Cross-Cultural Transformation Reforming English Teaching with Artificial Intelligence and Data-Fuzzy Computing

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Abstract. To improve the effect of English teaching reform, this paper combines artificial intelligence and data fuzzy computing to research English teaching reform to enhance the intelligence of English teaching. Moreover, this paper introduces the evaluation module of the fuzzy inference system to establish the FIS model of structure type evaluation ultimately, discusses the construction of the fuzzy inference system, and constructs its evaluation model in combination with the problem of structure selection. In addition, for this model, this paper selects and derives a practical membership function and rule base by taking the high adaptability of English teaching data as an example. The research shows that the English teaching system based on artificial intelligence and fuzzy computing proposed in this paper can effectively eliminate the shortcomings of traditional English teaching and improve the quality of English teaching.

Keywords: artificial intelligence; data fuzzy; English; teaching reform;Cross-Cultural Transformation
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1 INTRODUCTION

With the popularization of higher Education and quality Education successively put forward, university personnel training has gradually shifted from quantity to quality. In particular, the quality of talent training for undergraduates has become a core issue for universities. The quality of talent cultivated by universities is related to the survival and development of Chinese universities, and the primary task of realizing the goal of high-quality talent cultivation is teaching.

Given the shortcomings and drawbacks of English teaching in Chinese colleges and universities, it is necessary to vigorously develop English for particular purposes, and it is also the direction and necessity of English teaching reform in Chinese colleges and universities. English for Special Purposes is a new method that determines teaching content and methods according to students' communicative needs and learning purposes.

College English courses follow the curriculum development method of ordinary colleges and universities, lacking the characteristics of college English application. Most English courses adopt language-oriented courses, so they have yet to form their own English curriculum characteristics. College Education should not be the "compressed biscuits" of Undergraduate Education. The key is to recognize the training objectives of colleges and universities and reasonably position English teaching. College Education should have its characteristics, that is, highlight the characteristics of practicality and professionalism. Colleges' and universities' training goals are high-level vocational skills and compound talents, and their English teaching policy is "practical first, enough for the degree."

This paper combines artificial intelligence and data fuzzy computing to research English teaching reform, improve the intelligence of English teaching, and promote the effect of current English reform.

2 RELATED WORK

Literature [4] systematically proposes the content of outcome-based Education and four basic principles of outcome-based Education: a clear focus on outcomes, reverse design, giving success to continuous and higher expectations, and expanding opportunities. The research in the literature [6] mainly focuses on exploring and analyzing the advantages and disadvantages of outcome-oriented Education. Literature [7] summarizes the twelve benefits of outcome-oriented Education that traditional Education does not have. Literature [7] sorts out its development process from the perspective of the theoretical basis of outcome-oriented Education and discusses its philosophical feasibility. Reference [9] also focuses on the implementation research of outcome-oriented Education and proposes an implementation effect monitoring model and inventory monitoring list based on ostrich, peacock, and beaver. In the study on the implementation of outcome-based Education, the literature [15] analyzes the implementation of outcome-based Education from the relationship between policy, theory, and practice. Literature [5] believes that policy, theory, and training interact and act together to implement outcome-oriented Education and play a guiding role in the implementation effect. The research in the literature [1] mainly focuses on classroom application, applying outcome-oriented Education to language arts classrooms. He pointed out that although outcome-oriented Education involves educational authorities, experts and scholars, parents, students, and other groups, the teachers in the school play a key role in its successful implementation.

