Analysis of Cross-cultural Education in Japanese Teaching based on Multimedia Technology

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Abstract: In order to improve the quality of Japanese cross-cultural teaching, this paper combines multimedia technology to analyze cross-cultural education in Japanese teaching, and analyzes the principle of image segmentation algorithm based on random walk. Aiming at the difficulties in Japanese teaching image segmentation, this paper analyzes the shortcomings of different random walk algorithms for image segmentation in these scenarios through experiments, and makes targeted improvements. Moreover, this paper improves the image recognition algorithm for Japanese online teaching, and applies random walk image segmentation to Japanese online teaching. The research shows that the Japanese cross-cultural education system based on multimedia technology proposed in this paper can effectively improve the effect of Japanese teaching.

Keywords: multimedia; Japanese language teaching; cross-cultural; education
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1 INTRODUCTION

With the continuous development of social economy and the update and progress of Internet technology, China's participation in the process of globalization and integration into the family of world civilizations is also accelerating. In particular, General Secretary Xi Jinping proposed the "Belt and Road" initiative, which has become an inevitable trend of the times for the world to know China, understand China, accept China, and learn to tell Chinese stories in an acceptable way for international exchanges.

With the changing times, the current Japanese translation teaching should not only remind students to actively reserve grammar knowledge and vocabulary knowledge, but also pay attention to cultivating students' ability to master the cultural differences between China and the West, so as to realize the cultivation of cross-cultural communication skills in Japanese translation teaching. Chinese and Western civilizations have formed different cultures and ways of thinking because of their different historical development processes and trends. The differences between cultures affect the progress of Chinese and Western diplomacy and document translation [19]. For Japanese translators, in order to achieve smooth talks and exchanges with foreign friends, they must adapt to the cultural differences that may appear in the process of communication, and look at the issue of value orientation with an inclusive mentality. At the same time, in the teaching of Japanese translation in colleges and universities, in order to achieve the purpose of students' cross-cultural communication ability, students should also be encouraged to look at the cultural differences between China and the West with an inclusive attitude. At the same time, it is necessary to learn different ways of thinking under the influence of Western culture, and implement them into actual translation activities [1].In order to achieve this goal, Japanese teachers in colleges and universities should provide students with classic cases of cultural differences between China and the West in their daily teaching work to help students subtly cultivate their Western thinking, so as to integrate it with Chinese thinking, and allow students to achieve smooth cross-cultural expression in the translation process [17]. On the other hand, teachers should also allow students to view the cultural differences between China and the West more dialectically and objectively [4].

The cultivation of cross-cultural communication skills is a process that requires continuous practice. It should be recognized that in today's translation teaching work in colleges and universities, students are not proficient in Western idioms and local language expression patterns. In the course of classroom translation practice, it is not difficult to find that some students are still immersed in the use of Chinese grammar habits for foreign language translation. In order to improve this situation, it is urgent to change the Chinese language habits in translation teaching [5]. Specifically, in order to achieve students' ability to express foreign language sentences proficiently, students can be encouraged to read more foreign scenic spots, watch more foreign film and television works, and listen to foreign live radio stations more, so as to cultivate students' language perception ability for foreign language sentences, so as to replace the need for students to read foreign language sentences. To carry out too advanced grammar teaching, or to require students to memorize the traditional teaching mode of vocabulary knowledge which is more difficult to realize the system innovation of translation teaching in colleges and universities [13]. Therefore, in order to change the problem of Chinese language in the translation process, the focus is not on strengthening the teaching of students' grammar and vocabulary knowledge, because advanced grammar knowledge and vocabulary expression are actually not applicable to Western daily life. The translation process of the corpus is not very helpful [7]. The focus of teaching reform should be to encourage students to read more, read more, and listen more, help students form a good sense of language, enable students to realize the combination of Chinese and Western translation in a subtle way, and improve students' translation level [8].

Practice is the best way to learn, especially for the cultivation of students' cross-cultural communication skills in Japanese translation teaching in colleges and universities. Therefore, in the cultivation of students' cross-cultural communication ability, the penetration of Western culture gradually becomes more important. That is to say, only by fully understanding the Western cultural background and common expression patterns can we successfully realize cross-cultural communication in translation practice [14]. Although in the teaching classroom of colleges and universities, it is also possible to provide a way for students to learn the Western cultural background through multimedia teaching, teaching content reform, knowledge system updating, etc., but it is obvious that the best way to learn Western culture is to join the Western background. In the process of life, improve students' understanding and thinking ability of Japanese learning [10]. Therefore, for the development of intercultural communication skills, it is extremely important to encourage students to accumulate Western life experience. Teachers can make full use of the opportunities of going abroad programs and exchange student programs in inter-school exchanges to encourage students to have actual transnational life experience as much as possible, cultivate foreign cultural literacy in life, and understand the similarities and differences between foreign and Chinese cultures. In order to improve students' cross-cultural communication skills [12]. For students, they should also pay attention to making full use of every opportunity to go abroad, experience the customs of other countries in the process of studying abroad, exchange studies or even traveling, understand the living habits of foreign people in daily life, and accumulate these knowledge to achieve better results. Good translation ability can promote the improvement of Japanese translation teaching in colleges and universities [6].

