Computer Science and Information Systems 19(3):1481–1498 https://doi.org/10.2298/CSIS210320020L

Application of Wearable Motion Sensor in Business English Teaching

Dan Lu[1] and Fen Guo[2,*]

[1] School of Foreign Languages, Shunde Polytechnic,
Shunde 528300, Guangdong, China
rachellu2009@126.com
[2] School of Software Engineering, South China University of Technology,
Guangzhou, 510006, China
csguofen@scut.edu.cn

Abstract. With the advancement of science and technology, portable motion sensors are becoming increasingly popular in life and have become a research point for improving life and learning, and are widely used in medical care and smart terminals. Based on the advantages of portable motion sensors, this paper focuses on its application in learning English business. Collects speech information through special motion sensors, analyzes the accuracy of students' reading through speech recognition, to help students better learn business English. Firstly, the wearable sensor is used to collect and preprocess the speech information of students' business English reading as the input of speech recognition. Secondly, the linear predictive cepstrum coefficient (LPCC) and Meier frequency cepstrum coefficient (MFCC) of students' business English reading speech are extracted, and the mixed parameters of LPCC and MFCC are taken as speech features. Finally, the correctness of reading speech is recognized by combining HMM and WNN. Through the simulation analysis of students' reading speech recognition, it is shown that the speech recognition based on wearable motion sensor is feasible and the recognition method has good performance. In addition, the feasibility of wearable motion sensors in business English teaching is verified by the establishment of an experimental classes, which can promote students' English learning better.

Keywords: Wearable motion sensor, Business English, Business English Teaching.

1. Introduction

Judging by the current situation, based on the professional curriculum of the English company in the country, especially the higher vocational education that focuses on the training of qualified talents, the current curriculum does not meet the respective national standards. Vocational training and basic knowledge go beyond their basic needs. Continuing this strategy, a large number of key skills and foreign trade staff will have the opportunity to work and study abroad. For them, having the same language expertise

* Corresponding author

is a fundamental requirement of foreign business and entrepreneurship, and needs to be improved as well. In this economic environment, the ability of "foreign languages + skills" is a necessary demand. With the global economic integration and the rapid development of China's opening process, China has steadily lost touch with other countries around the world. Learning foreign languages, and especially learning English, has become an essential means of living and working for people. With the rapid growth of the demand for learning English, many language schools, teaching tools and teaching methods are appearing in an endless stream. However, teaching and learning spoken English has always been a difficult problem for Chinese to learn English. The main reasons lie in the following two aspects: on the one hand, the characteristics of Chinese pronunciation are quite different from those of English pronunciation, which makes Chinese learners of foreign languages make many pronunciation errors that are difficult to detect or even impossible to detect under the influence of their mother tongue. On the other hand, there is a great lack of qualified oral English teachers in China. Even primary and secondary schools in large and medium-sized cities lack their own pronunciation standards and English teachers who can accurately guide oral English learning. However, general media teaching can only be imparted unilaterally, but not in accordance with the specific situation of students. Teachers and students interact in oral teaching, so it can not play a very effective role.

The current computer-aided language learning system [1], mostly focuses on the learning of words and grammar. Only a few oral English learning programs, its function is relatively uniform, can only give students a whole pronunciation score. However, due to their own level limitations, it is difficult for self-learners to find errors and correct incorrect pronunciation by themselves. The application of speech recognition technology makes the software have the function of correcting pronunciation errors. It can help learners correct pronunciation errors in time and avoid repetition of errors in habits. Greatly improving the efficiency of learners' oral English learning will achieve great social benefits and market value.

Looking at the current domestic research on curriculum design, it is found that the theoretical results of its research are mainly concentrated in three aspects: curriculum design principles, curriculum design analysis, and curriculum design suggestions. Once pointed out that the speciality of the business English professional curriculum design lies in the "complex professional pain". He believes that in addition to completing the corresponding development concepts and training objectives, in addition to completing the corresponding development concepts and training goals, the complex pain is the key, and the important thing is to change the teaching model of "learning business through English and learning English through business". Speech recognition applied in business English teaching can achieve business English teaching reform and improve the effect of English learning. However, the current system of teaching speech recognition in English is limited to computers. People have to learn business English through software on computers or terminals, which makes it incapable of meeting the needs of people learning business English anytime, anywhere. Therefore, people urgently need to develop a portable device to facilitate people to learn business English with interest at any time and anywhere. Wearable motion sensors provide technical conditions for this purpose.

Wearable Motion Sensor [2-4] was developed from wearable computing. From the 1960s to 1970s, wearable computing was in its infancy. In 1966, a wearable computer

for roulette was developed by Thorp and Shannon MIT students. It was the first wearable device in history. After the 21st century, wearable computing has made remarkable progress and entered the vision and life of ordinary people. The rapid development of computer information technology provides a good technological basis for the development of wearable devices. In addition, the demand for more free, healthier, and personalized information processing opens up the application market of wearable devices.

