Retraction

Retracted: Design of Regression Model for MultiParameter Evaluation of English Pronunciation Quality

Mathematical Problems in Engineering

This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

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Research Article

Design of Regression Model for MultiParameter Evaluation of English Pronunciation Quality

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In order to better evaluate the quality of English pronunciation, this paper proposes a regression model design method based on multiparameter evaluation of English pronunciation quality. This method takes college students' English pronunciation as the research object. Through the combination of various algorithms, a speech recognition model based on a machine learning neural network is constructed with characteristic parameters as input, and a speech quality evaluation model based on multiple regression is constructed with multiparameters such as intonation, speed, rhythm, and intonation as evaluation indicators. The experimental results show that log posterior probability and GOP are good measures of pronunciation standard. When used alone, a higher correlation with manual scores can be obtained, and the correlation of both exceeds 0.5. GOP has the best performance, with a correlation of 0.549. The combination of these two pronunciation standard evaluation features can further improve the evaluation performance, and the correlation degree reaches 0.574. Compared with the GOP algorithm with better performance, the evaluation performance is improved by 4.6%. *Conclusion*. The model provides a scientific basis for oral English speech recognition and objective evaluation of pronunciation quality.

1. Introduction

With the rapid development of computer science and technology, computer English learning has become the norm [1, 2]. In early 2007, the Ministry of Education clarified the standard for computerized English language instruction. Currently, most computer language learning tools focus on memory, writing, and reading and are rarely used in oral instruction. This is because computer speech is very difficult to measure speech. However, in recent years, the use of advanced technology in computer language learning has led to more and more oral English learning, including the assessment of time and sound adjustment by recording the observer's mouth [3]. This technique is helpful to correct learners' pronunciation errors. At the same time, this can help learners, especially second language learners who do not have an environment of speech and practice, to better understand and improve their language. Nowadays, English proficiency assessment has become a standard technology

for computer language learning [4]. In addition, a telephone call test can be used to measure an English oral test, as it lacks the independence of content, more objective and honest. rather than a manual measurement, and can be very effective.

In this context, the design of multiparameter regression model for English pronunciation quality evaluation plays a very important role. Through regression analysis of English pronunciation quality, combined with multiparameter English pronunciation quality standards as a reference, students' English pronunciation quality can be greatly improved.

2. Literature Review

Regression analysis is a mathematical method to deal with the correlation between variables. Its main content is to establish an approximate mathematical expression empirical formula of the correlation between variables by using the

least square method based on the observed test data; The validity of the empirical formula is verified by the correlation test; The established effective empirical formula is applied to predict and control. The practice has proved that using the regression analysis method in economic work is an effective scientific method for better understanding the relationship between economic phenomena, mastering economic laws, and carrying out economic prediction and control [5, 6]. As a global language, English has greatly facilitated the communication of people all over the world. With the deepening of China's integration into the world, people pay more and more attention to the oral English test and students' oral English ability. However, in the traditional English classroom teaching in China, oral English has always been the weakest link. Students' time for oral English training is very limited. Teachers cannot give targeted guidance according to different students' pronunciation, which leads to the poor oral English level of Chinese students. Although most of the students can achieve good results in the written examination based on English vocabulary, grammar and writing, few students can skillfully use English for practical and effective oral communication [7].

The Chinese Academy of Sciences has adopted standards such as accuracy and precision in the measurement of English proficiency. Yi have added guidelines for good telephone measurement and developed good telephone measurement standards that make telephone calls better and more efficient [8]. Ma et al., proposed a pronunciation quality evaluation model independent of phonemes, and the scoring effect is better than other methods [9]. Xh et al., use the wheel as an event after a function in custom language. The correlation coefficient between the automatic score and the manual score was 0.795, and the rating performance improved by 9% [10]. Wagner et al., developed an accurate algorithm for measuring telephone quality based on the ellipse design, which improved the accuracy and efficiency of telephone quality measurement [11]. Wen and Fu have proposed new procedures for assessing oral English and using it in Tsinghua University's English-speaking teaching methods [12]. After testing, the sentence correlation between pass and expert scoring is 0.66, which is better than other scoring algorithms. Bang et al., comprehensively evaluated the oral pronunciation quality of the testees by comparing the speech speed, intonation, stress, intonation, and rhythm of the pronunciation sentence to be tested with the standard language in the corpus and achieved good results [13]. These results provide strong support for the study of computer-aided pronunciation quality assessment.