The application, selection, and reward activities of teaching reform projects in colleges and universities are still at the level of qualitative disclosure, mainly relying on the experience and wisdom of experts [3]. Only by establishing scientific and reasonable evaluation standards and being fair, scientific, and appropriate in the evaluation process can the level of the teaching achievement award correspond to the research level, be recognized by the majority of teachers and educators, and truly achieve teaching results. The award's incentive effect promotes teaching reform and improves teaching quality [16]. Carry out further research on educational evaluation theory, explore the fundamental laws and development trends of teaching reform, build a comprehensive evaluation index system for teaching reform projects in colleges and universities on this basis, and apply for project initiation, mid-term inspection, and project completion review of teaching reform projects in colleges and universities. It is particularly urgent and essential to scientifically evaluate the effects of research, research, and personnel training [12]. Relevant research is still in its infancy, and a few people have begun to pay attention to this issue. Applying the theory and practice of project management to teaching management in colleges and universities has received attention [10]. In this era of fierce international competition, higher Education plays a pivotal role in whether a country can gain an advantageous position and maintain long-term, healthy, and sustainable development. To meet the needs of competition and development in the new era, countries around the world have carried out higher Education reforms that suit their national conditions, not only to maintain the existing advantages of higher education but also to focus on enhancing the sustainability of national strategic development and Educational development through higher Education reforms, to contribute to the long-term development of the country and provide sufficient impetus for strategic planning and development [11]. Differences in cultural backgrounds and political systems have led to different countries maintaining their independent characteristics regarding Educational content and Educational models, which also determines that other countries must have additional higher Education reform and development paths. From the perspective of the overall development process of Higher Education in the world, although each country maintains its unique reform and development [2], there are also common general characteristics, which are the basis for mutual reference in Educational reform. Strengthening the connection between the university and society and realizing the organic combination of university Education and research with social development needs is essential to evaluating Education reform [13].

In the evaluation of higher education reform, various countries take improving the quality of higher education as an essential content of higher education reform and use multiple means to ensure and strengthen the quality of higher education because this not only determines the employment situation of students but also profound It affects the quality of the national intellectual resource bank and has strategic significance for the macro development of a country [14]. Therefore, on the issue of how to ensure the existing Education quality and improve and strengthen it through reforms, governments have established corresponding Education quality assurance mechanisms one after another. Improving the quality of higher education requires establishing a related testing and evaluation mechanism and transforming educational methods and models to enhance the quality of teaching [8].

3 INTELLIGENT FUZZY COMPUTING

Definition 1 Fuzzy set and membership function

We assume that X is a collection of objects x, and x is any element of X. A fuzzy set A on X is defined as a set of ordered pairs with $A = \{(x, \mu_A(x)) \mid x \in X\}$.

Among them, $\mu_A(x)$ is the membership function (MembershipFunction, MF for short) of fuzzy set A. MF maps each element in X to a function (or membership value) between 0 and 1.

X is called the universe of discourse, a discrete set of objects or a continuous space. The fuzzy set A can be represented as follows:

$$A = \begin{cases} \sum_{x \in X} \mu_A(X_i)/\mathrm{xi}_i & \text{If x is a discrete object set} \\ \int_x \mu_A(x)/x & \text{If x is a continuous space (often a real number R)} \end{cases} \quad (1)$$

Fuzzy sets can be uniquely determined and defined by membership functions. For example, taking "X=age" as the domain of discourse, three fuzzy sets of "young," "middle-aged," and "old" can be defined by the three curves of $\mu_{\text{young}}(x), \mu_{\text{middle age}}(x), \mu_{\text{aged}}(x)$ in figure 1.

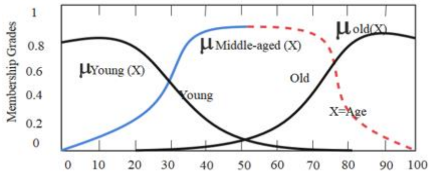


Figure 1: Typical MF of fuzzy sets "young," "middle-aged," and "old."

Definition 2 Support set

The support of fuzzy set A is all the point sets in X that satisfy $\mu_A(x) > 0$, that is:

$$Support(A) = \{x \mid \mu_A(x) > 0\} \quad (2)$$

Definition 3 The kernel

The kernel of fuzzy set A is all the point sets in X that satisfy $\mu_A(X) = 1$, that is:

$$Core(A) = \{x \mid \mu_A(x) = 1\} \quad (3)$$

If the kernel of fuzzy set A is not empty, there is $X \in X$ so that $\mu_A(x) = 1$, A is said to be normal.

Definition 4 The intersection point

The intersection of a fuzzy set A is the set of points in X that satisfy $\mu_A(x) = 0.5$, that is:

$$Crossouer(A) = \{x \mid \mu_A(x) = 0.5\} \quad (4)$$

Definition 5 Fuzzy single point

If the support of a fuzzy set is a single point in X that satisfies $\mu_A(x) = 1$, then the fuzzy set is called a vague single point. It has occasional applications in Sugeno-type fuzzy reasoning.