Examining the bibliography for English business course design at home and abroad, it can be seen that there is little in-depth research for a course in the research field. Wearable Computing is a new computer technology, which is very different from traditional computer technology. It breaks the traditional interactive mode, makes people and computers become one, and improves the overall human interaction and computing ability. It provides a ubiquitous way of computing and interaction from time to time, and allows users to use the computer while freeing up their hands or one-handed operation of other tasks. The reduction and mobility of computing devices, the anytime and anywhere nature of information and tasks make the interactive computing model develop towards mobility, accessibility, naturalness, and simplicity. Compared with the traditional interactive mode, the interactive mode of the wearable computer requires high flexibility and real-time. Simple interactive operation is also necessary (for example, a wearable computer GUI strives for simplicity and naturalness). Wearable computing technology involves many disciplines, such as ergonomics, advanced interactive technology, electronic engineering, advanced material technology, etc. It is a very complex computer technology. It is in the early stages of development, and various key theories and technologies are in the process of being perfected and developed.

Wearable computing technology enlarges the scope of human-computer interaction to a certain extent. Specific interactive tasks and devices promote the research of new interactive technologies. For example, in certain ways and environments, when interactive devices such as handwriting and voice cannot be used, it can support other interactive media, such as eye movement functions. Wearable computing makes the human-machine relationship very close. At the same time, because all kinds of equipment are equipped with the human body, their installation, location, shape, and operation convenience should be closely combined with the natural attributes of humen, forming a comprehensive and harmonious human-machine interface. This poses a new challenge to the research of the new generation of human-computer interaction.

Through wearable computing technology, the data needed can be accessed at any time. When some emergencies occur, wearing a computer can save a lot of time, such as not having to rush to the phone or work next to the computer. In the military, this demand is more urgent. It is important to receive military information in a timely manner and to receive proper judgment in military operations. In the field of medicine, doctors sometimes fail to record the examination results immediately in front of patients because of various reasons when they treat patients, which easily leads to omissions afterwards and affects the diagnosis of the disease. The wearable computing system can solve the above problems. In addition, if the diagnostic equipment is embedded in the wearing system, it can further improve the diagnostic accuracy and reduce the occurrence of human errors. In English learning, wearable motion sensors can collect students' speech information anytime and anywhere, and then analyze the correctness of students' pronunciation to provide good guidance.

We can say that laptops and their technology represent an important direction in the future development of computers, so that computers can provide better facilities to users in the future and become real people and tools. General Chat Chat Lounge It also reduces human-computer coordination, reduces human-computer interaction, and completes human-computer integration. Industry experts have said that "research that is helpful in reducing human-machine interaction is essential." Technology should be integrated with the application. Particularly because portable computing technology and speech recognition technology are likely to have high research value and application, it is very important to research on speech recognition technology based on portable computing platform. The professional English learning system in this article focuses on Motion Sensor Speech Recognition.

This paper mainly collects and preprocesses the voice information of students' business English reading through wearable motion sensors as the input of the speech recognition system, and puts forward voice features through the speech recognition system, then judges the accuracy of students' reading voice, and then provides pronunciation guidance. The specific contributions of this paper are as follows:

(1)Wearable sensors are used to collect and preprocess the speech information of students' business English reading as an input of speech recognition.

(2) Linear Predictive Cepstrum Coefficient (LPCC) and Meier Frequency Cepstrum Coefficient (MFCC) are extracted from students' business English reading pronunciation, and their mixed parameters are used as phonetic features.

(3) The combination of hidden Markov model (HMM) and wavelet neural network (WNN) can identify the correctness of students' reading pronunciation and guide students' pronunciation.

2. Some Methods are Proposed

2.1. Acquisition and Preprocessing of Speech Information

In this paper, the motion sensor is made into a wearable form, which is convenient for students to carry with them. Then, the spoken speech information of students is collected by a wearable motion sensor. It mainly converts the vibration energy of the sensor into current energy, which passes through the signal amplifiers, gain devices, sampling device, and A/D conversion devices, and finally converts into the digital signal stored in the computer. The WAV format is then used as the signal storage format. The WAV format file is also called a waveform file. It does not change the sampling amplitude of the original sound signal, but adds some control information to it. This format file is convenient for later data analysis and processing.

After obtaining the spoken speech information, it is necessary to preprocess the speech information before entering the speech recognition system. The preprocessing operations adopted in this paper are pre-emphasis [5, 6], frame windowing [7], and endpoint detection [8, 9].

Signal preemphasis.

The collection of audio compositions is the same as the filter function. In the audio signal, the power spectrum of many signals is proportional to the frequency and the energy is concentrated in the low frequency range, thus reducing the signal to noise ratio in the high frequency band, and data loss in the signal transmission process.Pre-emphasis uses the difference between signal characteristics and noise characteristics to process the signal.It amplifies the high-frequency section with low energy at the input end of the signal, so that the entire spectrum from low frequency to high frequency becomes flat and easy to analyze, and then performs the reverse processing at the output end. In the process of processing, the high frequency component of noise is correspondingly weakened, so the problem of signal-to-noise ratio decrease in the high frequency band of signal is effectively solved. Pre-emphasis is the pre-emphasis function processing of all input signals. The commonly used functions are:

$$H(z) = 1 - \mu z^{-1}, z \in (0.9,1) \tag{1}$$

This function is expressed as the relationship between input and output:

$$y(n) = x(n) - \mu x(n-1) \tag{2}$$

Signal framing and windowing.