In the Japanese translation teaching in colleges and universities, in order to improve students' ability of cross-cultural communication, the planning reform of the curriculum itself should also be paid attention to by educational researchers. Specifically, teachers should focus on changing the work focus of Western culture infiltration in the classroom, and stimulate students' interest in understanding and learning Western culture and improving cross-cultural communication skills through multimedia technology teaching [11]. In the teaching process, the teaching materials can be extended appropriately. For individual words and sentences with rich cultural background, teachers should explain to students to help them understand the meaning behind the meaning of words. In a subtle way, the cultural penetration of the classroom is of great significance for the cultivation of students' cross-cultural competence, and for helping students to transform translation activities from school to society, from teacher supervision to national needs [18]. It is worth noting that in the process of implementing cultural penetration, teachers should also reform the evaluation system for students at the same time. For the daily assessment of translation teaching, the form of testing how many words students can write and what grammar they can master cannot be used. Instead, we should focus on assessing students' understanding of cultural connotation, and encourage students to participate in translation activities. For some students who are weak in vocabulary knowledge, but have flexible translation methods and can achieve cross-cultural translation of materials, they should adopt an encouraging attitude to increase their interest in learning Western culture [16].

The process of learning Japanese is actually the process of understanding Japanese culture. If you don't understand Japanese society, Japanese behaviors and thinking patterns, you can't really master Japanese. Therefore, in the learning of Japanese, it is necessary to organically integrate into the learning of culture. The British linguist Jenny Tomas put forward the concept of "pragmatic error", which refers to the language expression errors in communication due to the lack of understanding or ignoring the social and cultural background differences between the two sides of the conversation. "A grammatical error can be seen on the surface, and it is easy for the addressee to spot such an error. Once such an error is discovered, the addressee will think that the speaker lacks sufficient linguistic knowledge and therefore can be forgiven. Pragmatic errors do not will be treated like a grammatical error [15] If a fluent Japanese speaker makes a pragmatic error, he is likely to be considered rude or unfriendly, and his communicative error will not be blamed on language The lack of ability will be blamed on his rudeness or hostility [3]. Japanese learners should pay attention to improving the respect and tolerance of various cultural phenomena in the target language country in Japanese learning, and have the sensitivity of cross-cultural communication. In order to communicate effectively and smoothly [2].

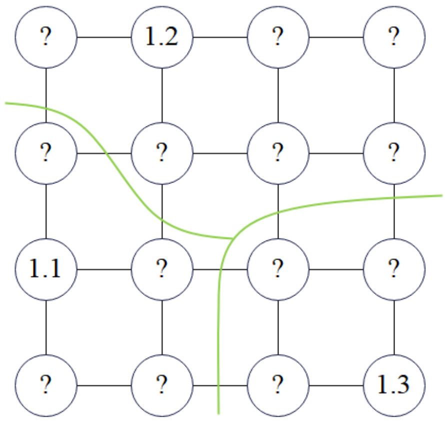
For a long time, traditional Japanese teaching has often only focused on cultivating students' language skills, that is, emphasizing the practice and mastery of pronunciation, grammar and vocabulary, but not enough attention has been paid to the cultivation of non-verbal communication skills. As a result, even if Japanese learners can use correct Japanese expressions, they may not be able to achieve real ideological and emotional communication with each other. The background of globalization has put forward new requirements for the cultivation of college students' knowledge system and practical ability. Students need to have an international vision, be familiar with international rules and conventions, and have strong intercultural communication skills [9].

This paper analyzes the cross-cultural education in Japanese teaching combined with multimedia technology, and improves the effect of cross-cultural education in Japanese teaching.

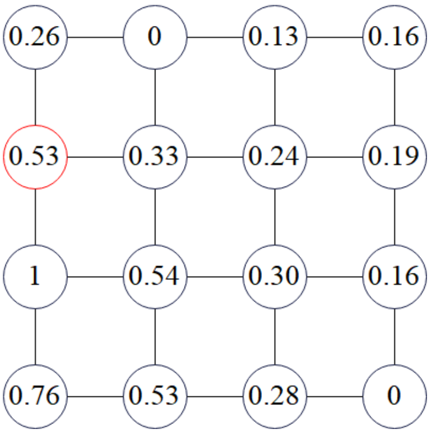
2 RANDOM WALK IMAGE SEGMENTATION RESEARCH

Random walk is widely used in the field of image processing, and there have been many achievements in the application of image segmentation. In order to study the segmentation principle of random walk algorithm in image segmentation and the advantages and disadvantages of the model, this paper improves the algorithm for image recognition in Japanese online teaching, and applies random walk image segmentation to Japanese online teaching.

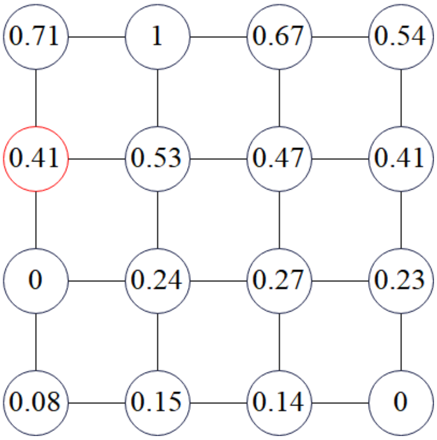
Figure 1 shows the segmentation process of Leo Grady's random walk. In Figure 1(a), L1, L2, and L3 represent the three seed points given by the user, and the blue line marks the final segmentation result. In Figure 1(b)-(d), the maximum arrival probability of random walkers arriving at different seed points for the first time from unmarked pixels is given respectively. By comparing the first arrival probabilities of the pixels in the red border to various sub-points, it can be seen that the first arrival probability of reaching L1 is the largest, and finally the pixels are divided into the area represented by L1. The segmentation task is completed by classifying all pixels by calculating the first arrival probability of all pixels.