The definition of 6 people is the interception set as follows:

The α-cut or α level set of fuzzy set A is the following set:

$$A_\alpha = \{x \mid \mu_A(x) \geq \alpha\} \quad (5)$$

$$\mathrm{Aa}' = \{x \mid \mu_A(x) > \alpha\} \quad (6)$$

If the above formula holds, it is called a strong α -cut set. Using level set representation, the support and kernel of fuzzy set A can be expressed as $Support(A) = A_0{}'$, $Core(A) = A_1$. Figure 2 presents the kernels, supports, and intersections of the bell-shaped membership functions representing "middle age."

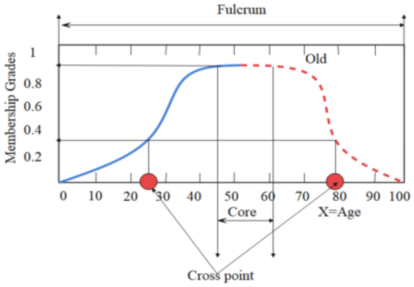


Figure 2: The kernel, support, and intersection of the fuzzy set "middle age."

Define 7 The bandwidth of a normal convex fuzzy set

For a normal convex fuzzy set, the bandwidth or width is defined as the distance between two intersections, as follows:

$$width(A) = |X_1 - X_2| \quad (7)$$

Among them, $\mu_A(X_1) = \mu_A(X_2) = 0.5$.

Definition 8 Symmetry

If the MF of the fuzzy set A is symmetric with a point $x = c$, A is said to be symmetric, that is:

$$\forall x \in X \quad \mu_A(c + X) = \mu_A(c - X) \tag{8}$$

Definition 9: The opening and closing of fuzzy sets

For fuzzy set A, we have:

If $\lim_{x\to-\infty} \mu_A(x) = 1$ and $\lim_{x\to+\infty} \mu_A(x) = 0$ holds, then A is left-open

If $\lim_{x\to-\infty} \mu_A(x) = 0$ and $\lim_{x\to+\infty} \mu_A(x) = 1$ holds, then A is right-opening

If $\lim_{x\to+\infty} \mu_A(x) = \lim_{x\to-\infty} \mu_A(x) = 0$ holds, then A is closed.

For example, the fuzzy set "young" in Figure 1 is left-open, "old" is right-open, and "middle-age" is closed.

Definition 10 Contains or subsets.

A fuzzy set A is contained in a vague set B (or equivalently, A is a subbase of B, or A is less than or equal to B). If and only if for any x, $\mu_A(x) \leq \mu_B(x)$. Figure 3 gives an illustration of the $A \leqq B$ concept. On the symbol, there are:

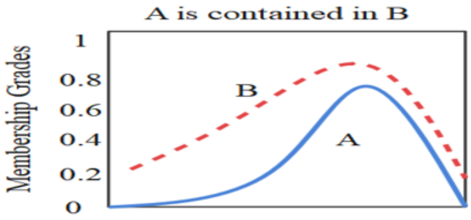
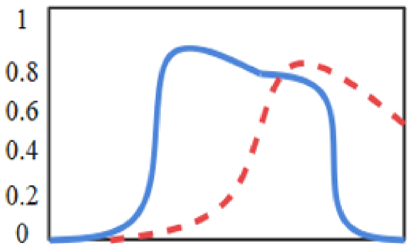


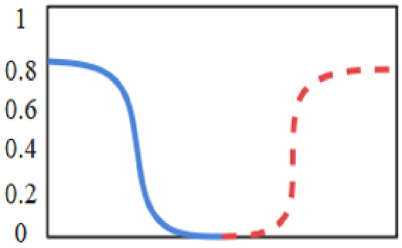
Figure 3: Illustration of the $A \subseteq B$ concept.

$$A \subseteq B \Leftrightarrow \mu_A(x) \leq \mu_B(x) \tag{9}$$

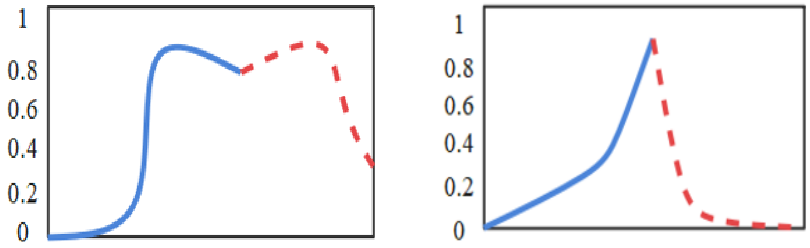
Figure 4 represents the following basic fuzzy set operations: figure 4(a) shows two fuzzy sets, A and B; Figure 4(b) is the complement of A; Figure 4(c) is the union of A and B, and Figure 4(d) is the intersection of A and B.