All signals require frame processing and the amount of audio signal data will increase as time goes on. When the computer processes the sound signal, it is unrealistic to perform an arithmetic process on an infinitely long sound signal. Therefore, it is necessary to take a limited time segment for analysis, that is, framing [10, 11]. The voice of students' spoken language is continuous, and its voice has a certain periodicity, which can be regarded as short-term stable. Therefore it can be subframe processed to speed up the computer operation and reduce the occupancy of memory space. In the process of framing, a second is usually divided into 33 to 100 frames, that is, each frame is 10 to 30 ms long. To ensure a smooth transition between two consecutive frames, two adjacent frames should overlap each other. This part is defined as a frame shift, and its length is generally half of the frame length. Although the overlap increases the burden of data processing, it also improves the accuracy of signal processing.

To reduce the leakage of spectrum energy, different interception functions are used to truncate the signal. This function is called window function [12-14]. The process of processing with a window functions is called windowing, that is, multiplying the window function by the sound signal.

Fast Fourier Transform (FFT) [15-17] is a necessary step for processing and analyzing acoustic signals. When processing frame signals with FFT, if the frame signal does not have periodicity, then after processing with FFT, an additional energy distribution will appear at both ends of the frame signal, resulting in deviation of the results, and the window function can solve the periodicity problem.

Correct selection of the window function can play an auxiliary role in signal analysis and processing [18]. The most window function for sound signal windowing is a rectangular window [19-20], but the essence of this window function is not windowing, and it does not play an auxiliary role in the FFT process of sound signal. In this paper, Hamming window function is selected to process the sound signal. Hamming window

meets the requirements of the sound signal. Its advantages are that the main lobe is widened and reduced, the side lobe is reduced relatively significantly, the change of both ends of the window is smooth and smooth, and the truncation effect of the signal frame is effectively avoided. The Hamming window function formula is as follows:

$$w(n)=\begin{cases}0.54-0.46(2\pi n/(N-1)), 0\le n\le N-1\\ 0, \qquad\qquad\qquad\qquad 0\end{cases} \tag{3}$$

Where N is the frame length.

Signal endpoint detection.

In the process of voice signal recognition, endpoint detection is a essential key link. Accurate identification of the starting and ending points of spoken reading voice in voice signals can reduce misjudgments in the process of recognition and increase the recognition rate of the recognition system. Therefore, the quality of the endpoint detection method directly affects the performance of the recognition system. Under the time-domain characteristics of sound signals, the noise of the surrounding environment is persistent. When the spoken reading sound appears, the collected sound contains the reading sound and the environmental noise, that is, the sum of the two, that is, the short-term energy and the short-term zero-crossing rate of the reading sound segment are higher than those of the silent segment. However, it is not effective to detect the endpoint only by a single short-term energy or short-term zero-crossing rate. For example, the wind noise generated by a small wind will cause a short-term energy increase. To avoid the misjudgment of single feature recognition, we can use the method of combining two features to judge, that is, setting threshold values for both features at the same time and setting two threshold values.

This method of setting two thresholds simultaneously for short-time energy and short-time zero-crossing rate is called double-threshold endpoint detection method. Its principle is that when the short-time energy or short-time zero-crossing rate of the signal has a value beyond the low threshold, the endpoint detection enters the preparatory stage. However, it is not certain that this point is the signal endpoint. Only when one or two of the two features exceed the high threshold at the same time, can this point be determined as the starting point. Conversely, the process of determining the end point is to first compare whether the feature is below the high threshold, and then determine whether it is below the low threshold.

Business English.

Mental health can be set in the public elective courses, and English reading, business, English translation, English-speaking country overview, international trade, geography, exhibition business, business planning, archives management, and other courses can be added to the professional elective courses. And according to the needs of the students, the communication theory courses can be expanded appropriately to cultivate their own qualities. In the basic training courses, such as comprehensive training of business, English correspondence writing, comprehensive training of international business, document preparation, comprehensive training of business, English business, etc., these

should be arranged in a dedicated training week for completion. For the special training week for orientation courses, it should also be added in an appropriate amount at the right time according to the needs of the school curriculum. In addition, the school also needs to work hard to introduce corporate culture and gradually build a high-level curriculum structure with a steady development of school-enterprise cooperation.

Business English is a covering term, which originated from ESP. Like other categories of ESP Business, English is a definition of a special corpus that emphasizes special language communication in a special environment. It includes English for General Business Purposes (ESGP) and English for Special Business Purposes (ESBP). Business English textbooks need to carefully select and design teaching materials, study specific materials for adult learners, and the textbooks need to meet the specific needs of learners.

2.2. Feature Extraction of Spoken Speech Information

Linear Predictive Cepstrum Coefficient (LPCC).

Speech signal is the common result of both channel frequency characteristics and excitation signal source. The speaker's personality characteristic largely depends on the speaker's pronunciation channel, i.e., the channel spectrum characteristics. Therefore, it is necessary to separate the two effectively. Therefore, in speech recognition systems, LPC coefficients are seldom used directly, but another parameter is derived from LPC coefficients: LPC (Captrum Linear Prediction More. The LPCC can completely eliminate the multiplication of the speech production process, especially reflecting the frequency characteristics of the sound system. The caprum is actually a homomorphic signal. Is the processing method. The standard Cepstrum coefficients calculation process is complex. The LPCC solution process is shown in Fig. 1.