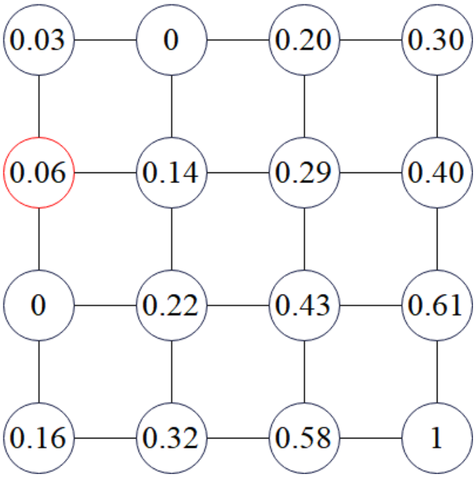
(a) Marking points and segmentation results



(b) Probability of unmarked points first reaching L1



(c) Probability of unmarked points first reaching L2



(d) Probability of unmarked points first reaching L3

Figure 1: Schematic diagram of random walk principle.

To calculate the initial probability of arrival, it is first necessary to map the digital image into a connected and undirected weighted graph, denoted as graph G=(V, E, W). V represents the set $V=\{v_1,v_2,\dots,v_n\}$ of nodes in the graph, and the total number of nodes is n. $E=\{e_1,e_2,\dots,e_m\}$ represents the set of m edges in the graph, and W represents the weight of all edges in the graph. The edge e_{ij} connects the nodes v_i and v_j, and the weight is w_{ij}. Usually, the weight is defined by a Gaussian function.

The Laplacian matrix of the defined graph, formula (1) gives the expression of the Laplacian matrix L, where L is an nxn positive semi-definite matrix, and d_i is the degree of the node v_i.

$$L_{ij} = \begin{cases} d_i, i = j \\ -w_{ij}, i \sim j \\ 0, other \end{cases} \tag{2.1}$$

Formula (2.2) is an association matrix A used to represent the correspondence between edges and nodes, and its size is m x n.

$$A_{e_{ij}v_k} = \begin{cases} +1, i = k \\ -1, j = k \\ 0, other \end{cases} \tag{2.2}$$

The size of the constitutive matrix C is m x m, and it is a diagonal matrix whose elements are the corresponding edge weights.

Once the above variables are defined, the combined Dirichlet integral function can be solved. The definition of the combined Dirichlet integral function is given in formula (2.3). a represents the probability of each node reaching a marked node.

$$D(x) = \frac{1}{2}(Ax)^T C(Ax) = \frac{1}{2}x^T Lx = \sum_{e_{ij} \in E} w_{ij}\left(x_i - x_j\right)^2 \tag{2.3}$$

All nodes in the graph are divided into two categories according to whether they are marked, VL represents the set of marked nodes and VU represents the set of unmarked nodes. The two sets satisfy $V_L \cap V_U = \phi$ and $V_L \cup V_U = V$. The matrix L is divided according to the order of marked points and unmarked points, and the rearrangement is arranged as follows:

$$L = \begin{bmatrix} L_L & B \\ B^T & L_U \end{bmatrix} \tag{2.4}$$

By substituting the decomposed form of the above matrix into equation (2.3), weget:

$$D(x_U) = \begin{bmatrix} x_L^T & x_U^T \end{bmatrix} \begin{bmatrix} L_L & B \\ B^T & L_U \end{bmatrix} \begin{bmatrix} x_L \\ x_U \end{bmatrix}$$
$$= \frac{1}{2}\left(x_L^T L_L x_L + x_U^T L_U x_U + 2x_U^T B^T x_L\right) \tag{2.5}$$

In the above formula, x_L and x_U represent the probability of first reaching the marked node for the marked and unmarked nodes, respectively. Differentiating $D(x_U)$ with respect to x_U, we get:

$$L_U x_U = -B^T x_L \tag{2.6}$$

x_i^s represents the probability that a random walker starts from an unlabeled node u and reaches the seed node labeled s for the first time. The labeling function for labeling node v_j is defined as $Q(v_j)=s$ .A vector of size $|V_L|\times 1$ with respect to label s is defined, and for node $v_j \in V_L$,we get:

$$m_i^s = \begin{cases} 1, Q(v_j)=s \\ 0, Q(v_j)\neq s \end{cases} \tag{2.7}$$

Therefore, for the label s, the final probability that each node reaches the seed node of the label s for the first time can be obtained by solving the combined Dirichlet function.

$$L_U x^* = -B^T m^s \tag{2.8}$$

Finally, by solving formula (9), the combinatorial Dirichlet problem can be solved.

$$L_U X = -B^T M \tag{2.9}$$

Among them, M is a matrix composed of K m^s vectors, K is the total number of labels of the labeled nodes, and X is composed of K column vectors x^s to be solved. For each seed pixel input by the user, the probability value of a set of unlabeled nodes arriving at the corresponding seed pixel for the first time can be calculated. Finally, according to the maximum first arrival probability between the unlabeled node and the labeled node, the label corresponding to the labeled node is assigned to the node, so as to obtain the segmentation result of the image.

The seed point input by the user is K class, $s\in(1\cdots K)$. λ_i^s represents the probability density of node v_i in the brightness distribution of label l^s , which is the prior information estimated for unlabeled nodes. Assuming that the probability of each label is equal, the probability p_i^s of assigning the label l^s to v_i is

$$p_i^s = \frac{\lambda_i^s}{\sum_{q=1}^{K} \lambda_i^q} \tag{2.10}$$

Formula (2.10) can be rewritten as follows:

$$\left(\sum_{q=1}^{K} \wedge^q\right) p^s = \lambda^s \tag{2.11}$$

Among them, $\wedge^q$ is a diagonal matrix, and the value of the diagonal element is λ^s . The energy function of the above formula is:

$$E_{aspatial}\left(x^s\right)=\sum_{q=1,q\neq s}^{k}\left(x^s\right)^T\wedge^q x^s+\left(x^s-1\right)^T\wedge^s\left(x^s-1\right) \tag{2.12}$$

The final segmentation is obtained by solving the energy minimization. The total energy function expression is as follows:

$$E_{total}\left(x^s\right)=E_{spatial}\left(x^s\right)+E_{aspatial}\left(x^s\right) \tag{2.13}$$

Among them,

$$E_{spatial}\left(x^s\right)=x^{sT}Lx^s \tag{2.14}$$

is the energy function in the Leo Grady random walk model. The final segmentation probability of unlabeled pixels can be obtained by solving formula (2.15).

$$\left(L+\gamma\sum_{r=1}^{K}\wedge^r\right)x^s=\gamma\lambda^s \tag{2.15}$$

λ is the control parameter.

