a crime is a dynamic evaluation process that combines multiple factors. The risk assessment approach of minor community corrections is to use certain methods or means to evaluate and predict juvenile offenders' personal endangerment risk and the possibility of recidivism. Community correction classifies minor offenders based on their personal risk levels and determines different levels according to their scores, subsequently adopting different levels of supervisory correction measures.[38]

Generally speaking, the risk assessment of community corrections for minors includes risk assessment before corrections, personal hazard assessment during corrections, and comprehensive assessment before dismissal of community corrections. Risk assessment of youths is not only the basic component of juvenile community correction, but also an important part of promoting community correction in general, which is of great significance and necessity.[39]

First of all, community correction risk assessment can help the community correction management agencies to effectively allocate resources. Because the human and material resources of community corrections are limited, it is impossible to evenly allocate public resources and manage time to each young person. Therefore, through the community correction risk assessment, the risk and need of correction can be classified and formulated, leading to better and more targeted measures to reform and correct community prisoners.[40]

Second, community correction risk assessment can provide a timely supervision and education basis for minors entering the community and better help them to reform, as each young offender who enters the community has their own characteristics and needs. Accordingly, it is impossible for any two to be identical. In other words, the results of the community correction risk assessment can implement differentiated supervision and correction measures, which provide individualized and humane execution of community corrections.[41]

Third, community correction risk assessment can provide a good guarantee

for the public safety of community residents and prevent high-risk people who are not suitable for community corrections from entering the community. In the pre-trial investigation stage, through risk assessment investigation procedures and system guarantees, high-risk offenders are excluded from the scope of community corrections, reducing the source of risk in the community. In the community correction stage later, through further risk assessment, it is possible to identify high-risk community offenders with certain characteristics and to take special supervision and reform measures, which is effective to maintain social harmony and stability.[42]

Finally, the community correction risk assessment evaluates and measures personal endangerment and the possibility of recidivism of offenders in the community, so as to formulate appropriate corrective measures and reduce the possibility of those in community corrections continuing to pose risks to society. It has been widely used in the major countries of the world as entire process of community corrections risk assessment is actually a full manifestation of the value of penalty prevention.[43]

IV. Current Main Risk Assessment Methods of Minor Community Correction

When John Augustus first proposed the prototype of community corrections risk assessment in the 19th century, he mainly assessed the offenders' risk of recidivism by investigating and analyzing the offenders' personal information, the cause of the crime, and economic and emotional factors to determine whether to guarantee the crime and determine the appropriate correction measures. Of course, along with the social development, the community corrections risk assessment system in the US has been continuously improved. Initially, the US mostly adopted a statistical personal risk assessment strategy, which included three stages. The first stage was to select a large number of offenders, examine the personal characteristics of these offenders and their corrections, and then use modern mathematical statistics to remove parameters with greater deviations and less relevance to form standard parameters. The second stage was to apply the proposed standard parameters to evaluate and score the sampled offenders and to classify and group the offenders according to the evaluation scores. The third stage was to apply the periodic observation and evaluation to verify the proposed classification scheme and make amendments to related schemes.[44]

In response to the above strategies, "The Wisconsin Risk-Assessment Instrument" designed by S.C. Baird, R.C. Heinz, and B.J. Bermus in 1979 has to be mentioned.[45] This specific evaluation form is composed of 11 questions.[46] Each question has two to three options, each of which has a score. The score is used to determine the degree of danger of the offender. This form has the advantages of completeness and conciseness and become the blueprint for many states in the US to formulate their own community corrections assessment methods. For example, the "Initial Client Assessment" tool developed by the State of Pennsylvania consists of 11 questions and is generally used for new rulings of parole. There is also the Massachusetts Probation Service Assessment of Offender Risk, which is composed of eight questions, each of which has three to five options. In Massachusetts, the results of the correction evaluation of thousands of probation offenders proved that the tool has good results.[47]