Based on the above-given research, this paper proposes a method to develop a multiparameter regression model for English pronunciation quality assessment. This method takes English speech pronunciation of college students as the research object, extracts Mel-frequency cepstral feature parameters from the speech signal and uses the feature parameters as input to build a machine learning neural network-based speech recognition model. Based on multiple regression, it is used as an evaluation criterion to create a model for evaluating the quality of spoken English pronunciation. According to the test results, combining the

standard evaluation characteristics of these two pronunciations further improves the evaluation performance, and the correlation reaches 0.574. GOP algorithm and evaluation performance improved by 4.6%. It aims to create a scientific basis for the recognition of spoken English and the objective assessment of pronunciation quality.

3. Research Methods

3.1. Principle of Regression Analysis. Regression analysis methods can be divided into two types according to the number of changes studied: single-variable regression analysis, multivariate regression analysis, and linear regression analysis and nonlinear regression analysis in the form of empirical models. Most nonlinear regression tests can be converted to horizontal tests, and the principle of multiple regression tests is the same as a single test. In terms of regression, this form is just a version of horizontal regression. The empirical formula is defined by the smallest square [14]. In the univariate linear regression analysis, we study the relationship between two variables, one is the common variable x, and the other is the random variable y.

For example, the relationship between the demand for commodities and the number of residents is uncertain. In order to make a purchase and supply plan for a certain commodity throughout the year, the commercial department needs to investigate the demand for such a commodity. Suppose 20 residential areas are investigated, and the relationship between the demand for commodities and the number of residents is listed in Table 1.

How to infer the demand of the whole city and the supply plan of each residential area based on these data? It can be seen from Table 1 that the relationship between Y and X is generally linear, but not completely determined [15]. If there are three settlements with the same population of 600, the demand for commodities is different. Therefore, after the number of people is determined, the demand for goods can not be completely determined. We can only roughly estimate the demand or the range of the demand. That is to say, in addition to the linear influence of X on y, there are other factors on y, forming the randomness (i.e., uncertainty) of Y, which is expressed by the mathematical formula as follows:

$$Y = a + bx + \varepsilon, \qquad (1)$$

where ε is called a random term. The problem now is how to use the survey data to eliminate the influence of random factors and find out the linear relationship expression between Y and X. therefore, first draw 20 pairs of data as points on the coordinate plane to get the following line graph, as shown in Figure 1.

From Figure 1, this line is called the regression line of Y to x, and the equation represented by the regression line $Y = a + bx$ is called the regression equation of Y to x.

3.2. Mel Frequency Cepstrum Coefficient. The research on the principle of human ear hearing shows that the sensitivity of human ear to high and low frequency sound signals is different, which is approximately logarithmic. Mel frequency

Table 1: Relationship between commodity demand and number of residents.

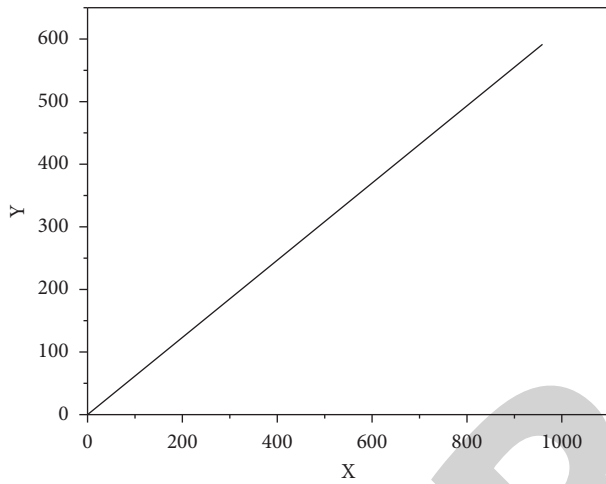| Settlement No	Number of residents	Commodity demand	Settlement No	Number of residents	Commodity demand
1	100	50	11	700	400
2	200	120	12	750	450
3	300	160	13	800	490
4	300	190	14	800	480
5	400	240	15	850	500
6	500	290	16	850	490
7	550	330	17	900	550
8	600	350	18	950	540
9	600	360	19	950	560
10	600	380	20	1000	610

Figure 1: Linear relationship between ordinary variables and random variables.

cepstrum coefficients (MFCC) is an acoustic feature that makes full use of the auditory perception characteristics of the human ear. By setting a group of triangular band-pass filters that are nonuniformly distributed along the linear frequency axis, the conversion from linear frequency to Mel frequency is realized, and then the speech signal is processed in the Mel frequency domain.