The restarted random walk treats image segmentation as a labeling problem and assigns labels input by K classes to unlabeled pixels. By calculating the posterior probability of assigning the corresponding label to the pixel point, the label with the highest probability can be assigned to the corresponding pixel intuitively. The posterior probability $p\left(l_k\mid v_i\right)$ is calculated from formula (2.16) according to Bayesian theory.

$$p\left(l_k\mid v_i\right)=\frac{p\left(v_i\mid l_k\right)p\left(l_k\right)}{\sum_{n=1}^{K}p\left(v_i\mid l_n\right)p\left(l_n\right)} \tag{2.16}$$

The set is $X^{l_k}=\left\{x_1^{l_k},\cdots,x_m^{l_k},\cdots,x_{M_k}^{l_k}\right\}$, where $x_{M_k}^{l_k}$ represents the m-th seed point of label l_k. The probability $p\left(x_i\mid l_k\right)$ is calculated as follows:

$$p\left(v_i\mid l_k\right)=\frac{1}{ZM}\sum_{m=1}^{M_k}p\left(v_i\mid x_m^{l_k},l_k\right) \tag{2.17}$$

Among them, Z is a normalized constant and M_k is the total number of marked point pixels for label l_k.

We assume that there is a random walker starting from the m-th seed point $x_m^{l_k}$ of label l_k and performing a random walk through each of the directly connected edges between the neighborhoods.

At each step, the random walker has probability c to return to the original seed point $x_m^{l_k}$, or to another node in the neighborhood. The probability of the next node depends on the proportion of the weight between the two nodes in the neighborhood. After repeating this process many times, a steady-state probability $r_{im}^{l_k}$ is finally obtained. This is the probability of starting from the seed point and finally staying at the pixel point x_i .In this model, the steady-state probability $r_{im}^{l_k}$ is replaced by $p\left(v_i \mid x_m^{l_k}, l_k\right)$ in formula (17), and $r_m^{l_k} = \left[r_{im}^{l_k}\right]_{N\times 1}$ is an n-dimensional vector. The final steady-state probability calculation can be obtained by calculating formula (2.18).

$$r_m^{l_k} = \left(1-c\right)Pr_m^{l_k} + cb_m^{l_k} = c\left(I-\left(1-c\right)P\right)^{-1} b_m^{l_k} = Qb_m^{l_k} \tag{2.18}$$

Among them, $b_m^{l_k}$ is a vector of size Nx1, $b_{im}^{l_k} = 1$ when $v_i = x_m^{l_k}$, and otherwise $b_{im}^{l_k} = 0$. c is the probability that the random walker chooses to return to the original starting point at each transition. P is the transition matrix, which is the row-normalized matrix of the adjacency matrix W, which is given by formula (2.19).

$$P = D^{-1}W \tag{2.19}$$

In the above formula, $D = diag\left(d_1, d_2, ..., d_N\right)$, and $d_i = \sum_{j=1}^{N} w_{ij}$.

Q is an N × N matrix, which is used to calculate the global correlation between two pixels in the image, and q_{ij} is the probability of the same label between pixel v_i and pixel v_j . Q can also be expressed in the following form:

$$Q = c\left(I-\left(1-c\right)P\right)^{-1} = c\sum_{t=0}^{\infty}\left(1-c\right)^t P^t \tag{2.20}$$

In the above formula, P^t is the t-order transition matrix. The element p_{ij}^t represents the probability that a random walker will stay at pixel v_i after t iterations after starting from pixel v_j , considering all paths between two pixels. For pixel v_i , the basis for which label is finally assigned is given by formula (2.21):

$$R_i = \underset{l_k}{arg\,max}\, p\left(l_k \mid v_i\right) = \underset{l_k}{arg\,max}\, p\left(v_i \mid l_k\right) \tag{2.21}$$

Image segmentation can be achieved by assigning labels R_i to unlabeled nodes.

In the lazy random walk, the random walk process in the graph is made lazy by adding self-loops, so as to make full use of the global relationship between the seed point and the unlabeled pixel point. The lazy random walk algorithm utilizes a new global probabilistic mapping and commute time strategy, and can segment weak boundaries and complex texture regions well. Figure 2 shows the graph models of RW and LRW, respectively, and it can be seen that there is self-connection in LRW.

In lazy random walk, when a random walker walks on the graph, there is a probability of α at the current node to reach its adjacent node, and at the same time there is a probability of $1-\alpha$ to stay at the current node. The commute time is introduced in the lazy random walk as the final segmentation basis.