In the British penal system, the community corrections risk assessment system is typically divided into pre-judgment reports and post-correction reports. The pre-sentence report must be submitted to the court by the Probation Bureau for community penalties in the UK. It plays a very important role in the judge's decision. Article 36 of the UK Criminal Court Rights Act (2000) clearly stipulates: "Procedural requirements for community sentence: pre-sentence reporting." This article requires an evaluation of whether the offender is eligible for community corrections based on four factors identified before the sentence, including the offender's personal situation, the offender's specific crime implementation, the victim's personal situation, and sentencing recommendations.[48] During the execution of community corrections, a post-correction report is generated using the main and secondary factors of personal risk. The main factors are closely related to crime, such as anti-social views, the offender's lack of sympathy for the victim, drug abuse, etc. The secondary factors are predominantly economic factors, the offender's emotional aspects, housing factors, and the surrounding environment's impact. These factors are used in combination to form a risk assessment measurement table to evaluate community corrections personnel and to implement different levels of supervision measures.[49]

In Canada, D. Andrews and J. Bonta designed a "Level of Supervision Inventory" containing 54 sub-items in order to evaluate the degree of danger and needs in community corrections, suggesting nine rules to guide the evaluation of the danger of offenders.[50] In Asia, as shown in Table 3, countries such as Japan, South Korea and China have conducted a lot of work in community correction risk assessment.

For example, community correction in Japan is called "community treatment" [コミュニティでの出会い]. In particular, the specific community correction investigation system is stipulated in Article 9 of the Juvenile Law of Japan. Regarding the personal risk assessment of offenders, Japan has established some classified investigation centers. These centers are composed of experts in law, medicine, psychology, and sociology to give scores to juvenile offenders.

Table 3: Number and Parole Rate of Offenders in Some Countries in 2000[51]

Countries and regions	Number of parolees	Parole rate
US		72%
Australia	7,611	39.7%
Canada	9,925	32.8%
South Korea	12,407	26.3%
Thailand	23,348	37.9%
China	30,075	2.3%
Indonesia	3,966	1.9%

Additionally, in 2012, China issued the "Regulations for the Implementation of Beijing Community Corrections." [北京市社区矫正实施细则] These were specific provisions for risk assessment that clearly stated the use of the "Beijing Community Corrections Personnel Comprehensive State Evaluation Index." [北京市社区矫正人员综合状态评估指标体系] In 2014, the Beijing Municipal Prison Administration Xinkang Prison Mental Health Center worked closely with the Beijing Fengtai Judicial Bureau to conduct social harm assessment and survey some community offenders. The survey mostly used computer testing, psychological testing, and interview methods to evaluate the risk and give scores.[52]

To date, a number of countries have developed effective assessment and prediction tools for community correction risk assessment.[53] The Wisconsin risk assessment instrument in the US, the OAS criminal assessment system developed in England and Wales, and the level of supervision inventory in Canada, to name a few, all play a huge role in juvenile offender corrections. The current risk assessment

of minor community correction education is divided into qualitative and quantitative assessment. Qualitative assessment includes the intuitive method and the clinical risk assessment method. The intuitive method largely relies on the professional training and experience of the staff of the community correction management agency of juvenile offenders and their ability to obtain relevant information intuitively while referring to such factors as family, daily performance, occupation, and criminal record to predict the personal risk of juvenile offenders and the possibility of recidivism. This assessment method is widely invoked in the early stage of community correction risk assessment. The clinical risk assessment method primarily evaluates the juvenile offenders through irregular interviews, psychological counseling, and prediction, and formulates the corresponding supervision and correction measures.[54]

The current quantitative assessment methods usually invoke statistical methods. It means that the assessor formulates a series of scoring standards for risk assessment of community corrections based on experience and personal opinions. Following the collected personal data and relevant statistical data, a scale can be developed to score according to the risk, and then the risk of community correction is assessed according to the results of the scoring. For example, based on sociology, psychology, law, and other disciplines, China has developed a comprehensive state evaluation index system for community prisoners in Beijing, which includes three sets of scales. Some researchers have also developed quantitative assessment tools based on neural network methods and artificial intelligence. However, these methods are currently used only in a small number of minor community corrections.[55]

The application of the above methods has greatly promoted the risk assessment of community correction for juvenile offenders. However, these methods also have obvious deficiencies, as shown in Table 4. Consider the intuitive method to the risk assessment of juvenile delinquency. Although it can quickly attain assessment results and provide correction institutions with targeted corrective measures, this method has strong subjectivity, low accuracy, and low operability. It is a highly complex job to evaluate the community correction risk of juvenile offenders with clinical methods, as doing so requires the assessor to have strong insight and deep psychological, sociological, and criminological literacy. Moreover, at present, there are more juvenile delinquents who could benefit from risk assessment for community correction, but there is a limited number of high-level experts who can carry out the work.[56]