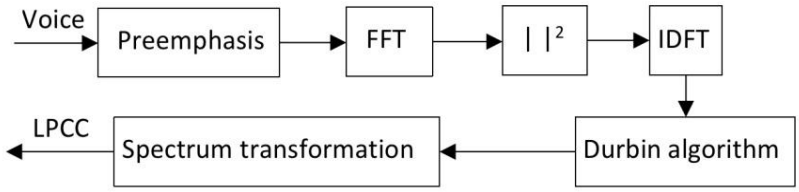

Fig. 1. LPCC solution flow

However, in practice, LPCC coefficients can be obtained by LPC. The direct recurrence relationship is as follows:

$$c_0 = \log G^2, c_m = a_m + \sum_{k=1}^{m-1} (\frac{k}{m}) c_k a_{m-k} \quad (4)$$

Where G^2 is the gain of the model, c_0 is actually a DC component, which is usually not used in the recognition and is not calculated, p is the order of LPC. LPCC can improve the stability of parameters. Its main advantages are small computation, easy implementation, good vowel description ability, and good effect in speech recognition. However, LPCC has its drawbacks, such as poor ability to describe consonants and poor ability to resist noise. At the same time, LPCC inherits the disadvantage of LPC. One of the main points is that LPC is a linear approximation of speech at all frequencies, which is inconsistent with human auditory characteristics.

Meier Frequency Cepstrum Coefficient (MFCC)

Screws play an important role in the general identification of the language to the human ears in a variety of noise environments and in a variety of ways. Coachella is basically the equivalent of a filter bank. Angular filtration is performed on a Logarithmic frekuensi, with a line under 1000Hz and a Logarithmic scale above 1000Hz, which makes the human ear more sensitive to low frequency signals than to low frequency signals. For this acoustic model of the human ear, mail-frequency capstrom coefficients (MFCs) have been proposed. In recent years, MFCC has been widely used and many studies show that it improves the efficiency of system identification.

The calculation of MFCC parameters is based on "bark" as its frequency benchmark. Its conversion relationship with linear frequency is as follows:

$$f_{mel} = 2595\log_{10}(1+ f / 700) \tag{5}$$

MFCC parameters are also calculated by frame. Firstly, the power spectrum $x(n)$ of the frame signal is obtained by FFT and converted to the power spectrum at Mel frequency. This requires that several band-pass filters $H_m(n), m = 0,1,\mathrm{L}\ , M-1, n = 0,1,\mathrm{L}\ , N/2-1$ be set in the frequency range of speech before calculation. M is the number of filters, usually 24. N is the number of points in a frame of the speech signal. The filter is a simple triangle in the frequency domain, and its center frequency is f_m, they are uniformly distributed on the Mel frequency axis. In linear frequency, when m is small, the adjacent f_m interval is small. With the increase of m, the adjacent f_m intervals gradually open. The parameters of band-pass filters are calculated in advance and used directly in calculating MFCC parameters.

The business English major was born under the background of China's continuous deepening of reform and development and the globalization of world economy, culture, and politics. As a derivative major of the English major, Business English has changed its name, from "Business English" when it was founded in the 1950s to the later "Finance English", "Business English", "Business English" to today's "Business English" "The course of this major has also experienced a development process from the course of "Business English Correspondence" to a major that has begun to take shape (Chen Zhunmin, Wang Lifei 2009). After tortuous development, Business English was finally officially approved as an independent subject by the Ministry of Education in 2007.The specific steps of calculating MFCC parameters are as follows:

(1) Firstly, the number of points in each frame of the speech sampling sequence is determined, and $N = 256$ points are selected in this paper. After preemphasis of each frame sequence, the discrete power spectrum $S(n)$ is obtained by discrete FFT transform and the square of the mode.

(2) Calculate $S(n)$. The M parameters P_m ($m = 0,1,\mathrm{L}\ ,M-1$) are obtained by calculating the sum of the product of $S(n)$ and $H_m(n)$ at each discrete frequency point through the power value obtained after M $H_m(n)$, that is, calculating the sum of the product of $S(n)$ and $H_m(n)$ at each discrete frequency point.

(3) Calculate the natural logarithm of P_m and get L_m, $m = 0,1,\mathrm{L}\ ,M-1$.

(4) For L_m, the discrete cosine transform is calculated and D_m is obtained. $m = 0,1,\mathrm{L}\ ,M-1$.

(5) Abandoning the D_0 representing the DC component, take $D_1, D_2, \mathrm{L}\ , D_K$ as MFCC parameters. In this paper, $K = 12$.

Voice information is mostly concentrated in the low-frequency part, while the high-frequency part is vulnerable to environmental noise interference. MFCC parameters emphasize the low-frequency information of the voice, thus highlighting the information that is beneficial to the recognition and shielding the interference of noise. However, the calculation and extraction of MFCC parameters are complex and time-consuming.

2.3. Recognition of Speech Information

Hidden Markov model

Hidden Markov Model (HMM), as a statistical model of speech signals, is widely used in various fields of speech processing today. Its theoretical basis was established by Baum et al. around 1970, and then applied to speech recognition by Baker of CMU and Jelinek of IBM et al. Because of the deep and simple introduction of HMM by Robiner et al. of Bell Laboratory in the mid-1980s, HMM has gradually become a recognized research hot spot for researchers engaged in speech processing all over the world.

