The Application of Interpretable Artificial Intelligence Theory in the Construction of Automatic Interpretation Evaluation System

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Abstract: With the rapid development of artificial intelligence technology, it can be explained that the theory of artificial intelligence has a great impact on the interpretation industry and work. However, the quality of interpretation teaching in most colleges and universities in China is relatively low. The process of interpretation work is dominated by theory, and the teaching content is simple. Students' personal abilities have not been significantly improved after interpretation learning. At the same time, the content, method and mode of interpretation test are backward in tradition, which is not conducive to the comprehensive development of interpretation teaching. Aiming at this problem, this paper adopts the interpretable artificial intelligence theory to deeply study the interpretation teaching content, and constructs an automatic interpretation evaluation system, in which BP neural network is applied. At the same time, the interpretation evaluation criteria are formulated, the interpretation ability types and parameters are classified, and the comprehensive interpretation ability scores of interpreters are automatically evaluated from the two modules of "interpreter ability" and "interpretation ability". Finally, five students were randomly selected to enter the interpretation data into the system, and the interpretation score growth rate and interpretation comprehensive score of five students were calculated. The results showed that the student with the highest interpretation growth rate was C, whose growth rate was 8.33%, and the average growth rate was 5.28; Student A has the lowest growth rate among the five students, with a value of 1.88%. In order to evaluate the adequacy and integrity of information in the interpretation quality system, fluency of expression, logic, terminology, grammar accuracy, pronunciation and intonation, pleasant voice, and translation style, the impact of the use of interpretation by professionals and non professionals on the quality of interpretation is analyzed. The results show that the highest impact is information adequacy and integrity, with 87% for professionals and 81% for non professionals.

Keywords: Artificial Intelligence, BP Neural Network, Interpretation Evaluation, System Design

1. Introduction

The arrival of the era of artificial intelligence promotes the innovation and progress of technology. More and more industries use the theory of artificial intelligence to reform and develop [1]. Traditional interpretation assessment mainly relies on manual methods. Teachers evaluate students according to their personal experience, teaching outline and test method. The results obtained by this method are not scientific, the test method is too simple, and there is some subjectivity in the set scoring standards, which makes the effect of interpretation teaching unsatisfactory [2].

Therefore, this paper builds an automatic interpretation evaluation system based on the explanatory artificial intelligence theory, sets standard interpretation evaluation modes, processes and standards in the system, and conducts data analysis by collecting students'audio information for

interpretation, in order to judge students' interpretation quality [3]. Teachers should improve teaching methods based on interpreting data and improve the quality of interpreting teaching.

The innovations in this research process are as follows: (1) The explanable artificial intelligence concept used in this paper is introduced first, and the BP network and genetic algorithm operation process required to build an automatic interpretation evaluation system is described in detail, which is the important theoretical basis of this system. (2) Establish standards for interpreting assessment in the system, calculate interpreter's interpreting ability according to the proportion of each standard, and classify interpreting strategy competence and basic parameters. The system evaluates interpreter's interpreting ability through two modules: Interpreting competence and interpreter competence.

2. Related Work

The language service market is developing rapidly with the promotion of artificial intelligence and other technologies, and the content of language services is increasing. All of these have created new challenges and opportunities for interpretation. Hoang et al. points out that interpretation is interpretive and its purpose is to express its own meaning, so the criterion to be used in evaluating the quality of interpretation translation is "interpretive accuracy"[6]. Wang X et al. analyzed user expectations for interpreting quality and formulated 16 standards for assessing the quality of interpreting, including logical coherence, consistency, grammatical accuracy, translation fluency, integrity, authenticity, pleasant sound, etc. [7]. Anelli et al. establishes a semantic score standard for interpreting, which uses an error scoring mechanism. However, this mechanism is unable to judge the appropriateness of sound pauses, tones and other characteristics, making it difficult to evaluate the quality of interpreting as a whole. Akpaca et al. pointed out that there is no quality standard for interpretation, because there are many factors that can interfere with interpretation activities, such as the quality of interpretation, the content of interpretation activities, etc. [9]. Wang F et al. has developed three different modes for assessing interpreting, namely, measurement, assessment and judgment. It is suggested that the content and factors for assessing the quality of interpreting vary greatly, so different methods of assessment can be used. For better interpretation teaching, a judgment mode can be selected for the evaluation of students'interpreting proficiency. Goriaeva has developed a comprehensive dynamic assessment model of interpreting quality based on the differences between the assessment of professional interpreting quality and the interpretation teaching. Zulhafizh pointed out that the core of undergraduate translation teaching is technology, and paid attention to students'translation skills during the training period as a measure of students' translation ability [12]. Tang J et al. uses tool competence to judge translation competence when building a translation competence model. Lin B et al. proposed that the quality of interpretation should be evaluated from two perspectives: language and pragmatics. From the perspective of pragmatics, the quality of interpretation should not be absolute value, but be judged according to context. From the perspective of pragmatics, the quality of interpretation should be assessed from the aspects of audience, speaker, interpreter, extralingual effect, information form, interpretation occasion and language interaction standard. Fidyka et al. holds that the organizers and participants of the interpreting activities have a direct impact on the quality of interpretation. If interpreting is regarded as a language activity in which an interpreter is the intermediary, the quality of interpretation should be evaluated according to the speaker, interpreter, client, organizer, audience, etc. [15].