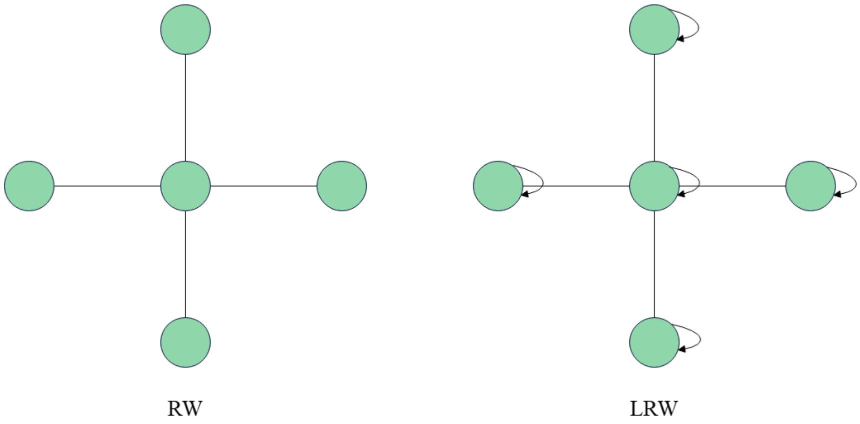


Figure 2: Graphical model of RW and LRW.

The adjacency matrix W of the lazy random walk model is given by formula (2.22).

$$W_{ij}=\begin{cases}1-\alpha,i=j\\ \alpha w_{ij},i\sim j\\ 0,other\end{cases} \tag{2.22}$$

Among them, i~j means that and two pixels v_i and v_j are in the neighborhood, and α is a control parameter in the range (0.1). W is a sparse symmetric band matrix with positive non-zero elements, and there is a transition probability matrix P after normalizing the adjacency matrix row.

$$p_{ij}=\begin{cases}1-\alpha,i=j\\ \alpha w_{ij}/d_i,i\sim j\\ 0,other\end{cases} \tag{2.23}$$

The transition probability matrix can also be written in the following form:

$$P=(1-\alpha)I+\alpha D^{-1}W \tag{2.24}$$

Among them, D is a diagonal matrix and D_{ij} is the degree of vertex v_i. According to equation (2.24), the Laplace matrix L of the graph is:

$$L_{ij}=\begin{cases}d_i,i=j\\-\alpha w_{ij}/d_i,i\sim j\\0,other\end{cases} \tag{2.25}$$

The above formula can be written as:

$$L=D-\alpha W \tag{2.26}$$

Next, CT_{ij} represents the expected number of steps a random walker needs to take from vertex v_i to vertex v_j and return to v_i. CT_{ij} represents the commute time between v_i and v_j

$$CT_{ij}=\begin{cases}L_{ii}^{-1}+L_{jj}^{-1}-L_{ij}^{-1}-L_{ji}^{-1},i\neq j\\1/\pi_i,i=j\end{cases} \tag{2.27}$$

Among them, L-1 is the inverse of matrix L and CT_{ij} is the Euclidean norm derived from the inner product L_{ij}^{-1}.

In order to be more consistent with the eigenvalues of the connectivity matrix in spectral geometry and random processes, the commute time normalized Laplacian matrix L is calculated by solving the inverse of the normalized Laplacian matrix in lazy random walk as follows:

$$L=1-\alpha D^{-1/2}WD^{-1/2} \tag{2.28}$$

$$CT_{ij}=\begin{cases}1-L_{ij}^{-1},i\neq j\\1,i=j\end{cases} \tag{2.29}$$

From the nature of the commute time, we know that it is inversely proportional to the probability, so we can get the probability f_l of the label l. Because of $S=D^{-1/2}WD^{-1/2}$, the closed-form solution of probability f is formula (2.30).

$$f_l=\left(I-\alpha S\right)^{-1}y_i \tag{2.30}$$

I is the identity matrix and f_l is an N×1 vector representing the probability that a pixel is assigned the label I. y_l is an N-by-1 column vector where all elements are 0 except the seed pixel, which is 1. Finally, class labels are assigned to all unlabeled nodes according to formula.

$$R_{v_i}=\underset{l_k}{arg\,min}\,CT\left(c_{l_k}\mid v_i\right)=\underset{l_k}{arg\,max}\,f_{l_l}\left(v_i\right) \tag{2.31}$$

Susceptible-Infected-Recovered (SIR) model is a classic model of epidemic transmission. This model can reveal the spread of an infectious disease from the onset of the disease over time. There is a total of C individuals in a community environment, and each individual is in one of the states: S is the susceptible state, I is the infected state, and R is the state of recovering from the infected state. The SIR model satisfies the following mathematical formula.

$$\frac{dS}{dt} = -kSI \quad \frac{dI}{dt} = kSI - \frac{1}{\tau}I \quad \frac{dR}{dt} = \frac{1}{\tau}I \tag{2.32}$$

In the above formula, k is the transmission rate of infection, and τ is the time it takes for an infected person to recover.

The four-neighbor system is considered when the model is applied in digital image segmentation and each pixel of the image is taken as a node. $I(x,y,t)$ is the probability that the node at x,y is infected at time t, S(x, y, t) is the probability that the node at x, y is susceptible at time t, and R(x, 3, t) is the probability that the node at ax, gy will recover at time t. Therefore, the variation of $\Delta I(x,y,t)$ with time is defined as:

$$\Delta I(x,y,t) = \frac{k}{4}S(x,y,t)[I(x+a,y,t) + I(x-a,y,t) + \\ I(x,y+a,t) + I(x,y-a,t)\ ]\Delta t \tag{2.33}$$

Combining this model with random walks, in the SIR model every pixel in the image has the same probability of being infected. That is, for any x, gy, and t, there is S(z, g, t) = 1.Moreover, we assume that no pixels are in the restored state, and r → ~o. The normalized time step Δt is fixed to 1.

$$\Delta I(x,y,t) = \frac{k}{4}S(x,y,t)[I(x+a,y,t) + I(x-a,y,t) + \\ I(x,y-a,t)] = I(x,y,t+1) - I(x,y,t) \tag{2.34}$$