As HMM is a stochastic probability model, it not only describes the dynamic change of speech signal characteristics, but also describes the statistical distribution of speech signal characteristics very well. It is a powerful tool for quasi-static speech signal analysis and speech recognition.

Hidden Markov process is a double stochastic process: one is used to describe the statistical characteristics of the short-term stationary period of the nonstationary signal (the transient characteristics of the signal can be observed directly); the other is used to describe how each short-term stationary period can be transformed into the next short-term stationary period, that is, the dynamic characteristics of the short-term statistical characteristics (implicit in the observation sequence). Based on these two stochastic processes, HMM can effectively solve the problems of how to identify short-term

stationary signal segments with different parameters and how to track the transformation between them.

The human speech process is also such a double random process. Because the speech signal itself is an observable sequence, and it is a parameter stream of phonemes (words and sentences) produced by the brain (not observable), according to speech needs and grammatical knowledge (state selection). At the same time, a large number of experiments show that HMM can really describe the process of speech signal production very accurately.

Wavelet neural network

The main idea of Wavelet Neural Network (WNN) is to use the wavelet function as the neuron activation function, thus combining the wavelet and BP network. Based on a similar ideas, Pati introduced discrete wavelet transform into neural network in 1993 and proposed a discrete affine wavelet neural network with single hidden layer forward structure. Because the wavelet neural network inherits some advantages of wavelet analysis, such as multiresolution, compact support, and even orthogonality of the basis function, the research of wavelet network has attracted extensive attention from the beginning, and a variety of network forms and design methods have emerged.

From the structural point of view, the wavelet network is a BP network based on the analysis of wavelets, so it can usually be regarded as a generalization of Radial Basis Function (RBF) network, but it has different characteristics from the general forward network and RBF network. For example, the determination of wavelet primitives and the whole network is based on the theory of wavelets, which can avoid the blindness in structure design, such as BP network, have strong function learning and generalization ability, have good ability of feature extraction and shielding random noise, especially suitable for the classification of non-stationary and non-linear signals. In signal classification and recognition, the wavelet space can be used as the feature space of signal classification, and the rule of signal feature extraction can be realized by the function of neural network classification. Because of its unique mathematical background, wavelet network has been widely used in image compression, data classification, signal representation, nonlinear approximation, feature extraction, pattern recognition, and adaptive control.

Speech recognition based on HMM/WNN Hybrid Model

Large English companies are in dire need of teaching models and teaching materials that incorporate English and business knowledge. The teaching described here rejects the teaching methodology and textbook integration. In terms of teaching methodology, teachers who are proficient in language proficiency and subject matter are required to teach, and not just teachers who excel in a particular area. By integrating itself into the atmosphere of both business and English knowledge at the same time, students can combine these two areas of knowledge and skills and achieve learning outcomes that complement business knowledge and basic English skills.Usually, the HMM parameters of each digit are trained by EM algorithm. The training criterion is maximum likelihood

estimation, that is, the output probability of each digit is maximized by adjusting the HMM parameters. Training is carried out in the same kind of sample data, and classification decision-making needs to be carried out in different types. Therefore, when the differences between words are small, such as confusing numbers, it is difficult for HMM methods to ensure that the probability calculated by HMM parameters in a certain class of patterns is greater than that calculated by HMM parameters outside the class. The hybrid system adds a WNN classifier with the ability to distinguish between classes on the basis of the optimal state sequence, which not only guarantees the original classification characteristics of HMM, but also makes use of the nonlinear classification ability of WNN to classify small pattern differences in different intervals. The method proposed in this paper mainly focuses on distinguishing similar sequential patterns and considering all training samples in the training process, which is why the performance of HMM/WNN hybrid model is better than that of HMM.

The feature of HMM is that it can extract temporal features effectively, but it can only use the state with the greatest accumulation probability in each model, and it does not make full use of the accumulation probability of other states. At the same time, it ignores the similar features of each pattern, which affects the performance of HMM speech recognition. The wavelet neural network is applied to HMM speech recognition, and its ability of subdivision is utilized to recognize speech. The specific method is to use the cumulative probability $[\delta_T^1(1),\mathrm{L}\ ,\delta_T^1(N),\delta_T^2(1),\mathrm{L}\ ,\delta_T^2(N),\mathrm{L}\ ,\delta_T^K(1),\mathrm{L}\ ,\delta_T^K(N)]$ of all States in HMM as the input characteristic of the wavelet neural network classifier. Where K is the number of speech primitives to be recognized. Take the number recognition in Chinese as an example, $K=10$. The neural network model consists of the input layer, the hidden layer, and the output layer. The input layer consists of L neurons ($L=N*K=40$ in this experiment), which corresponds to the state accumulation probability of each speech element in HMM. The hidden layer is a dynamic tissue layer containing P neurons. P Dynamically changes in network training, here take P=10. The output layer consists of K neurons, each corresponding to a speech unit to be recognized (Take $K=10$ in this experiment).

The block diagram of HMM/WNN hybrid model speech recognition system is shown in Fig. 2. The whole system consists of two parts: HMM recognition subsystem and wavelet neural network recognition subsystem.