(a) Fuzzy sets A and B



(b) Fuzzy sets "not A"



(c) Fuzzy sets "A OR B" (d)Fuzzy sets A and B

Figure 4: Fuzzy set operations (a) Two fuzzy sets A and B; (b) $\overline{A}$; (c) $A \cup B$; (d) $A \cap B$.

Definition 11 Union (disjunction)

The union of two fuzzy sets A and B is a fuzzy set C, which is written as $C = A \cup B$ or $C = \mathrm{AORB}$, where the relationship between the MF of C and the MF of A and B is:

$$\mu_c(x) = max(\mu_A(x), \mu_B(x)) = \mu_A(x) \vee \mu_B(x) \tag{10}$$

An intuition about union, the equivalent definition of which is the "minimum" fuzzy set containing A and B. On the other hand, if D is any set containing A and B, then D also has $A \cup B$.

Definition 12The intersection (conjunction)

The intersection of two fuzzy sets A and B is a fuzzy set C, which is written as $C = A \cap B$ or $C = \mathrm{AANDB}$, where the relationship between the MF of C and the MF of A and B is:

$$\mu_c(x) = min(\mu_A(x), \mu_B(x)) = \mu_A(x) \vee \mu_B(x) \tag{11}$$

As in the case of unions, the intersection of A and B is the "largest" fuzzy set that A and B contain.

Definition 13Complement

The complement of fuzzy set A, $\overline{A}(\rightarrow A,\mathrm{NOTA})$, which is defined as:

$$\mu_A(x) = 1 - \mu_A(x) \tag{12}$$

Parameterized membership functions will be the first choice for system implementation. Typical and commonly used one-dimensional parametric membership functions are given below.

Definition 14 The triangle MF

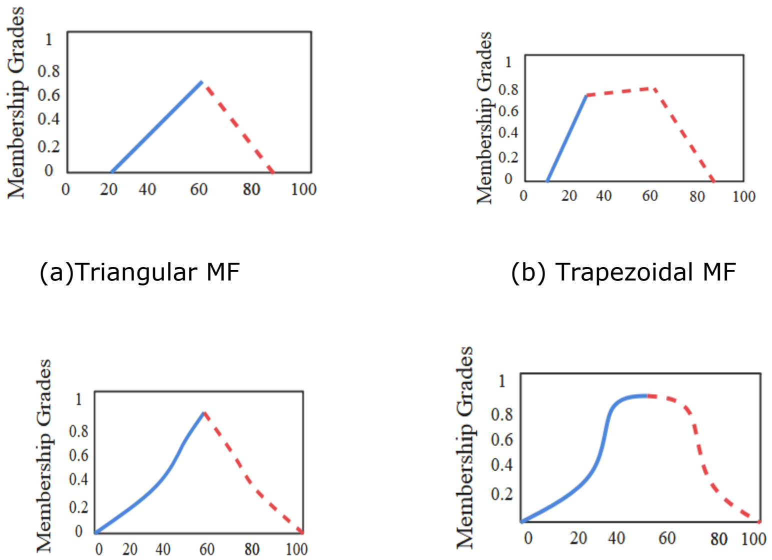
The triangle MF is described by three parameters {a,b,c} as follows:

$$\text{triangle } (x, a, b, c) = \begin{cases} 0, & x \leq a \\ \frac{x-a}{b-a}, & a \leq x \leq b \\ \frac{c-x}{c-b}, & b \leq x \leq c \\ 0, & c \leq x \end{cases} \tag{13}$$

Using min and max operators, formula (13) can be written as:

$$\text{triangle } (x, a, b, c) = max\left(min\left(\frac{x-a}{b-a}, \frac{c-x}{c-b}\right), 0\right) \tag{14}$$

The parameter $\{a, b, c\}(a < b < c)$ determines the x-coordinates of the three corners of the triangle MF. Figure 5(a) shows the triangle MF defined by $a\, triangle(x, 20,60,80)$.