Then, an initial infection state is given, and for a pixel at x,y, the infection probability at time t is:

$$I(x,y,t+1) = I(x,y,t) + \frac{k}{4}[I(x+a,y,t) + I(x-a,y,t) + \\ I(x,y+a,t) + I(x,y-a,t)] \tag{2.35}$$

$I(x_i,y_i,t)$ is rewritten as $I_{i,t}$ to represent the infection probability of the pixel at (x_i,y_i) at time t. Referring to other seed segmentation methods, for the seed pixels of the corresponding classification, there is $I_{i,t} = 1$ at any time t, and the seed pixels of other different categories are 0.All other pixels are in a healthy state. Therefore, an iterative process looks like this:

$$I_{i,t+1} = I_{i,t} + \sum_{j\sim i}\frac{w_{ij}}{d_i}\left(I_{j,t} - I_{i,t}\right) \tag{2.36}$$

The steady state probability that the steady state is finally reached after many iterations is:

$$I_{i,\infty} = \sum_{j\sim i} \frac{w_{ij}}{d_i} I_{j,\infty} \tag{2.37}$$

In order to consider the node centrality of adjacent nodes and measure the contribution of each adjacent node to the potential diffusion process to add a degree-aware term, the normalized graph Laplacian matrix is $\hat{L} = D^{-\frac{1}{2}}(D-W)D^{-\frac{1}{2}}$. Therefore, the iterative strategy of the final normalized random walk is

$$I_{i,t+1} = I_{i,t} + \sum_{j\sim i} \frac{w_{ij}}{\sqrt{d_i}} \left(\frac{I_{j,t}}{\sqrt{d_j}} - \frac{I_{i,t}}{\sqrt{d_i}} \right) \tag{2.38}$$

The final steady state probability is:

$$I_{i,\infty} = \frac{1}{\sqrt{d_i}} \sum_{j\sim i} \frac{w_{ij}}{\sqrt{d_i}} I_{j,\infty} \tag{2.39}$$

Figure 3 is a sub-Markov random walk graph model with prior information, and the whole graph model is composed of pixel nodes and auxiliary nodes. In an undirected weighted graph G representing an image, there is a set of labeled nodes V_M and unlabeled nodes V_U, and $V_M \cup V_U = V$, and V are sets of pixel nodes. Unmarked nodes in the figure are represented by gray ovals, and the rest are marked nodes. The seed node entered by the user has $V_M = \{V^{L_1}, V^{L_2}, \cdots, V^{L_K}\}$ and a series of labels $LS = \{L_1, L_2, \cdots, L_K\}$.The auxiliary nodes are the stay node set S_M connected to the corresponding seed node, the termination node △ connecting all unmarked nodes, and the prior node set H_M representing the prior information.

The sub-Markov random walk treats the image segmentation problem as a labeling problem, and each $v_i \in V$ is assigned a label from the label set LS. This problem can be obtained by solving for the probability $r_i^{l_k}$ that each pixel is assigned a label l_k .

The sub-Markov transition probability in the graph has the following properties. The sub-Markov transition probability q of node v_i on the graph G is as follows:

$$\sum_{j\sim i} q(i,j) \le 1 \tag{2.40}$$

After considering only the addition of auxiliary nodes Δ, the transition probability at G_e is expanded by setting

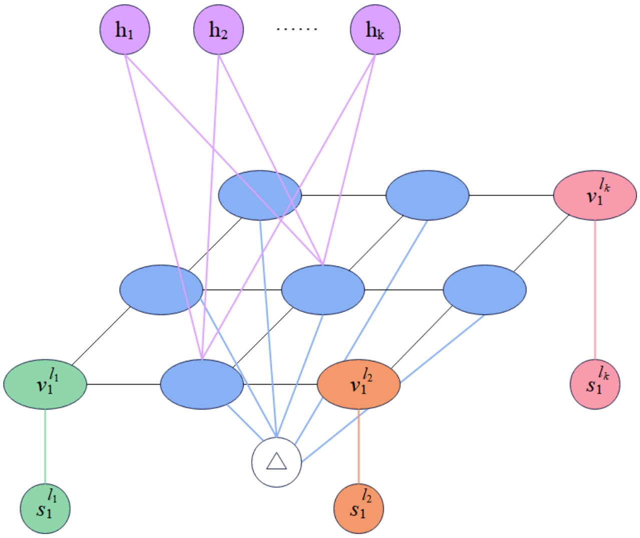


Figure 3: Graphical model of SMRW with prior information.

$q(\Delta,\Delta)=1$ and $q(i,\Delta)=1-\sum_{i\sim j} q(i,j)$, where $q(i,\Delta)$ is considered to be the probability of a random walker leaving the graph G_e. Therefore, the transition probability on the extended graph G_e after considering all auxiliary nodes is:

$$\bar{q}(i,j)=\begin{cases} c_i, i\in V, j\in\{\Delta\}\cup S_M \\ (1-c_i)\dfrac{w_{ij}}{d_i+\lambda g_i}, j\sim i\in V \\ (1-c_i)\dfrac{\lambda u_i^k}{d_i+\lambda g_i}, i\in V, j=h_k \\ 1, i=j\in\Delta\cup S_M\cup H_M \\ 0, other \end{cases} \tag{2.41}$$

We assume that a random walker starts from $v_i\in V$ and performs a random walk on $V\cup S_M\cup\{\Delta\}\cup H_M$ with probability q(i.,j). $r_{im}^{l_k}$ represents the probability that the random walker starts from node v_i and reaches the auxiliary node $s_m^{l_k}$ of label l_k or the prior node hk.