On the other hand, the statistical evaluation method is more accurate and objective

than traditional qualitative evaluation. Unfortunately, most statistical assessments only use a simple evaluation scale, with the risk assessment index, weight setting, and scoring standard by and large based on experience and personal opinions. Thus, the establishment of such an evaluation system lacks scientific and credible theoretical support. Neural network-based and other artificial intelligence (AI) methods for correction risk assessment have their own issues. In particular, the neural networks require lots of samples with known results for training to obtain rules. Therefore, these networks are still developing.[57]

Table 4: The Main Risk Assessment Methods[58]

Risk assessment method	Features	Shortcomings
Qualitative assessment		
Intuitive method	obtain relevant information intuitively based on the professional training and experience of the staff	strong subjectivity, low accuracy, and low operability
Clinical risk assessment	evaluates juvenile offenders through irregular interviews, psychological counseling, and prediction	requires the assessor to have strong insight and knowledge; lack of high-level experts
Quantitative assessment		
Statistical methods	formulates a series of scoring standards and give scores; more accurate and objective than traditional qualitative evaluation	uses simple evaluation scales; lacks scientific and credible theoretical support
Neural network-based and other artificial intelligence methods	have the function of associative memory and strong learning ability	need a lot of data and training; used in only a small number of minor community corrections so far

In the risk assessment and education decision-making of minor community corrections, it is very important to classify delinquents according to the assessment results.[59] Dean Champion believes that classification has the following six functions in the community correction of minors to help: (1) management departments to

reasonably arrange for juvenile offenders to participate in community correction; (2) meet the needs of juvenile offenders and prescribe specialized treatment; (3) parole committees effectively make decisions regarding criminals who meet the conditions for parole; (4) select parole offenders who participate in correction programs and related activities; (5) classification can help decide the necessary type of supervision by juvenile correctional personnel; and (6) make decisions related to community crime control.[60] All this to say that satisfactory classification of risk assessment and education decision-making in the community correction of minors is highly valuable. But under what standard should the risk assessment of juvenile community corrections be classified and how many kinds of community corrections of minors should be divided into? These problems are worthy of in-depth study.

Table 5: Community Corrections Risk Assessment Based on the Number of Test Scores or Percentages[61]

Risk assessment tool	Scoring classification	Scoring criteria	Hazard classification
The Wisconsin Risk-Assessment Instrument	3 types	0-8 points 9-15 points 16 points and above	Low risk Moderately dangerous Highly dangerous
Massachusetts Probation Service Assessment of Offender Risk	4 types	2-10 points 11-15 points 16-24 points 25 points and above	Most dangerous Dangerous Moderately dangerous Low risk
Comprehensive State Evaluation System of Community Prisoners, Shandong Province, China	3 types	80 points and below 81-107 points 108 points and above	Low risk Moderately dangerous Highly dangerous
British Community Corrections Risk Assessment	3 types	≤30% 31~60% ≥60%	Least Dangerous Dangerous Most dangerous

At present, there is no unified standard for the risk assessment of juvenile community corrections. Currently, a judgment method is to determine a score using a risk assessment scale.[62] As shown in Table 5, the Wisconsin evaluation tool is divided into three sections according to the resulting score, namely 0-8, 9-15, and 16 and

above, and the corresponding risk classification levels are low-risk, moderate risk, and high-risk. Then there is the Massachusetts Probation Service Assessment, which is divided into four sections based on scores: 2-10 points, the most dangerous; 11-15 points, high risk; 16-24 points, medium risk; and 25 points and above, very small risk. In Shandong Province, China, the comprehensive status evaluation index system of juvenile community correction is divided into three grades, corresponding to 80 points and below, 81-107 points, and 108 points and above. It can be seen that because of the inconsistent evaluation indices and evaluation methods, the classification and standardization of the risk assessment of minor community corrections based on score are different in different countries and regions.[63]