3. Interpretable Artificial Intelligence Algorithms

3.1 Explains AI concepts

"Interpretation" is the mapping of various abstract concepts in the field that human can understand. "Interpretability" is the information that people can acquire with a strong understanding and need when they want to handle or master something, and it belongs to the basic of human social behavior and psychology. From the perspective of cognitive psychology, human beings have a mental model that can correctly reflect their environment. When an accident occurs, the mental model is updated quickly, looking for a way to interpret the event. Then, from the perspective of social behavior, it is proposed that managing social interaction and meaning are two basic factors that people interpret. Therefore, Interpretable Artificial Intelligence (XAI) is interpreted in a way that people can understand. It reflects the latest AI of intelligent system decision-making and behavior. It enables users to trust and understand the output and result obtained by learning algorithms more deeply. It enables the AI system to have human-oriented interpretation ability and better connect the machine and human, as shown in Figure 1 below [17].

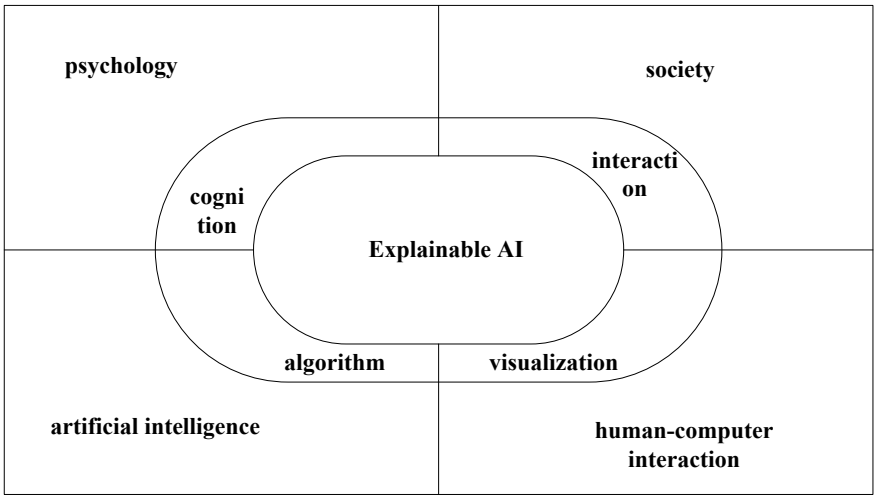

Figure 1 Explains AI concepts

3.2 Application of BP Neural Network in Automatic Interpretation Assessment System

BP network is a multilayer feed-forward neural network. Signals propagate forward during network training. The core of BP network is to adjust network weights by error back propagation, so it is called back propagation learning algorithm. BP neural network can learn and memorize the mapping mode between input and output without displaying the explicit mathematical equation of the mapping mode in advance. In the process of transmitting forward signal, the signal is input from the input layer, passed through the hidden layer, and finally transmitted to the output layer under the processing of each layer. There is no connection between each layer of neurons, and full interconnection mode can be used to interfere with the state of the lower layer of neurons. If the output layer does not get the desired output result, it can jump to the backward propagation based on gradient descent to complete the prediction and update of network weights, improve the network performance, and make the output result more similar to the expected output value. The following calculation formula:

（1） Implicit layer excitation function f:

$$f(x)=\frac{1}{1+e^{-x}} \quad (1)$$

（2） Implicit Layer Output H:

$$H_j = f\left(\sum_{i=1}^{n} \omega_{ij} x_i - a_j\right) \qquad j = 1,2,\ldots,l \qquad (2)$$