$$\bar{r}_{im}^{l_k} = (1-c_i)\sum_{j\sim i}\frac{w_{ij}\bar{r}_{jm}^{l_k}}{d_i+\lambda g_i} + (1-c_i)\sum_{j\sim i}\frac{u_i^k}{d_i+\lambda g_i} + c_i b_{im}^{l_k} \tag{2.42}$$

$\bar{r}_m^{l_k} = \left[\bar{r}_{im}^{l_k}\right]_{N\times 1}$ has the following matrix form:

$$\bar{r}_m^{l_k} = (I-D_c)\bar{P}\bar{r}_m^{l_k} + (I-D_c)\bar{u}\bar{r}_m^{l_k} + D_c b_m^{l_k} \tag{2.43}$$

$b_m^{l_k} = \left[b_m^{l_k}\right]_{N\times 1}$ is an N-dimensional indicator vector, that is, $b_m^{l_k} = 1$ when $x_i = v_m^{l_k}$, and otherwise it is 0. Dc is a diagonal matrix whose elements are c, and I is an N×N identity matrix. $\bar{P} = \left[\bar{p}_{ij}\right]_{N\times N}$ is the transition probability matrix, $\bar{u} = \left[\bar{u}_i^k\right]_{N\times 1}$, and is expressed as:

$$\bar{p}_{ij} = \frac{w_{ij}}{d_i+\lambda g_i}, \bar{u}_i^k = \frac{u_i^k}{d_i+\lambda g_i} \tag{2.44}$$

The seed pixel with the label lx input by the user is Mx, and the average arrival probability L is used here to represent the probability to a node. Therefore, the steady state probability in the form of a vector is given by formula (2.45).

$$\bar{r}^{l_k} = \frac{1}{Z_K}\bar{E}^{-1}\left((I-D_c)\bar{u}^k + \frac{1}{M_K}D_c b^{l_k}\right) \tag{2.45}$$

In the above formula, $\bar{E} = I-(I-D_c)\bar{P}$, and Zk are a normalizing constant. Therefore, the final segmentation result of the sub-Markov random walk is given by formula (46).

$$R_i = \arg\max_{l_k} \bar{r}_i^{l_k} \tag{2.46}$$

3 ANALYSIS OF CROSS-CULTURAL EDUCATION IN JAPANESE TEACHING BASED ON MULTIMEDIA TECHNOLOGY

On the basis, guided by social learning theory and connectivism theory, this paper constructs a regional online teaching practice community model of "before practice: program formulation + curriculum development", "in practice: resource construction + teaching practice" and "after practice: quality assessment + discussion and reflection" (as shown in Figure 4).

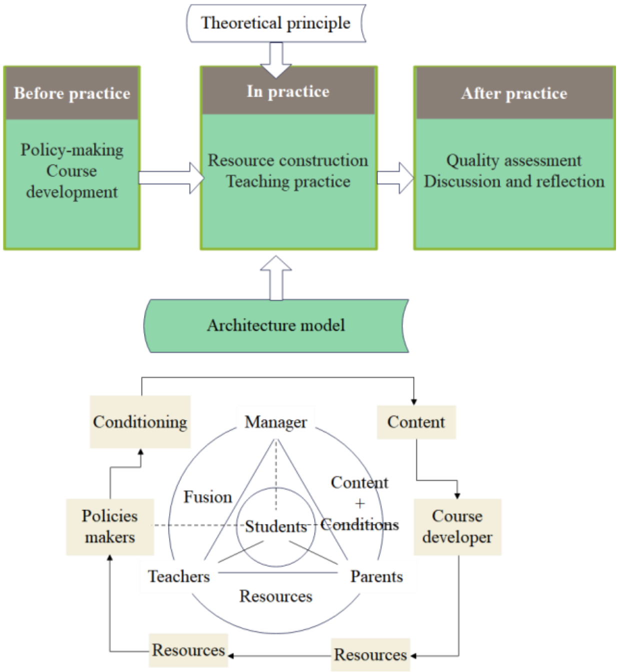


Figure 4: Community model of online teaching practice in Japanese teaching area.

Through the Internet of Things and cloud computing technology, the monitoring and feedback of cloud learning status is solved, and the teaching rhythm is adjusted according to the teaching strategy and students' learning status, and the students' classroom performance is evaluated, so as to realize the real-time stability of the inner loop of online teaching. Figure 5 shows the deployment mode of the online teaching platform.

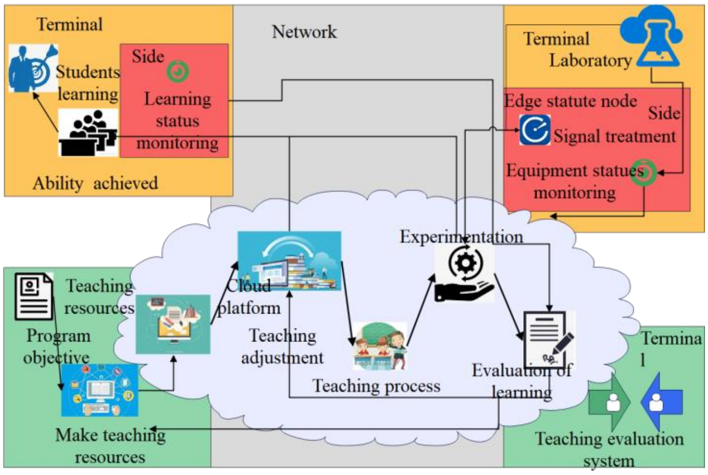


Figure 5: Deployment mode of Japanese cross-cultural online teaching platform.