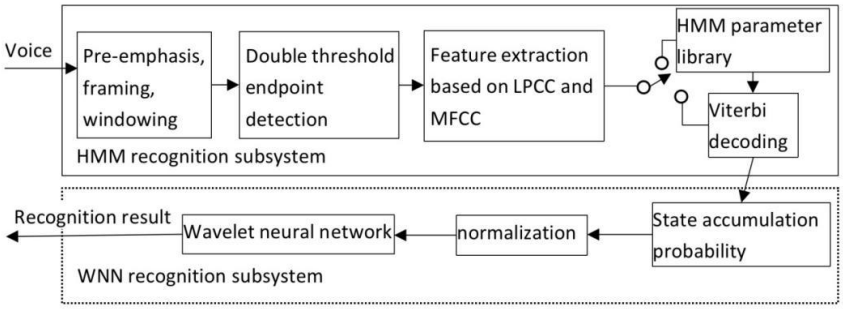

Fig. 2. HMM/WNN hybrid model speech recognition block diagram

As can be seen from the process in Figure 2, first, the voice enters the frame and window we designed, and then the dual-threshold endpoint is detected. The detection results are based on LPCC and MFCC for feature extraction, and then the HMM parameter library is calculated to perform Wider Compare decoding to get the cumulative probability of transition, normalize the probability, enter the wavelet neural network, and finally get the recognition result. Among them, the received symbols are first judged by the demodulator, outputting 0 and 1 codes, and then sent to the decoder in a form called Viterbi decoding; and HMM is the simplest dynamic Bayesian network, and it is a particularly famous directed graph structure.

3. Concrete Experiments

In this article, the wearable motion sensor is used to collect students' voice information, and through the extraction of voice features, recognized vocal information is obtained in order to correct and guide students' pronunciation, and to reform the way English is taught. The flow chart of this article is shown in Figure 3.

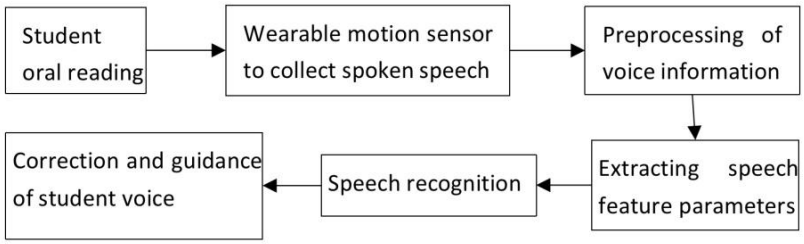

Fig. 3. Article idea flow chart

It can be seen from the process in Figure 3 that the student transmits the voice through oral reading, then collects the voice through the wearable motion sensor, first preprocesses the voice information, and corrects and guides the student to make the correct voice, and finally through voice recognition extract the voice feature parameters.

To better evaluate the performance of the speech recognition method designed in this paper, the recognition rate is used as the evaluation index. The expression is as follows:

$$\text{Recognition rate}=\frac{\text{Number of samples correctly identified}}{\text{Total number of test samples}}\times 100\% \quad (6)$$

In addition, questionnaires were used to investigate the students' sense of the business English teaching equipment based on wearable motion sensor, speech recognition designed in this paper, and the teaching effect of the business English teaching equipment based on wearable motion sensor, speech recognition designed in this paper was tested by the experimental class method.

4. Discussion of Experimental Results

The knowledge involved in business English majors is very different from that of ordinary English majors. In a broad sense, English in all business-related fields (economics, management, law, etc.) is considered business English. Strictly speaking, it is not a pure linguistics, but belongs to the category of applied linguistics. It belongs to the category of English for special purposes. First, before confirming the doctor's findings, it is imperative that the performance of the proposed speech recognition method be decided. At different signal-to-noise rates, this document sets out the HMM speech recognition method for speech recognition on the neural network, and the identification rate to reflect the performance of the speech recognition system built into this document. Uses as the criterion. Results are shown in Table 1.

Table 1. Identification rate of different speech recognition methods

Signal to noise ratio (dB) Recognition methods	HMM speech recognition	Speech recognition based on neural network	Method of this paper
30	97.5	98.1	99.2
25	97.1	97.4	99.3
20	91.3	92.7	97.1
15	85.4	86.9	91.4
10	73.7	75.8	87.6
5	67.3	68.6	83.2
0	61.7	63.9	75.7

For the visual representation, draw a line chart according to Table 1 as shown in Fig. 4.

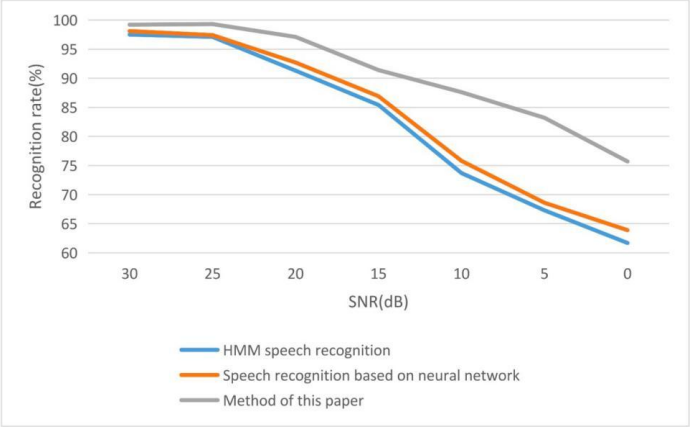

Fig. 4. Comparison of the performance of different speech recognition methods

Combining Table 1 and Figure 4, we can see that, first, by decreasing the SNR, i.e. increasing the noise, the recognition rates of the three speech recognition methods are reduced. Among them, HMM-based speech recognition method and neural network-based speech recognition method have a faster downward trend, which shows that the antinoise performance of this method is better than HMM-based speech recognition method and neural network-based speech recognition method. Secondly, under the same SNR condition, the speech recognition rate of this method is the highest, followed by the speech recognition method based on neural network, and the speech recognition method based on HMM is the worst. This shows that this method has good speech recognition performance and is feasible for students to read speech recognition, and has good recognition performance and antinoise performance.