（3）Predictive Output O:

$$O_k = \sum_{j=1}^{l} H_j \omega_{jk} - b_k \qquad k = 1,2,\ldots,m \qquad (3)$$

（4） Find e budget error and expect output to be represented by Y:

$$e_k = Y_k - O_k \qquad k = 1,2,\ldots,m \qquad (4)$$

（5） Update ω_{jk}, ω_{ij}:

$$\omega_{ij} = \omega_{ij} + \eta H_j \left(1 - H_j\right) x(i) \sum_{k=1}^{m} \omega_{jk} e_k \qquad i = 1,2,\ldots,n \qquad j = 1,2,\ldots,l \qquad (5)$$

$$\omega_{jk} = \omega_{jk} + \eta H_j e_k \qquad j = 1,2,\ldots,l \qquad k = 1,2,\ldots,m \qquad (6)$$

（6） Update a, b thresholds:

$$a_j = a_j + \eta H_j \left(1 - H_j\right) \sum_{k=1}^{m} \omega_{jk} e_k \qquad j = 1,2,\ldots,l \qquad (7)$$

$$b_k = b_k + e_k \qquad k = 1,2,\ldots,m \qquad (8)$$

m, n, l are the number of nodes in the output layer, input layer and hidden layer respectively.

3.3 Genetic algorithm

The genetic algorithm is a random optimization algorithm, which differs from the random comparison search algorithm in that it performs genetic operations by evaluating chromosomes and genes. It can make full use of existing information to search for improved chromosome quality. The following is the basic operation flow of the genetic algorithm:

（1）A randomly generated set of initial individuals is selected as the initial population.

（2）The solution in the solution space is a genotype string in the genetic space, also known as a chromosome.

（3）The fitness values of all the individuals in the population were calculated according to the fitness function.

（4）Selecting individuals with high fitness within a population by some selection method;

（5）Individuals within the population were randomly selected according to the P_c crossover rate to complete the crossover operation.

（6）Select some individuals within the population according to the P_m mutation rate to complete the mutation operation.

（7） If the algorithm stopping criteria meet the requirements, select the individual with the highest fitness within the population as the output of the optimal solution to complete the algorithm;

Otherwise, skip to the third step.

In this paper, through in-depth analysis of the genetic algorithm operation process, it is concluded that one of the main criteria for evaluating individuals in the population is the fitness value, which is also an important driving force during the evolution of the genetic algorithm, as a basic criterion for natural selection. The selection operation is based on the basic principles of survival of the fittest and survival of the fittest. Individuals with high fitness values have a higher probability of being selected than those with low fitness values, thus increasing the fitness values of the individuals in the next generation. In genetic algorithm, new individuals are generated by crossover operation, two individuals are selected in a population with a fixed probability, and some genes on two individuals are exchanged in some way to generate two new individuals. Variation operation is an assistant way to generate a new individual. It uses other gene values instead of some gene values in the individual coding string to generate a new individual. The result of the operation has a direct impact on the local search ability and population diversity of the genetic algorithm. By effectively combining mutation with crossover, the genetic algorithm can perform both local and global searches in the search space. Figure 2 below shows the genetic algorithm operation process.