(a)Triangular MF (b) Trapezoidal MF

(c) Gaussian MF (d)Generalized Bell MF

Figure 5: Examples of 4 kinds of parameterized MF: (a)Trangle(x; 20, 60, 80); (b) Trapezoid(x; 10, 20, 60, 95); (c) Gauss(x; 50, 20) ; (d) bell(x; 20, 50).

Definition 15 The trapezoidal MF

Trapezoid MF is described by four parameters $\{a, b, c, d\}$ as follows:

$$trapezoid(x; a, b, c, d) = \begin{cases} 0, & x \leq a \\ \frac{x-a}{b-a}, & a \leq x \leq b \\ 1, & b \leq x \leq c \\ \frac{d-x}{d-c}, & c \leq x \leq d \\ 0, & d \leq x \end{cases} \tag{15}$$

Using min and max operators, formula (15) can be written as:

$$trapezoid(x; a, b, c, d) = max\left(min\left(\frac{x-a}{b-a}, 1, \frac{d-x}{d-c}\right), 0\right) \tag{16}$$

The parameter $\{a, b, c, d\}(a < b \leq c < d)$ determines the x-coordinate values of the four corners of the trapezoid MF.

Figure 5(b) shows the trapezoid MF defined by $trapezoid(x; 10,20,60,95)$.

Definition 16 Gaussian MF

Gaussian MF is represented by two parameters $\{c, \sigma\}$ as follows:

$$gaussian\{x; c, \sigma\} = e^{-\frac{1}{2}\left(\frac{x-c}{\sigma}\right)^2} \tag{17}$$

The Gaussian MF is wholly determined by c and σ; c represents the center of the MF, and σ determines the width of the MF. Figure 5(c) plots the Gaussian MF defined by $Gaussian\ (x; 50{,}20)$.

Definition 17 Bell-shaped MF

The bell-shaped membership function is described by three parameters $\{a, b, c\}$ as follows:

$$bell(x; a, b, c) = \frac{1}{1+\left(\frac{x-c}{a}\right)^{2b}} \tag{18}$$

Figure 5(d) plots the MF defined by $the\ bell(x; 10{,}4{,}50)$. The center and width of the MF can be changed by adjusting c and a, and the slope of the MF at the intersection can be controlled by b.

Definition 18 Sigmoid MF

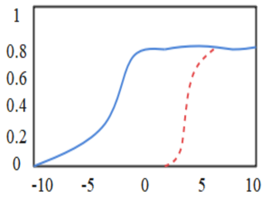
Although Gaussian MF and bell-shaped MF are smooth, they still cannot represent asymmetric MF. However, the S-shaped SigmoidMF formed by left-opening or right-opening or their combination can solve this problem very well. A SigmoidMF is defined as:

$$sig(x; a, c) = \frac{1}{1+exp[-a(x-c)]} \tag{19}$$

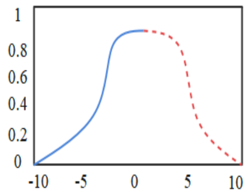
Among them, a controls the slope at the intersection $x = c$. According to parameter A's sign, SigmoidMF can be open right or left.

Figure 6(a) shows two sigmoid functions: $y_1 = sig(x; 1, -5)$ and $y_2 = sig(x; 2{,}5)$. A closed and asymmetric MF can be obtained by calculating the absolute value $|y_1 - y_2|$ of its difference, as shown in Figure 6(b).

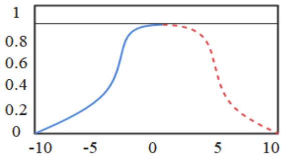
Figure 6(c) additionally defines a SigmoidMF as $y_3 = sig(x; -2{,}5)$, and the second way to form a closed and asymmetric MF is to take its product $y_1 y_3$, as shown in Figure 6(d).