In addition to judging the results of community corrections based on the actual assessment scores, some parts are determined by the percentage of community correction risk assessment evaluation, for example, in the British Community Corrections Risk Assessment. A good classification of the risk assessment of juvenile community correction should have a certain degree of differentiation and accuracy, so that the correctives of different levels can be accurately distinguished according to the purpose of classification. At the same time, the sensitivity of classification should be appropriate and the results of the classification should be fair, with all relevant indicators taken into account, rather than solely focusing on a certain evaluation factor.[64]

Moreover, the results of classifying juvenile community corrections should be practical, as it is undesirable for the results to be divided into too many classifications or deviate from the actual situations. In this case, they are too distanced from the existing correction conditions and measures. At present, the classification of risk assessment of juvenile community correction is mainly based on the subjective feelings of correction institutions, with little literature on quantitative classification and judgment criteria. Therefore, the efficiency and accuracy of risk assessment classification of minor community correction is very worthy of attention and research.

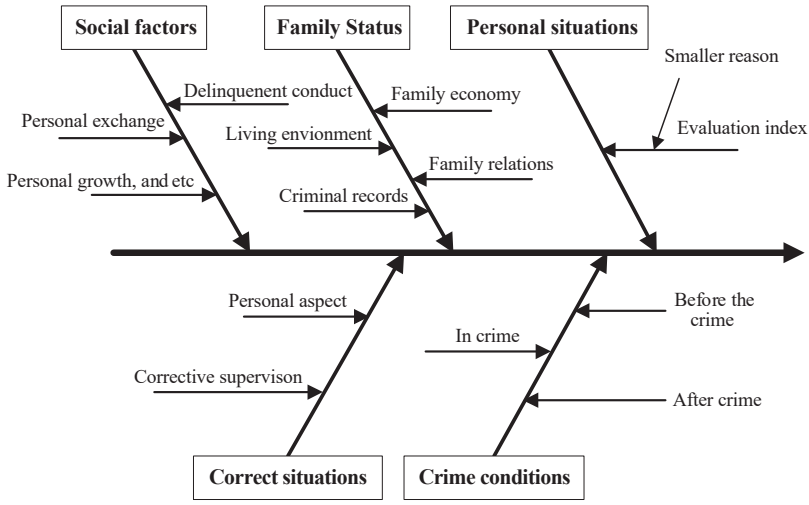
V. Application of Artificial Intelligence to Juvenile Offenders in Community Corrections

What risk factors have the gravest influence on minors and ultimately lead to crime, and for those who have committed crimes, what factors lead to their recidivism?[65] This

issue has long been the focus of legal circles.[66] John Bowlby, a British psychoanalyst, put forward the famous theory of maternal deprivation. He believed that any separation behavior would lead to serious psychological and emotional problems in children at the critical stage of development, which would have a huge harmful impact on their later life.[67] Many countries, including the US, Germany, Britain, Canada, Japan and China, have conducted extensive research on the characteristics, manifestations and factors of personal risk.[68] Canadian criminologist D.A. Andrews and other researchers found that young people with nine characteristics, including poor economic situation, unstable job, poor education, antisocial and illegal friends and companions, brothers and sisters in family, parents with criminal records, violence, drug abuse and other characteristics, have a high level of personal risk and are particularly prone to crime.[69] In addition, there are some other well-known factors, such as age, gender, etc. which have different degrees of impact on an individual's personal endangerment. All these will add to the complexity of risk assessment of minor community correction.[70]

Based on the analysis of a large number of crime characteristics, criminology and community corrections risk assessment literatures, the authors propose causal analysis, as shown in Figure 2, noting that the risk factors of persons who are engaged in community corrections can be roughly divided into five aspects: personal situations; family status; social factors; crime conditions; and correction situations.

Figure 2: Community Corrections Risk Assessment Causal Analysis[71]



Most of the literature divides crimes into pre-crime, in-crime, and post-crime situations. Pre-crime refers to the criminal motive, the purpose of the crime, the cause of the crime, the psychological activities before the crime, and the criminal form of the crime. The in-crime situation relates to the danger of a criminal act, including the criminal act itself, the nature of the crime, the means of the crime, the purpose of the crime, the consequences of the crime, and so on. Post-crime refers to the perpetrator's attitude toward confession and repentance after the crime and the compensation behavior toward the crime victim.[72] As for the sources of risk in corrections, the evaluation is mainly based on the actual performance of the corrected persons in community corrections and the opinions of management personnel.