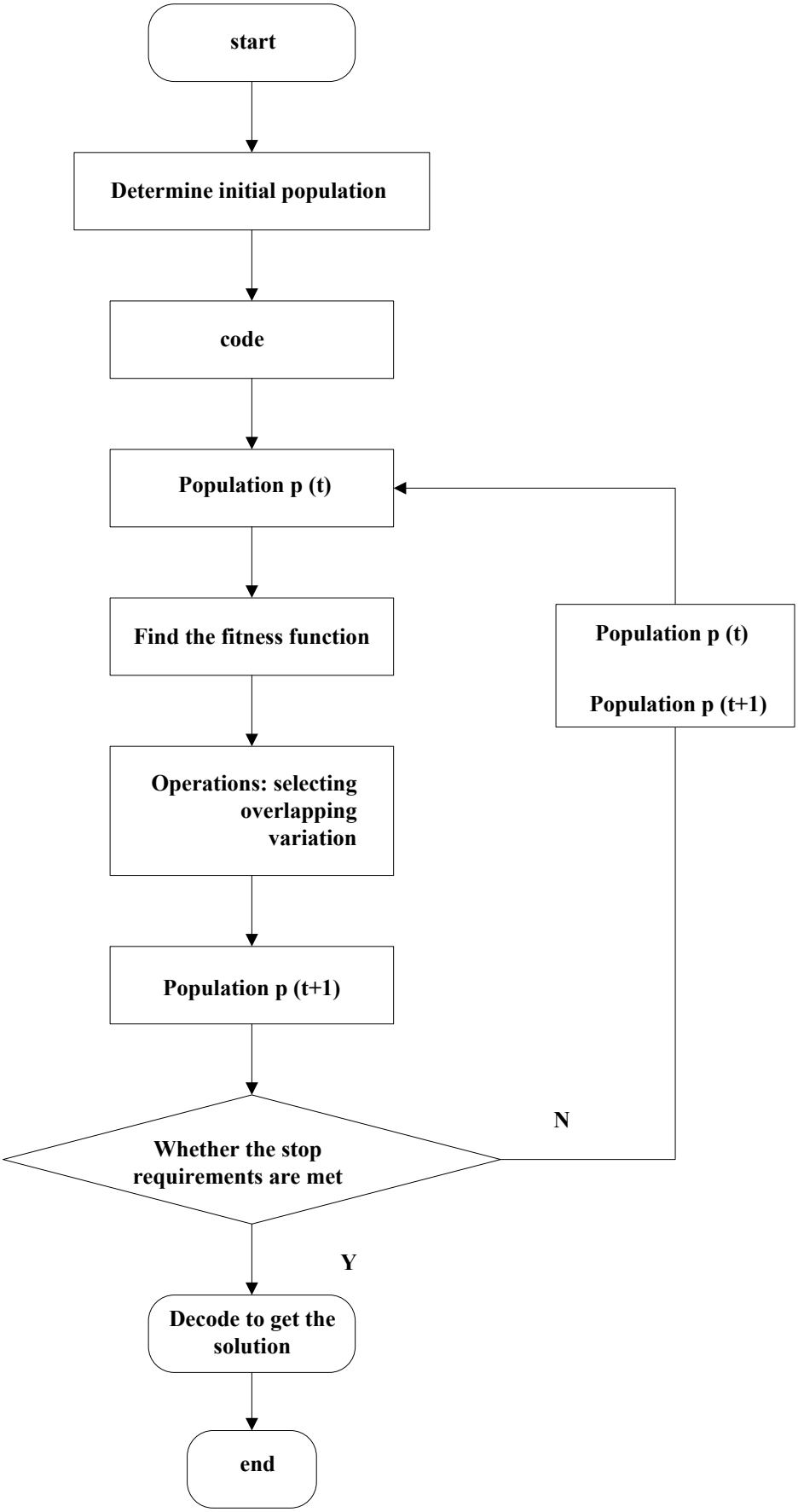

Figure 2 Genetic algorithm operation process

4. Automatic Interpretation Assessment System

In this paper, we use the interpretable artificial intelligence to study and set up an automatic interpretation assessment system, which is based on the MVC three-tier model and the Struts framework. This three-tier structure allows the system to be logically independent, with each module setting clear task content. Clients use a Web browser to send HTTP requests to the control-level application server on the view layer. The application server authenticates the user according to the requests sent by the client, processes the legitimate user requests and connects to the database to store the data, and finally returns the acquired data information to the client browser.

4.1 Interpretation Evaluation Criteria

Based on the teaching objectives, operability, students'interpreting ability and teachers' teaching ability, this paper formulates the standards for interpreting evaluation for the major of English interpreting in Colleges and universities. The specific contents are shown in Table 1 below:

Table 1 English Interpretation Test

	Evaluation items	Project score proportion	Project standard description
Comprehensive judgment（10%）	Professional judgment （10%）	Professional judgment（10%）	Teachers' comprehensive professional judgment based on personal interpretation experience
Quantitative details scoring （90%）	Information loyalty (50%)	Integrity（25%）	Judge whether information points/information volume are complete, and analyze the coverage of information points
		Accuracy（25%）	Judge whether the original content can be accurately expressed, and analyze the accuracy of information transmission
	Expression ability (20%)	Definition（10%）	Judge whether the meaning of the translated text is clear, whether the content is smooth, and whether the logic is coherent
		fluency（10%）	Judge whether the translated text can be expressed smoothly and naturally
	Language quality (10%)	Phonetic intonation（5%）	Judge whether the intonation of the translated text is natural and the pronunciation is accurate
		grammar（5%）	Judge whether the syntax is accurate, whether there are local errors and overall errors
	Comprehensive quality (10%)	reaction rate （5%）	Whether it can be translated within 3s after the end of the speech, and whether there are many stutters, pauses and repetitions during the interpretation
		Strain capacity （5%）	Can you skillfully use a variety of interpretation skills and emergency strategies