The conversion relationship from the actual linear frequency f to Mel frequency m is

$$m = 2595 \left(1 + \frac{f}{700} \right). \tag{2}$$

Because MFCC features use Mel frequency, it can better reflect the response of human auditory system than linear frequency. The detailed process of extracting MFCC features from preprocessed speech signals is shown in Figure 2.

Figure 2 shows that for each frame of speech signal after preprocessing, the fast Fourier transform is first performed to obtain the energy distribution on the spectrum. Then, the spectrum is weighted and summed through a group of triangular bandpass filters to convert the spectrum of each frame of speech signal to Mel frequency domain. Then, take the logarithm of Mel filter bank output. Since the filter banks are overlapped, the output energy of each filter is correlated. Then, discrete cosine transform (DCT) is performed on these logarithmic energies to eliminate the correlation of the output energy of the filter banks. After DCT transformation, 12 Mel cepstrum coefficients and one energy feature can be obtained for each frame of the speech signal, but these parameters only reflect the static characteristics of the speech signal [16]. In order to capture the dynamic characteristics of speech signal at the same time, first-order difference and second-order difference are made for these parameters in turn. After the above processing, the 39 dimensional MFCC feature vector can be extracted from each frame of the speech signal.

3.3. Building a Search Network.

After the construction of the knowledge base is completed, in order to align the students' reading pronunciation with the given reading text, a search network should be built according to the information provided by the knowledge base, as shown in Figure 3.

A three-layer search, the first layer is the conjunction that connects the spoken words with some occurrences in the trilingual structure, and the second layer is the phoneme layer that describes the word sequence. Communication words from the telephone dictionary. Phoneme sequences, the third layer is the HMM state layer, which is an acoustic statistical representation of phoneme sequences using the HMM model.

3.4. Construction of Multiparameter Regression Model for English Pronunciation Quality Evaluation

3.4.1. Voice Data Acquisition

(1) Training Data Set. In order to verify the effectiveness of the speech recognition model in this study, the speech data are downloaded from the libri speech ASR corpus. The downloaded data set includes 8800 groups of English phonetic data, which are composed of the pronunciation of 10 English words by 88 native speakers aged 10–40 and each word repeated 10 times. The data set is mainly used to train the speech recognition model.

(2) Test Data Set. According to the needs of College Students' English audio-visual and oral teaching, this paper establishes a database of test terms. The corpus text materials of this study are derived from the original sound of four movies,
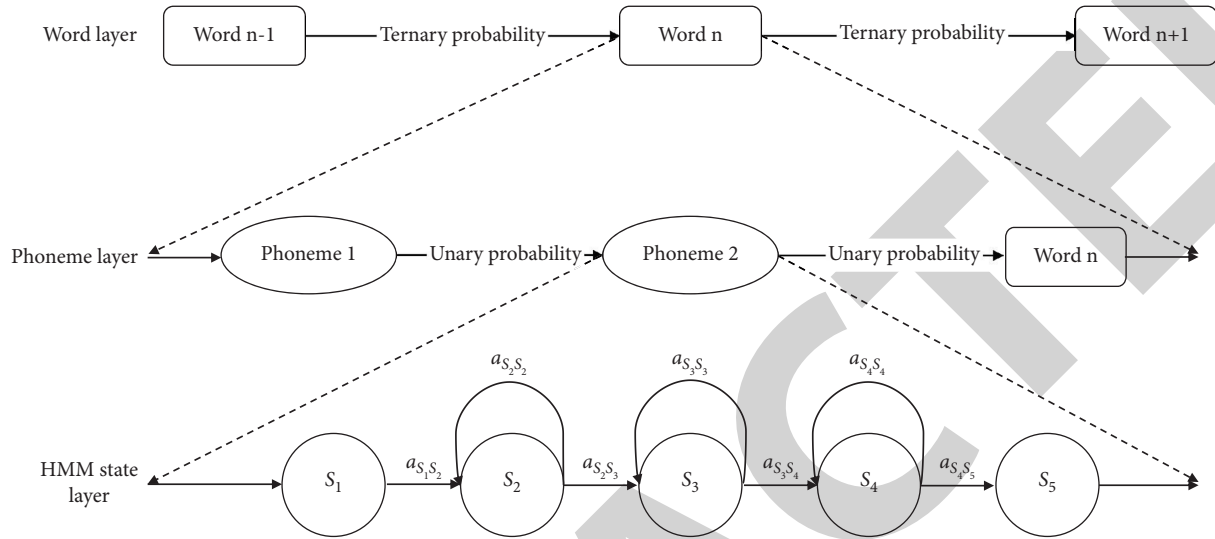
FIGURE 2: MFCC feature extraction flow chart.