Table 6: Analysis of Correlation Coefficients of Community Correction Risk Assessment Scale[73]

Category	Correlation coefficient of different dimensions				
	personal situations	**family status**	**social factors**	**crime conditions**	**correction situations**
Personal situations	1	-	-	-	-
Family status	0.53	1	-	-	-
Social factors	0.33	0.21	1	-	-
Crime conditions	0.51	0.47	0.37	1	-
Correction situations	0.32	0.31	0.28	0.22	1
Total relevance of evaluation results	0.86	0.81	0.77	0.72	0.65

Probability and statistics methods are used to analyze the construction validity of the community correction risk assessment scale as shown in Table 6. The correlation coefficients among the different dimensions are between 0.21 and 0.53, which are low to moderate correlations, indicating that the various dimensions of the community corrections evaluation indicators are consistent in direction and different; and they cannot be substituted for each other. At the same time, each dimension is related to the community correction risk assessment results, with coefficients between 0.65 and

0.86, which is a moderately high positive correlation, indicating that the proposed index dimensions of the community corrections risk assessment are highly consistent with the overall goal of the community corrections risk assessment results.[74]

Artificial neural networks are also applicable to the area of community correction risk assessment. An artificial neural network is a kind of neural network behavior inspiring from the animals and people. By imitating the organizational structure and activity mechanism of the brain's nervous system, it mimics the thinking characteristics of the human brain.[75] Then, by adjusting the relationships among a large number of internal nodes, external information is comprehensively analyzed to process information. This type of network has been widely used in decision-making and management, intelligent control, education, and learning.[76] With the development of artificial intelligence technology, its research and application in the field of justice and juvenile community correction has gradually increased. Some literature uses the method of system modeling to study the dynamic risk assessment process of minor community correction, while others use the AI method of artificial neural networks to simulate the process of risk assessment and the behavior characteristics of minors.[77]

In recent, the authors have cooperated with Fujian Academy of Social Sciences and the PRC Department of Justice to conduct extensive research on juvenile crime prevention and community correction education.[78] Through the extraction of risk assessment characteristics, a neural network method is used to establish the risk assessment method of juvenile community correction. The model structure is designed with a three-layer neural network that includes an input layer, a hidden layer, and an output layer. The input layer is determined by the actual needs of the community correction risk assessment index system, while the output is the result of the community correction risk assessment of the juvenile offenders. The input layer of the network has 40 neuron nodes, which correspond to the 40 evaluation index factors constituting the community correction risk assessment scale. In the neural network, after the input layer and output layer are determined, the hidden layer nodes are selected according to an empirical formula and combined with the actual training results.[79]

The neural network structure used in the empirical analysis of community corrections is based on Backpropagation (BP) neural network. In terms of setting the operating parameters of the neural network, the number of iterations is set to 1,000 and the allowable error is 0.001. The learning rate of the neural network is the key to determining the amount of weight adjustment during the operation of the

network. If too small, the network will converge slowly. If too large, the system is likely to enter an oscillating state. The learning rate of this analysis is set to 0.1. When the community correction risk results are classified, the classification of the juvenile community corrections risk assessment is based on the 3σ criterion. After normalizing the scores of the community correction risk assessment, we calculate the mean μ and standard deviation σ. According to mathematical statistics, the probability of a numerical distribution between (μ-3σ, μ+3σ) is 0.9974. Community corrections risk assessments are divided into five risk categories: lower risk, low risk, medium risk, high risk, and higher risk. When the normalized value corresponding to the community corrections risk assessment result falls within a particular interval, its risk level is corresponding to the interval. In the analysis, when the risk level matches a certain vector value, the vector number 1 is used to indicate "lower risk," and the vector number 5 is used to indicate "higher risk."[80]

In the research of Fujian Province juvenile offender community correction, as shown in Table 7, the risk assessment and evaluation of minor community correction based on a BP neural network can reach to more than 95 percent accuracy, and the results and speed of the analysis are much higher than those of the traditional analysis and judgment of minors.[81]