Based on the scale set by the different options in Table 1 above, the following formulas are used to calculate the translation quality:

$$Sq = \sum_{t-1}^{n} \qquad (9)$$

$$C_i S_i = C_1 S_1 + C_2 S_2 + C_3 S_3 + ... + C_n S_n \quad (10)$$

The comprehensive weighted average of the above interpreting quality is represented by S_q, the importance factor is represented by C_i, and the score of a factor is represented by S_i, where i is the number of partial factors, n is the number of factors and $n \leq 9$.

Interpretation assessment is a basic work in the process of interpretation teaching. It can standardize the management of the content of interpretation tests, help to improve the quality of interpretation tests, and also play a role in improving the quality of interpretation teaching. This paper establishes a standardized system for the assessment of interpreting performance for English majors, which includes the test form, test objectives, evaluation criteria, and the content of test types, and also makes an analysis of test standards. Simulated interpreting tasks, descriptive collection, and instant backtracking interviews are also used to obtain more data analysis. The metacognitive strategies of alternative interpreting are divided into three parameters. The specific categories and parameters are listed in Table 2 below.

Table 2 Interpretation Strategic Competence Parameters and Classification

Descriptor Dimension	Descriptor basic parameters	Descriptor Category
Metacognitive strategy ability	Planning strategy capability	Preparation before interpretation
		Interpretation planning
	Monitoring strategy capability	Monitor and understand source language
		Monitor the expression of the target language
		Concentration
		Self assessment
		Aware of self problems
	Remedial strategy capability	On site remediation
		Feedback and analysis

4.2 Constructing an Automatic Interpretation Assessment System

This paper first focuses on the analysis of the interpreter's individual learning process and career development when building an automatic interpretation assessment system. In assessing the interpreter's translation ability, this paper starts from the following three categories:

Firstly, the interpreter's interpreting potential at the time of initial enrollment is assessed, which is mainly based on extralingual knowledge, bilingual ability and potential cognitive processing ability.

Secondly, it evaluates the interpreting ability of the interpreters at their graduation stage. The assessment includes whether the translator's extra-linguistic knowledge, interpreting ability and bilingual ability can be taken into account.

Finally, it evaluates the individual level of an interpreter in his or her career. The contents involved are interpreter's professional skills, interpreting ability, etc. [20].

In order to distinguish the occasion of an interpreter during the evaluation, the interpreter should be evaluated and tested according to the corresponding interpreting perception criteria in different occasions. After clarifying the content of the test, the testing process and method should be further designed, and an automatic interpretation evaluation system should be built. This paper evaluates the effectiveness of this system from two aspects: interpreting ability and interpreter ability.

（1）Assessing interpreter's "interpreting ability": The system evaluates interpreter's interpreting

ability based on whether the interpreter has acquired relevant knowledge and skills during the execution of the task. The evaluation module is shown in Figure 3 below.

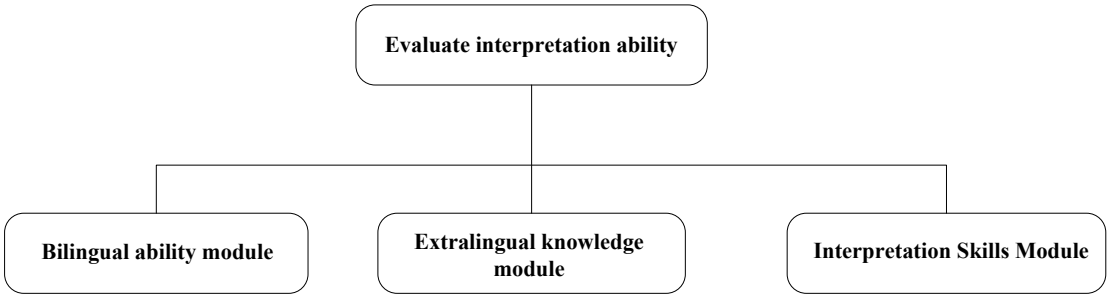

Figure 3 Interpretation Competence Assessment Module

The core of the system in evaluating interpreter's bilingual competence lies in the interpreter's oral expression ability and listening comprehension ability. The extralingual knowledge in interpreting mainly consists of professional subject knowledge, encyclopedia knowledge and the skills in interpreting include note taking, memory and multitask processing.