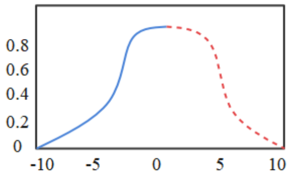
(a)y1=sig(x;1,-5):y2=sig(x:2,5)



(b)□y1-y2□



(c)y1=sig(x;1,-5):y3=sig(x:-2,5)



(d)y1*y3

Figure 6: (a) Two sigmoid functions y_1 and y_2; (b) MF closed by $|y_1 - y_2|$; (c) Two sigmoid functions y_1 and y_2; (d) MF closed by $y_1 y_3$.

Generally, we assume that f is a mapping from n-dimensional product space $x_1, x_2, \cdots, x_n$ to one-dimensional space Y, that is, $f(x_1, \cdots, x_n) = y$, and there is a fuzzy set $A_i, i = 1, \cdots, n$ in each dimension space x_i. Since the elements in the input vector $(x_1, x_2, \cdots \ and \ x_n)$ appear simultaneously, this implies an AND operation. Therefore, the membership function of fuzzy set B obtained by mapping f should be the minimum value of the membership degree of each constituent fuzzy set $A_i, i = 1, \cdots, n$. Under this definition, a formal definition of the extension principle can be given.

Definition 19 The extension principle

We assume the function f is a mapping $y = f(x_1, \cdots x_n)$ from the n-dimensional Cartesian product space $X_1 \times X_2 \times \cdots \times X_n$ to the one-dimensional Y. Moreover, $A_1, \cdots, \ and \ A_n$ are n fuzzy sets in $x_1, x_2, \cdots \ and \ x_n$, respectively, so the extension principle shows that the MF of the vague set B derived from the mapping f is:

$$\mu_B(y) = \begin{cases} \max\limits_{(x_1, \cdots x_n), (x_1, \cdots x_n) \in f(y)} \left[\min_i \mu_{Ai}(x_i)\right] & \text{If } f^{-1}(y) \neq \varnothing \\ 0, & \text{If } f^{-1}(y) = \varnothing \end{cases} \quad (20)$$

The extended principle above assumes that $y = f(x_1, \cdots, x_n)$ is exact.

If f is a fuzzy function (or $y = f(x_1, \cdots, x_n)$ is a fuzzy set characterized by n+1-dimensional MF), then the fuzzy composite inference rule can obtain the vague set B.

Definition 20 Binary fuzzy relation

We assume that X and Y are two fields, then we have:

$$R = \{((x, y), \mu_R(x, y)) \mid (x, y) \in X \times Y\} \quad (21)$$

The above equation shows the binary fuzzy relation on $X \times Y$. [It's worth noting that $\mu_R(x, y)$ is actually a 2D MF]

For example, we assume $X = Y = R^+$ (positive real axis), and R="y is much larger than x" fuzzy relation, the MF of R can be subjectively defined as:

$$\mu_R(x, y) = \begin{cases} \frac{y-x}{x+y+2}, & \text{if } \hat{u}\ y > x \\ 0, & \text{if } y \leq x \end{cases} \quad (22)$$

If $x = \{3,4,5\}, Y = \{3,4,5,6,7\}$, the fuzzy relation R can be conveniently expressed as a relation matrix as follows:

$$R = \begin{bmatrix} 0 & 0.111 & 0.200 & 0.273 & 0.333 \\ 0 & 0 & 0.091 & 0.167 & 0.231 \\ 0 & 0 & 0 & 0.077 & 0.143 \end{bmatrix} \quad (23)$$

Among them, the element in the i-th row and j-th column equals the degree of membership between the i-th element of X and the j-th element of Y.

Definition Max-min composite operation

We assume that R1 and R2 are two fuzzy relations defined on X×Y and Y×Z, respectively, and the max-min composite of R1 and R2 is a fuzzy set.

$$R_1 \cdot R_2 = \left\{\left[(x,z), \max_{y} min(\mu_{R1}(x,y), \mu_{R2}(y,z))\right] \mid x \in X, y \in Y, z \in Z\right\} \quad (24)$$

Equivalently, there are:

$$= \vee_y \left[\mu_{R_1}(x,y) \wedge \mu_{R_2}(y,z)\right] \quad (25)$$

Among them, ∨ they ∧ represent the maximum and minimum, respectively.

When R_1 and R_2 are represented as relational matrices, the computation of $R_1 \bullet R_2$ is the same as the matrix multiplication operation, except that × and + are replaced by ∨ and ∧, respectively. Therefore, the max-min composite is also called the max-min product.