After verifying the feasibility of this method in students' reading and speech recognition, this paper selected 100 students through a questionnaire survey to investigate their views on the business English teaching system based on wearable motion sensor, speech recognition designed in this paper. The results are shown in Fig. 5.

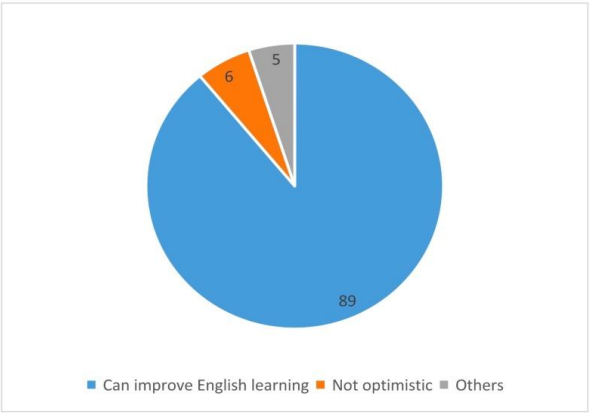

Fig. 5. Students' views on the teaching method of this article

As can be seen from Figure 5, 89 of the 100 students are optimistic about the business English teaching system based on wearable motion sensor speech recognition proposed in this paper. The method proposed in this paper can promote students to learn business English better. Only 6 students are not optimistic about the teaching system designed in this paper. This shows that the business English teaching system based on wearable motion sensor, speech recognition designed in this paper meets the needs of today's students in learning English and can arouse students' interest in learning English.

The above survey of students is only a survey of students' opinions. It does not represent the real effect of the business English teaching system based on wearable motion sensor, speech recognition designed in this paper. To verify the teaching effect of the business English teaching model designed in this paper, non-experimental classes and experimental classes are set up for testing. The students with almost the same level of English are divided into two classes. The non-experimental classes are taught in the traditional way of business English teaching, while the experimental classes are taught in the traditional way of business English teaching. The business English teaching system based on wearable motion sensor, speech recognition designed in this paper is also used to assist learning. After one semester, the two classes were tested by book test and oral expression test. The full score was 100, and the oral expression test was scored by three English teachers. The average score was used as the result. The test results are shown in Table 2 and the bar chart is shown in Fig. 6.

Table 2. Test results of experimental class

Class	Book test class average score	Oral expression grade class average score
Non-experiment class	72.5	63.3
Experimental class	83.1	84.7

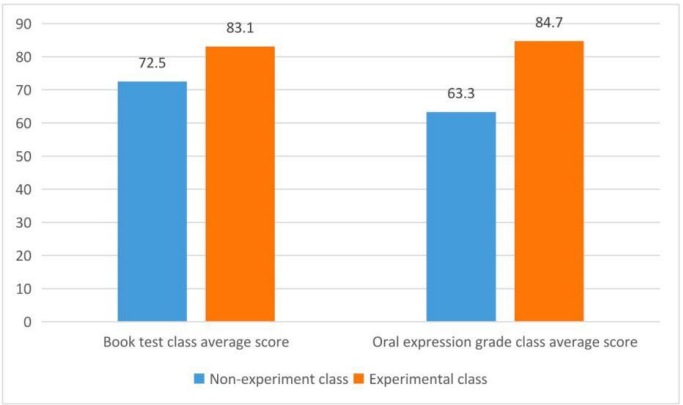

Fig. 6. Experimental class test analysis

The most important part of Business English course design is the perfection of course implementation. The quality of implementation links directly affects students' ability for theoretical knowledge and practical ability. Therefore, improve the school-enterprise

cooperation evaluation mechanism, pay attention to the industry's requirements for talent training, for teachers to continuously improve the implementation of teaching, and for students to adjust their learning habits through feedback. Combining Table 2 and Figure 6, it can be seen that the scores of the experimental class are higher than those of the nonexperimental class in both the book test and the oral expression test. In the aspect of oral expression, the gap between the two classes is larger, and the scores of the experimental class are 21.4 points higher than those of the non-experimental class. This shows that the business English teaching system based on wearable motion sensor, speech recognition designed in this paper can promote students to learn business English better and has a better effect in oral expression, which can make up for the shortcomings of oral expression in our country.