（2） Assessing Translator Competence

When evaluating "interpreter's ability", the system should judge whether the interpreter is skilled in interpreting skill system, knowledge system, professional quality and psychological quality. The evaluation module is shown in Figure 4 below.

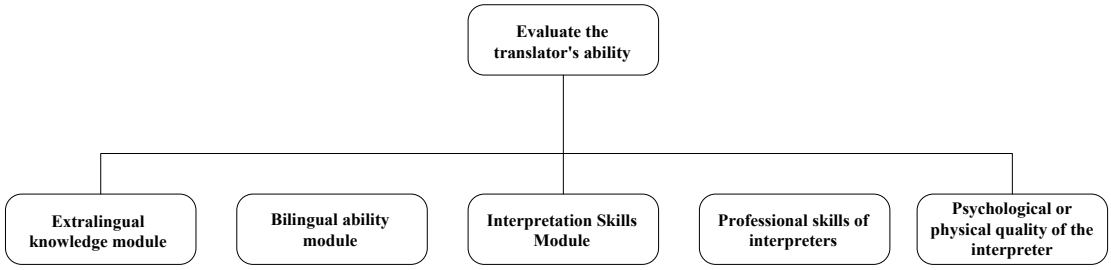

Figure 4 Translator Competency Assessment Module

The purpose of systematic assessment of "interpreter competence" is to comprehensively analyze whether an interpreter has the ability to engage in the interpreting industry. Interpreter competence refers to the standard of interpretation that an interpreter learns and learns and uses skillfully during the process of interpreting and practice. Therefore, the degree to which an interpreter learns the standard of interpretation is an important basis for evaluating an interpreter's ability. Therefore, the system considers the interpretation criteria of interpreters'performance as the conclusion in the evaluation, and considers them as important parameters to evaluate interpreters' interpreting ability.

5. Analysis of Automatic Interpretation Assessment System

5.1 An Analysis of Students'Comprehensive Interpretation Ability

This paper uses the theory of explanatory artificial intelligence to study and construct an automatic interpretation evaluation system, which is used by college students to collect students'interpretation data through the system. In order to improve the effect of interpreting classroom teaching, teachers add more links to interact with students during the teaching process, and use the "practice-feedback" mode in the classroom to obtain more information about students'learning. In this mode, students can concentrate more on their learning, and participate more in it, which improves

greatly compared with the traditional classroom effect. At the end of the Interpretation course, the teachers will test the students'skills according to their practice and make a statistical summary of the test results every month. In order to test the comprehensive ability of students in interpreting, five college students are randomly selected for the automatic assessment of interpreting. The scores are scored from the aspects of logical expression, information integrity, pronunciation, presentation, language use, topic extension, body language, confidence, note-taking and listening. The growth rate of five students'interpreting skill scores is calculated. The results are listed in Table 3 below. Five students in the table are represented by A, B, C, D, E.

Table 3 Growth Rate of Students'Interpretation Skill Scores

	A（%）	B（%）	C（%）	D（%）	E（%）	Average growth rate（%）
Logical expression ability	2.45	2.37	11.85	6.26	6.26	5.84
Information integrity	1.22	3.58	15.09	6.35	4.84	6.22
Pronunciation	0.0	3.62	8.89	1.20	5.01	3.74
Presentation power	2.73	9.62	6.24	4.89	7.35	6.17
Language use ability	3.76	3.62	4.89	3.64	8.77	4.94
Topic extension ability	3.76	7.45	7.23	4.66	12.7	7.16
body language	0.0	0.0	0.0	0.0	0.0	0.0
self-confidence	0.0	0.0	2.34	0.0	0.0	0.47
Note taking method	6.42	8.02	11.14	12.1	12.1	9.96
hearing	3.86	5.14	5.14	4.78	4.89	4.76

By counting the above data and entering the five students'interpreting ability scores into the system, the system uses a simple arithmetic averaging method to score the five students' comprehensive interpreting ability. The results obtained are shown in Fig. 5 below:

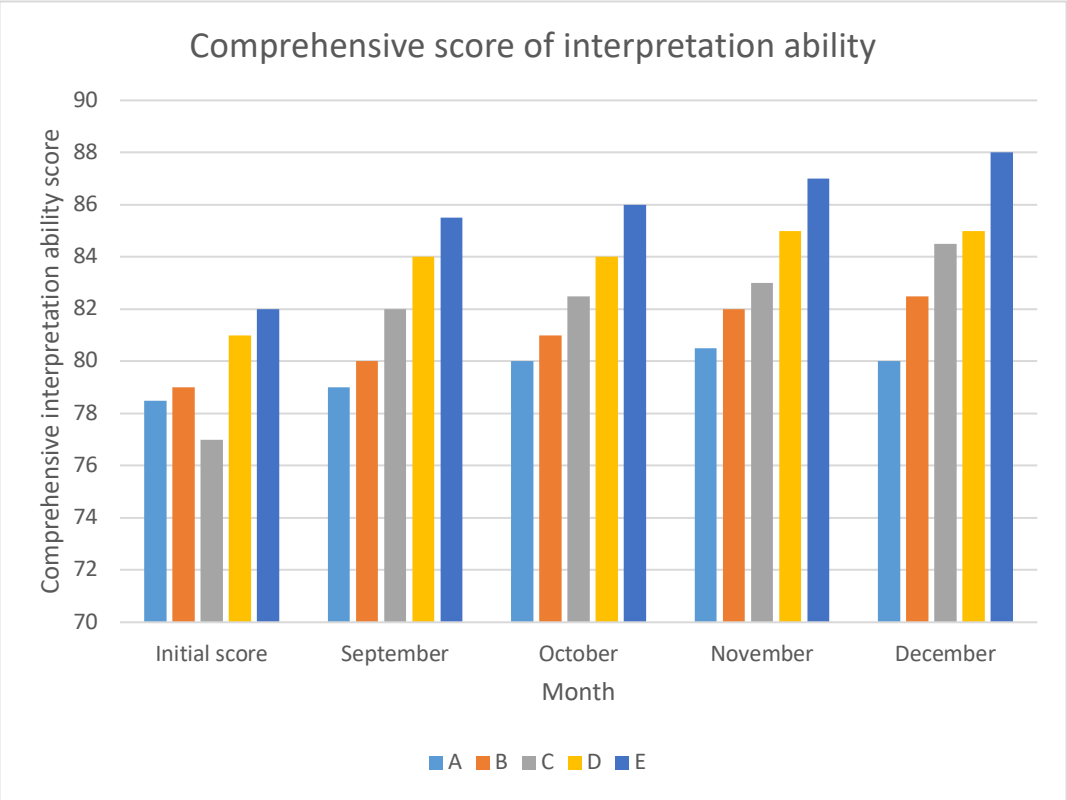

Figure 5 Interpretation Competence Comprehensive Score for 5 Students

Analyzing the scores of five students from September to December, the quickest improvement was student C, the initial score of student C was 77, and the score of interpreting ability rose to 84 in December, with an average growth rate of 8.33% and 5.28%. Class A had the lowest growth rate, with an initial score of 78.5. After four months of interpretation learning, the comprehensive score of interpreting ability in December was 80, with a growth rate of 1.88%, and the comprehensive score of interpreting ability of all five students improved.

5.2 Interpretation Quality Evaluation Analysis

This paper makes a further statistical analysis based on the "first choice" of the interpreter for different interpreting quality factors, i.e. the number of significant factors selected, which is converted to the percentage of a certain number of people in the total number. When evaluating the quality of interpretation, the system divides the interpreters into two types based on the relationship between the meeting subject and the interpreter's knowledge background, that is, non-professional users and professional users, and judges the requirements of these two types of users for the quality of interpretation. The system starts from information sufficiency and integrity, fluency of expression, logical organization, professional terms, grammatical accuracy, voice intonation, pleasant sound and translation style to analyze the impact of professional and non-professional interpretation on the quality of interpretation, and draws the result of system operation as Figure 6 below.