We assume that R, S, and T are binary relations on $X \times Y$, Y×Z, and $Z \times W$, respectively, then we have:

$$\begin{gathered} \text{Combination law} \quad R \bullet (S \bullet T) = (R \bullet S) \bullet T \\ \text{Distributive law of union operation} \quad R \bullet (S \cup T) = (R \bullet S) \vee (R \bullet T) \\ \text{Weak distribution law of intersection operation} \quad R \bullet (S \cap T) \sqsubseteq (R \bullet S) \cap (R \bullet T) \\ \text{Monotonicity} \quad S \leqq T \Rightarrow R \cdot S \leqq R \cdot T \end{gathered} \quad (26)$$

For example, we assume that R_1 = "x is related to" and R_2 = "y is related to correlation, which are two fuzzy relations defined on $X \times Y$ and $Y \times Z$, respectively, where $X = \{1,2,3\}, Y = \{\alpha, \beta, \gamma, \sigma\}, Z = \{a, b\}$.

We assume that R_1, R_2 the following relational matrix represents R1, R2:

$$R_1 = \begin{bmatrix} 0.1 & 0.3 & 0.5 & 0.7 \\ 0.4 & 0.2 & 0.8 & 0.9 \\ 0.6 & 0.8 & 0.3 & 0.2 \end{bmatrix} \quad R_2 = \begin{bmatrix} 0.9 & 0.1 \\ 0.2 & 0.3 \\ 0.5 & 0.6 \\ 0.7 & 0.2 \end{bmatrix}$$

$R_1 \bullet R_2$ is calculated, and its meaning is based on the fuzzy relation "x is related to z" derived from R_1 and R_2. We assume we are only interested in the correlation between $2(\in X)$ and $a(\in Z)$. If the maximum-minimum composite is used, there are:

$$\mu_{R_1 R_2}(2,a) = max(0.4 \wedge 0.9, 0.2 \wedge 0.2, 0.8 \wedge 0.5, 0.9 \wedge 0.7) \qquad = max(0.4, 0.2, 0.5, 0.7) \qquad = 0.7$$

Figure 7 shows the composition of two fuzzy relations, where the relation between element 2 in X and element A in Z is represented by four possible paths (solid lines) connecting these two elements.

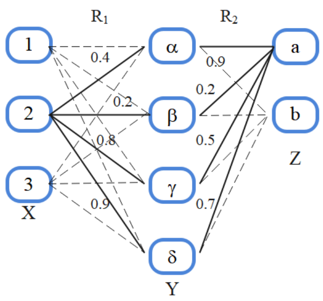


Figure 7: Compounding of fuzzy relationships.

Linguistic variables are another way to model the human mind.

Definition 22 Language variable

A linguistic variable is represented as a quintuple $(x, T(x), X, G, M)$, where x is the variable's name. $T(x)$ is the set of terms of x, the set of linguistic value names or terms of x. X is the universe of discourse, G is the syntactic rule that produces the terms in $T(x)$, M is the syntactic rule that assigns the meaning $M(A)$ to each linguistic value A, and M(A) represents the fuzzy set in X.

Fuzzy if-then rules (also called fuzzy rules) have the form:

$$\text{If x is } A, \text{then y is } B \tag{27}$$

A and B are the linguistic values defined by fuzzy sets on the universes X and Y, respectively.

Before we can model and analyze the system using fuzzy if-then rules, we must formalize the meaning of the expression "if x is A, then is B" (sometimes abbreviated as $A \to B$).

A binary fuzzy relation R on $X \times Y$. If we understand $A \to B$ as A coupled to B, then we have:

$$R = A \to B = A \times B = \int_{X \times Y} \mu_A(x) \tilde{*} \mu_B(y)/(x, y) \tag{28}$$

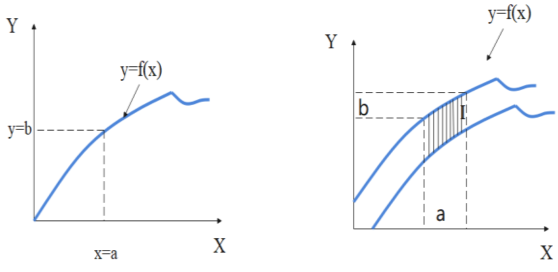
Among them ≈ is the T Fan operator, and $A \to B$ represents the fuzzy relation R. It is worth noting that R can be viewed as a fuzzy set with two-dimensional MF, then:

$$\mu_R(x, y) = f(\mu_A(x), \mu_B(y)) = f(a, b) \tag{29}$$

When using the minimal operator connection, the formula (29) becomes the fuzzy rule calculation formula used by the famous Mamdani model.