With the development of technologies such as cloud control, cloud computing, Internet of Things, 5G, cyber-physical systems, and digital twins, cloud control and networked control of industrial equipment have been applied to actual production, and good application results have been achieved. The existing research results are applied to the experimental teaching process, and digital signal network transmission modules, edge protocol nodes and video surveillance systems are added to the traditional experimental equipment, as shown in Figure 6.

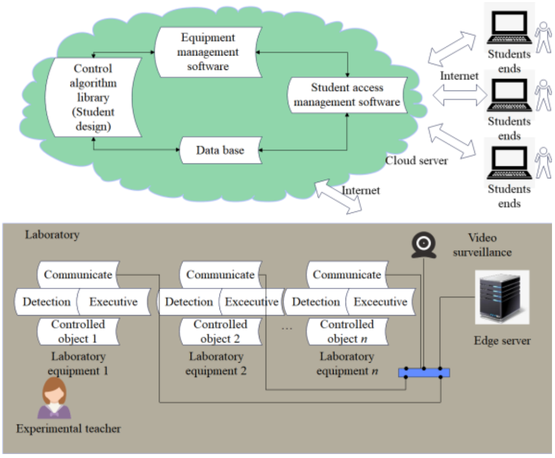


Figure 6: Japanese online cross-cultural teaching system based on multimedia technology.

In order to solve many problems in the current online teaching process and achieve high-quality online teaching under the new normal, the research team follows the concept of blended teaching to build a multi-dimensional blended online teaching model based on the "Academic Japanese" course (Figure 7).

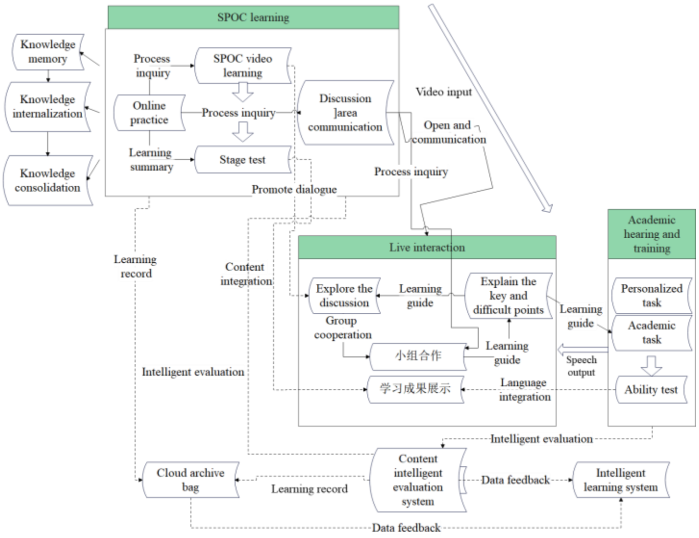


Figure 7: Multi-dimensional hybrid online teaching mode.

After constructing the above model, the model proposed in this paper is tested and studied, the effect of Japanese cross-cultural education based on multimedia technology is counted, and the results shown in Figure 8 are obtained through cluster analysis.

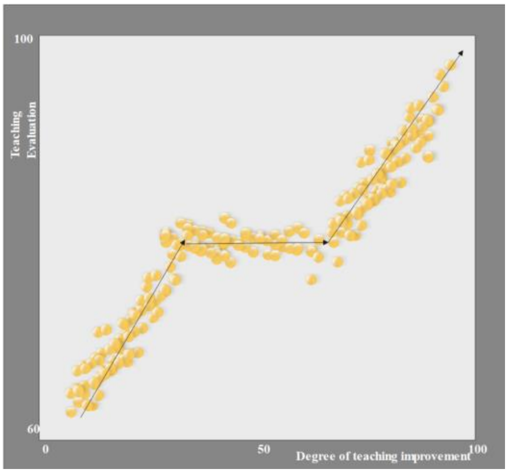


Figure 8: The effect of Japanese cross-cultural education based on multimedia technology.

This paper makes statistics on the teaching effect of the system proposed in this paper, and the obtained results are shown in Table 1.

Number	*Teaching improvement*	*Number*	*Teaching improvement*
1	*87.52*	*15*	*82.48*
2	*87.80*	*16*	*84.85*
3	*85.40*	*17*	*80.78*
4	*82.48*	*18*	*81.29*
5	*85.75*	*19*	*87.83*
6	*80.81*	*20*	*83.89*
7	*85.51*	*21*	*83.44*
8	*87.70*	*22*	*87.63*
9	*82.50*	*23*	*87.98*
10	*81.27*	*24*	*80.50*
11	*87.26*	*25*	*87.35*
12	*86.20*	*26*	*83.12*
13	*81.19*	*27*	*82.83*
14	*83.70*	*28*	*80.25*

Table 1: Statistical table of teaching effect.

It can be seen from the above research that the Japanese cross-cultural education system based on multimedia technology proposed in this paper can effectively improve the effect of Japanese teaching.

4 CONCLUSION

The research on the current foreign language teaching has proved that "Chinese cultural aphasia" is common among foreign language learners. "Chinese cultural aphasia" refers to the inability of foreign language learners to actively express Chinese culture in foreign languages and realize the effective output of Chinese culture. This results in the imbalance between the two cultures in cross-cultural communication. The soft power of cultural connotation shows the trend of national identity development and international influence. In the process of integrating into the big family of the world, how to achieve common ground while reserving differences between Chinese culture and other cultures in the world has become a major issue at present. Therefore, vigorously cultivating international talents with international vision and cross-cultural communication ability has become one of the core goals of foreign language teaching in colleges and universities. This article combines multimedia technology to analyze the cross-cultural education in Japanese teaching, and improve the effect of cross-cultural education in Japanese teaching. The research shows that the Japanese cross-cultural education system based on multimedia technology proposed in this paper can effectively improve the effect of Japanese teaching.

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