In order to achieve good applicability and high accuracy, the neural network community correction risk assessment system needs a large amount of sample data for learning, which introduces a large workload for the community correction risk assessment staff in the initial use of the system. Although the used artificial neural network has a simpler structure, before applied, it needs to manually extract the features and perform training, which takes a long time. In this regard, the accuracy of juvenile crime recognition given more categories needs to be improved.[82]

In 2006, Geoffrey Hinton proposed the deep confidence network DBN, which is composed of a series of restricted Boltzmann machines. The unsupervised greedy layer-by-layer training algorithm proposed by Hinton breaks the bottleneck of BP neural network development and has led to AI technology based on this new neural network topology becoming widely used in various fields.[83] Due to their considerable development, the deep learning algorithms has made it possible for machines to automatically learn features, so that the introduction of machine learning methods in the feature extraction process gives computers the ability to extract patterns from the original data.

Table 7: Community Correction Risk Evaluation Test Results of a Neural Network System[84]

Label	Expected output	Actual output	Expected risk level	Obtained risk level by BPNN	Conformity
1	2	2.1324	Lower risk	Lower risk	Yes
2	1	1.0533	Low risk	Low risk	Yes
3	1	1.2612	Low risk	Low risk	Yes
4	1	1.0361	Low risk	Low risk	Yes
5	2	2.1775	Lower risk	Lower risk	Yes
6	1	1.3467	Low risk	Low risk	Yes
7	3	3.2008	Medium risk	Medium risk	Yes
8	2	1.9981	Lower risk	Lower risk	Yes
9	3	2.9569	Medium risk	Medium risk	Yes
10	2	2.6525	Lower risk	Medium risk	No
11	4	3.9443	High risk	High risk	Yes
12	2	1.9865	Lower risk	Lower risk	Yes
13	5	4.8947	Higher risk	Higher risk	Yes
14	2	1.9752	Lower risk	Lower risk	Yes
15	1	1.0618	Low risk	Low risk	Yes
16	2	1.9874	Lower risk	Lower risk	Yes
17	4	3.9673	High risk	High risk	Yes
18	1	1.0386	Low risk	Low risk	Yes
19	2	1.9451	Lower risk	Lower risk	Yes
20	3	3.1632	Medium risk	Medium risk	Yes

The deep learning algorithms have improved the performance of classification and recognition in many areas. Some scholars have already begun to use AI technology like deep learning in the judicial and educational fields.[85] In this research, a juvenile community correction risk assessment model was preliminarily studied based on the convolution neural network (CNN) deep learning method. Thanks to its two convolution layers, two down-pooling layers, and one fully connected layer, the

multi-layer artificial neural network model has a stronger and more accurate feature learning ability than BP neural networks. However, there is still more work to be done. Namely, it is of great importance how to use new AI technology such as deep learning to establish an advanced and scientific evaluation method and assessment system for juvenile community correction, thereby further improving the education decision-making of juvenile community correction.

VI. Conclusion

Juvenile community correction involves multiple factors, such as psychology, physiology, family, education, social background, economic status, living habits and so on. As a highly complex system with many possibilities, it is very feasible to introduce AI into the research of minor community correction education and develop an intelligent education auxiliary evaluation system with corresponding functions. Specifically, AI is the direction of future technology development, which is of great significance to establish a scientific and objective decision-making system for juvenile community correction education. Moreover, once the proposed deep learning-based community correction risk assessment system for minors is widely used, as the sample size increases, it will become smarter just like a growing school-age child. The workload and manpower required for such evaluation will be much smaller than those of the current risk assessment scale analysis that relies on community corrections staff. This is not the only shortcoming of the current analysis approach that AI can address though. In addition, after an experienced risk assessment expert retires, new staff must be found and trained to engage in community correction risk assessment. Even with the new staff, the experience and knowledge of their predecessors cannot be copied. As for the deep learning neural network community correction risk assessment system, however, its knowledge and experience are processes of continuous growth and accumulation. Taking AlphaGo an example, which is also based on deep learning technology, it was the first AI robot to defeat a human Go world champion in 2016. Rather than merely relying on probability calculation as one might expect a machine to, AlphaGo uses AI to actually improve and learn, thereby improving its decision-making abilities. As some experts have said, “Artificial intelligence is the inevitable development of social and

natural science. The wheel of history cannot be stopped, the key is how to adapt."[86]

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