5. Conclusions

As an applied multiple discipline, the Business English major includes linguistics, psychology, sociology, economics, management, law, education, computer science and many other disciplines. Therefore, general comprehensive English textbooks may not fully meet the needs of business English majors for professional knowledge acquisition. With the changes of times, the monotonous college English textbooks have lost their vitality, and it is an inevitable trend to develop specialized English textbooks suitable for all walks of life. Considering the importance of comprehensive English courses in this major, it is particularly important to study whether the selection of materials and themes of the course materials are suitable for business English majors. Nowadays, with the rapid development of science and technology, the traditional business English teaching can no longer meet the needs of today's students, and the reform of business English teaching has become increasingly urgent. Wearable motion sensor is a kind of technology which can improve life and learning effectively with the development of technology. This is probably a good request. Based on the advantages of laundry motion sensors, this paper applies them to teaching English business so that students can better learn business English. This article specifically collects the student's reading speech through a vibration sensor and then extracts them. LPC and MFCC speech feature parameters through speech prepossessing with the relative benefits of HMM and WNN. The collection, based on the HMM / WNN, is a hybrid speech regulation model that allows students to feel the success of speech reading. By analyzing the recognition rate of speech recognition methods, it shows that the speech recognition wording in this article is good performance and resistance performance and can be used to recognize English business reading speech. Through questions, this paper illustrates students' views on vibration sensors in applied English business learning and through experimental classroom experiments, also shows the effect of vibration sensors on applied business English learning. It can promote business learning.

References

1. Barshan B, Yurtman A. Classifying daily and sports activities invariantly to the positioning of wearable motion sensor units. IEEE Internet of Things Journal, 7(6):4801-4815. (2020)
2. Huang H, Li X, Liu S, et al. TriboMotion: a self-powered triboelectric motion sensor in wearable internet of things for human activity recognition and energy harvesting. IEEE Internet of Things Journal, 5(6):4441-4453. (2018)
3. Fallahzadeh R, Ghasemzadeh H. Trading off power consumption and prediction performance in wearable motion sensors: an optimal and real-time approach. ACM Transactions on Design Automation of Electronic Systems (TODAES), 23(5):1-23. (2018)
4. He Z, Liu T, Yi J. A wearable sensing and training system: towards gait rehabilitation for elderly patients with knee osteoarthritis. IEEE Sensors Journal, 19(14):5936-5945. (2019)
5. Davide M, Leonardo B, Michele C, et al. Profiling the propagation of error from PPG to HRV features in a wearable physiological-monitoring device. Healthcare Technology Letters, 5(2):59-64. (2018)
6. Bichitra, Nanda, Sahoo, et al. Superhydrophobic, transparent, and stretchable 3D hierarchical wrinkled film- based sensors for wearable applications. Advanced Materials Technologies, 4(10):1900230-1900230. (2019)
7. Ostaszewski M, Pauk J. Estimation of ground reaction forces and joint moments on the basis on plantar pressure insoles and wearable sensors for joint angle measurement. Technology & Health Care, 26(2):605-612. (2018)
8. Deqing Zhuoma. The presentation and improvement of business English teaching mode in Colleges and Universities under the background of innovation and entrepreneurship%. Science and Technology Entrepreneurship Monthly, 032(006):101-103. (2019)
9. Si J. The practicality of ELF-informed teaching: attitudes and perceptions of Chinese business English teachers. Journal of English as a Lingua Franca, 8(2):269-296. (2019)
10. Li J. Design and implementation of project-based business English teaching based on culture of core professional competencies. Journal of Zhejiang Communications Vocational and Technical College, 020(001):50-53, 59. (2019)
11. Chen X. The application of flipped classroom in Business English Teaching -- Taking Business English reading for example. Journal of Heilongjiang Institute of Education, 038(003):130-132. (2019)
12. Qi C. Research on business English Teaching in minority areas under the training target of applied talents. Guizhou Ethnic Studies, 39(6):239-242. (2018)
13. Cui B Y. Research on the characteristics, orientation, development and teaching of business English. Overseas English, 000(1):244-245. (2019)
14. Zhao J. Research on business English listening and speaking learning reform from the perspective of ESP teaching theory% ESP, 029(001), 154-156. (2019)
15. Hu Y. Study on the effectiveness of task driven block teaching in Business English. Journal of Xinyu University, 023(004):123-127. (2018)
16. Liu R. Research on the business English translation teaching in the sight of frame semantics. Journal of Chongqing Vocational College of Electronic Engineering, 27 (3):110-112, 116. (2018)
17. Sun H. Project based teaching of business English translation based on micro class. Heilongjiang Science, 9(4):118-119. (2018)
18. Zhan W, Shen Z. Research on business English translation teaching in Ethnic Colleges under the circles of economic integration. Guizhou Ethnic Studies, 039(008):236-239.
19. Chen W, Department, F. Research on innovation and strategy of teaching paradigm of business English Major under the vision of information. Journal of Changchun University (Natural Science Edition), 28(4):82-86. (2018)

20. Feng J. Effectiveness of SPOC based blended teaching for Higher Vocational Business English. Vocational Technology, 017(011):52-55. (2018)

Dan Lu was born in Yiyang, Hunan, P.R. China, in 1977. She received the Master's degree from Hunan University, P.R. China. Now, she works in School of Foreign Languages, Shunde Polytechnic. Her research interests include Business English and English teaching. E-mail: rachellu2009@126.com

Fen Guo was born in Yiyang, Hunan, P.R. China, in 1979. She received the Ph.D. degree in Computer Application Technology from the School of Software Engineering, South China University of Technology (SCUT), Guangzhou, China, in 2015. She has been working as a teacher in SCUT since 2005. Her current research interests include data mining, data security and cloud computing. E-mail: csguofen@scut.edu.cn

Received: March 20, 2021; Accepted: March 08, 2022.