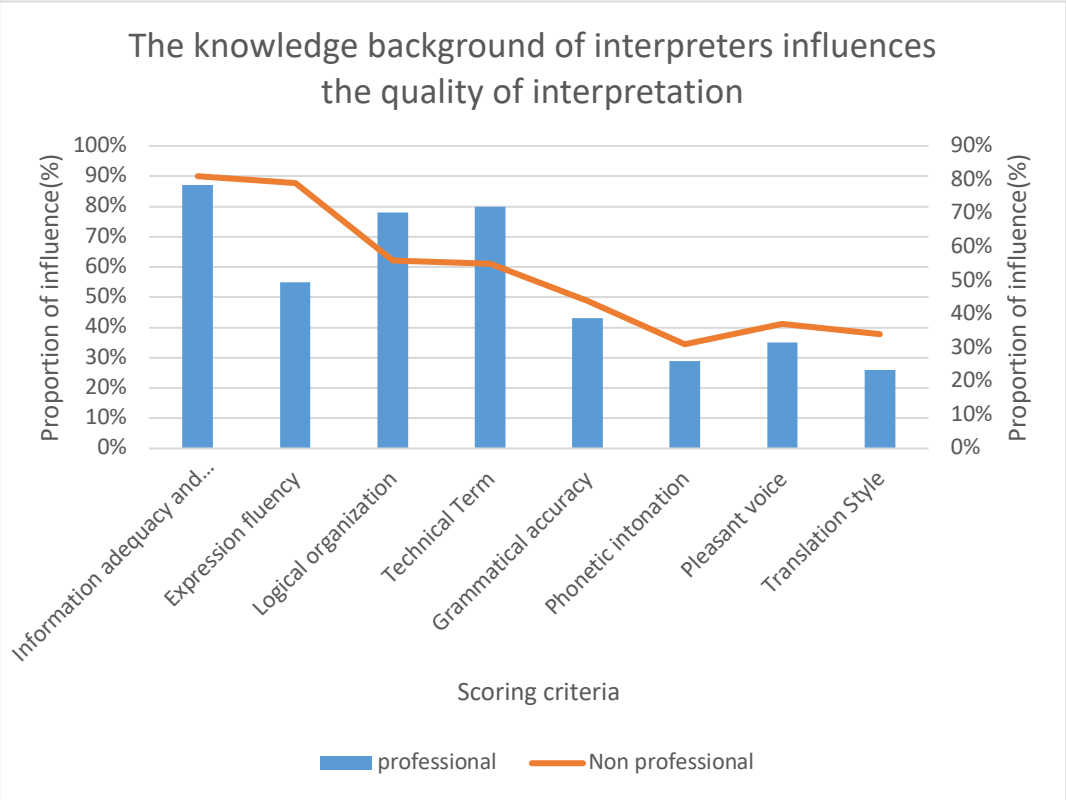

Figure 6 Interpreter's Knowledge Background Affects Interpretation Quality

According to the data in Figure 6, the most influential content among professionals and non-professionals is information adequacy and integrity, which affects 87% and 81% of the population, respectively. The less influential factors are translation styles, with 26% and 34% of professional and non-professional influencing respectively. The major influencing factors are professional terms and 80% and 55% of the two groups. This shows that interpreters with different backgrounds and knowledge have a direct impact on the quality of interpretation. Professionals pay more attention to the full and complete information, logical organization and other aspects of interpretation, while non-professionals pay more attention to the full and complete information and smooth expression in the process of interpretation.

6.Conclusions

With the emergence of artificial intelligence, around the "Internet technology" education revolution in the world, artificial intelligence technology has a profound impact on the interpretation industry, making the speed of interpretation professional iteration faster, the interpretation service mode, market shape, talent capacity structure, interpretation teaching environment, teaching content have undergone tremendous changes. Compared with translation teaching, interpreting is more flexible, faster to convert, and requires more ability of interpreters. However, students'interpreting ability cannot be accurately assessed in the course of interpretation teaching. To solve this problem, this paper uses the theory of interpretable artificial intelligence to study the field of interpretation, and constructs an automatic interpretation evaluation system to achieve the integration of interpretation teaching, practical ability and technical evaluation. The system evaluates the interpreter's interpreting ability through the two modules of "interpreting ability" and "interpreter ability". At the same time, 5 students were randomly selected to enter the interpreting data, and the growth rate and the comprehensive score

of the five students were calculated. The result shows that the highest growth rate of the students is C, the growth rate is 8.33%, and the average growth rate is 5.28; Class A had the lowest growth rate among the five students, with a value of 1.88%. In order to evaluate the quality of interpretation, such as the adequacy and completeness of system information, fluency of expression, logical organization, professional terms, grammatical accuracy, voice intonation, pleasant sound and translation style, the impact of professional and non-professional interpretation on the quality of interpretation is analyzed. The results show that the highest impact is information adequacy and integrity, with 87% and 81% of professional and non-professional respectively.

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