FIGURE 3: Three layer search network.

TABLE 2: Corpus information.

Corpus items	Corpus content
Recorder	300 college students in a college
Source of corpus	Select a segment from each of the four films kung fu panda, hua mulan, truman's world and teddy bear. Under each segment, select 5 representative lines as the reading text, a total of 20 sentences
Recording mode	Each student reads the assigned 20 sentences
Preliminary evaluation method	In order to compare with the followup model evaluation, the designated teacher will first make a preliminary evaluation of the sentence. According to the factors such as pronunciation intonation, rhythm, intonation and speed, the comprehensive evaluation is carried out by using the national CET6 oral test grading standard
Total number of corpora	A total of 6000 wav format speech (16000 hz sampling rate, mono channel, 16 bit quantization), 6000 evaluation data

kung fu panda, Hua Mulan, Truman's world and teddy bear [17]. Some representative phonetic clips are selected as reading materials. Students participating in the test can read aloud and record the corresponding pronunciation. The specific information of the test corpus is shown in Table 2.

3.4.2. English Speech Signal Preprocessing and Feature Extraction. Before speech signal analysis and processing, in order to eliminate the impact of environmental noise, clutter and distortion on signal quality, it is necessary to preprocess it, including pre-emphasis, windowing, endpoint detection, noise filtering, and other operations. Speech signal preprocessing and feature extraction are completed on matlab9.0 platform. MATLAB has corresponding data speech toolbox and digital filter toolbox for the realization of the above functions. Part of the theoretical analysis process is as follows.

Note that, the speech signal is $x(n)$, the output is tested, and the digital speech signal is $y(n)$ after the number. The main purpose of the speech signal is to emphasize the frequency of speech, eliminate the interference of the lip language, and improve the accuracy of speech frequency [18].

In order to strengthen the voice waveform and weaken the rest of the waveform, the window function is used to process the voice signal. At present, there are three commonly used window functions: hamming window, rectangular window, and hanning window.

Speech exploration is the exploration of the beginning and the end of conversation. There are two methods that are most commonly used: multiple start-ups at the end of the study end and two search-end points at the end. An algorithm for end-to-end detection with two start-ups is usually used to facilitate real-time removal. An algorithm for detecting the end of the end with two starting points must count the speech time: the energy of the short-term short-term and the short-term zero-velocity interactions to calculate check the end of the speech, which can overcome many shortcomings looking forward.

Decomposition of speech signals will eliminate information that does not interfere with speech, and the analysis and processing of speech signals. In this study, the Mel frequency cepstrum coefficient (MFCC), based on listening characteristics, was used to convert speech from the time written to the cepstrum domain and determine speech. The MFCC extraction procedure is shown in Figure 4.

The main extraction algorithms are fast Fourier transform (FFT), Mel filter, logarithmic operation and discrete cosine transform (DCT). MFCC feature parameters will be used as input of speech recognition model.

The language signal pre-emphasis is realized by programming the first-order fir high pass digital filter in the MATLAB system digital filter toolbox. The Hamming window is used to process the voice waveform. The Hamming window is programmed by the window function normalized DTFT amplitude function in the MATLAB system voice toolbox. Voice endpoint detection is realized by voice box function programming in MATLAB system voice toolbox. The speech signal feature extraction process based on Mel frequency cepstrum coefficient is realized by MATLAB and speech toolbox.

3.4.3. Construction of Spoken English Speech Recognition Model and Model Verification.

Three machine learning methods, support vector machine, BP neural network, and deep neural network, are used to construct an oral English speech recognition model. The MFCC feature parameters are used as the input of the oral English speech recognition model, and the four most commonly used pronunciation quality evaluation indicators, such as intonation, speech speed, rhythm, and intonation, are used as the output of the model. The model is verified and the speech recognition model with the best performance is selected.

(1) A Model of Spoken English Speech Recognition Based on Support Vector Machine. Support vector machine (SVM) is a supervised learning algorithm in machine learning. It can learn the characteristics of different kinds of known samples and then classify and predict the unknown samples according to the learning results. In this study, SVM algorithm is used to realize speech signal recognition and feature parameter extraction. The kernel algorithm of SVM depends on its kernel function. Kernel function determines the transformation relationship from the inner product in the original dimension to the inner product in the high dimension and directly determines the distribution of samples in the high dimension space. The training data set is used to train SVM, and the trained SVM is used to recognize and verify the parameters of the test data set speech. Before the training data, it is necessary to normalize the feature data to be input into the training set and the test set and then use the feature data in the training set to build SVM. Its parameter settings are as described above and then use the generated SVM prediction model to predict the test set, compare the prediction results with the sentences in the test set, so as to

FIGURE 4: Extraction process of mel frequency cepstrum coefficient.

obtain English speech recognition information and record the corresponding intonation, speed and other speech parameter information [19].

(2) A Model of Spoken English Speech Recognition Based on BP Neural Network. BP neural network has good parallelism, nonlinearity and fault tolerance and has excellent ability of pattern recognition and classification. This study uses a routing neural network consisting of three layers: the input layer, the hidden layer, and the output layer. Commonly used functions are logarithmic operations, logarithmic S-type conversions, and hyperbolic tangent S-type functions.

The input of BP neural network is MFCC characteristic value, the hidden layer adopts activation function, the output is speech recognition information, and records the speech speed, intonation, and other related information. In this study, the BP neural network adopts S-type transformation function, the expected error is set as 0.001, and the number of iterations is set as 200.

(3) Spoken English Speech Recognition Model Based on Res Net Deep Neural Network. The deep residual neural network res net model solves the problems that the traditional convolutional neural network or fully connected network may have more or less information loss and loss during information transmission. Because of its excellent performance, Res Net neural network is used in spoken English speech signal recognition in this study. By training the res net neural network model, the res net neural network model which can recognize speech features is obtained, and then the improved res net neural network model is trained with the new cross feature image training set. The trained neural network has formed a parameter matrix for a single feature and improved the residual block to increase the robustness of the model.

3.4.4. Multiparameter English Pronunciation Quality Evaluation Index and Model Construction

(1) Quantification of Oral English Pronunciation Quality Indicators. In this study, the correlation coefficient between MFCC feature parameters of standard sentences and MFCC feature output from speech recognition model is used as the quantitative index of intonation to judge whether the pronunciation is clear and accurate. The evaluation of speaking speed is quantified by the ratio of standard sentence length to test sentence length. For rhythm evaluation, the pairwise variability index (PVI) proposed by low of Nanyang Technological University in Singapore was used to calculate the rhythm correlation between standard sentences and input sentences.

Table 3: Characteristic performance of pronunciation standard evaluation.

Evaluation characteristics	Correlation degree
Logarithmic posterior probability	0.516
GOP	0.549
Pronunciation standard overall performance	0.574

(2) Construction of Regression Model for Multi Parameter Evaluation of English Pronunciation Quality. A multiparameter English oral quality analysis model is designed to use multiregression statistical analysis to determine the reliability of the above measurement parameters, as well as bring into account for various parameter parameters such as sound, speed, rhythm, and intonation and their heavy way. Different patterns of different sentences of English speech and pronunciation are considered to be English according to the difference, and the music, fast, music, and music as a difference. The standard English oral measurement model, the coefficient of each measurement, and the values of the model are used in the SPSS assessment analysis.

4. Results and Discussion

In this section, call recognition data effectively assesses students reading English against the call pattern. After testing the performance of the self-measurement function, a support vector regression (SVR) algorithm is used to combine the performance measurement to check the overall performance of the model hu. The performance of the call model measurement is shown in Table 3.

Table 3 shows that the log posterior probability and GOP are good measures of call standardization. If they are used alone, a high correlation with the manual score can be obtained. The correlation between the two exceeds 0.5, and GOP Evaluation has the best performance, with a correlation of 0.549. By combining these two call standard estimation features, the estimation performance is further improved and the correlation reaches 0.574. Compared to the better performing GOP algorithm, the estimation performance is improved by 4.6%. This shows that the multi-parameter regression model for English pronunciation quality assessment has a stronger applicability and can improve the level of spoken English pronunciation of college students [20].

5. Conclusion

This paper proposes several regression models to measure the quality of English speech. Combining the return measurement model and the English language proficiency standard multiple measure, and the English language proficiency standard of the high school students, this model creates a variety of different standards to measure good English, so as to improve the college students' oral English pronunciation level. The experimental results show that log posterior probability and GOP are good measures of pronunciation standard. When used alone, a higher correlation with manual scores can be obtained, and the correlation of both exceeds 0.5. GOP has the best performance, with a

correlation of 0.549. The combination of the standard measurement functions of these two contacts further improves the performance measurement and the correlation level up to 0.574. Performance rating was increased by 4.6% compared to the performance of GOP algorithm. It shows that the multiparameter regression model of English pronunciation quality evaluation is more applicable and can better improve college students' oral English pronunciation.

Data Availability

The data used to support the findings of this study are available from the author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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