$$R_M = A \times B = \int_{X \times Y} \mu_A(x) \wedge \mu_B(y)/(x, y) \tag{30}$$

We assume that the curve $y = f(x)$ regulates the relationship between x and y, and $x = a$ is given, then $y = b = f(a)$ can be inferred from $y = f(x)$, as shown in Figure 8(a). Extending this process allows a to be an interval and $f(x)$ to be a function of interval values, as shown in Figure 8(b). To find the interval $y = b$ corresponding to the interval $x = a$, the cylindrical extension of a is first constructed, and then its intersection I with the interval value function is found. The projection of I on the y-axis is the interval b.



(a) (b)

Figure 8: Deriving y=b from x=a and y=f(x); (a) a and b are Points, y=f(x) is a Curve; (b) a and b are the Interval, and y=f(x) is the Interval Value.

To make further extensions, we assume that F is a vague relation on X × Y, and A is an incomplete set of X. To find the resulting undefined set B, we again construct the cylindrical extension c(A) of the basis set A. The intersection of c(A) and F produces a region similar to the intersection I in Figure 9(b); c (A)∩F is projected on the y-axis, and the fuzzy set B on the y-axis can be inferred.

In detail, we assume that $\mu_A, \mu_c(A), \mu_B$ and μ_F are the MFs of $A, c(A), B$ and F, respectively, where $\mu_c(A)$ is related to μ_A, then we have:

$$\mu_{c(A)}(x,y) = \mu_A(x)$$

Then, there are:

$$\mu_{c(A)\cap F}(x,y) = min[\mu_{c(A)}(x,y), \mu_F(x,y)] \\ = min[\mu_A(x), \mu_F(x,y)] \quad (31)$$

Projecting $c(A) \cap F$ onto the y-axis, we have:

$$= \vee_x [\mu_A(x) \wedge \mu_F(x,y)] \quad (32)$$

Suppose both A (a univariate fuzzy relation) and F (a binary unclear relation) have a finite domain of discourse. In that case, the formula evolves into a max-min composite operator of the two relation matrices. Conventionally, B is represented as B=A•F, where • represents the compound operator.

Definition 23 is fuzzy inference as follows:

We assume that A, A', and B are fuzzy sets on X, X, and Y, respectively, and the fuzzy implicit $A \to B$ is represented as an unclear relation R on $X \times Y$. Then, the undefined set B' derived from "x is A" and the vague rule "if x is A then y is B" is defined as:

$$= \vee_x [\mu_{A'}(x) \wedge \mu_R(x,y)] \quad (33)$$

Equivalently, there are:

$$B' = A' \bullet R = A' \bullet (A \to B) \quad (34)$$

As long as a proper binary fuzzy relation is defined for the fuzzy implicit $A \to B$, the inference steps of fuzzy inference can be used to obtain the conclusion. In layman's terms, the extent to which "H fits very well" is supported by the extent to which the structure is "very reasonable." The whole fuzzy reasoning process is shown in Figure 9.

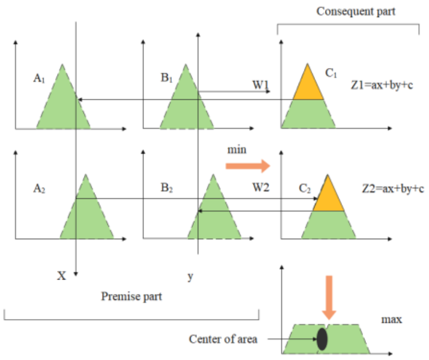


Figure 9: Schematic diagram of the fuzzy reasoning process.

4 ENGLISH TEACHING REFORM BASED ON ARTIFICIAL INTELLIGENCE AND DATA FUZZY COMPUTING

The intelligent classroom system comprises integrated multimedia computers, electronic whiteboards, teacher-side tablets, student-side tablets, the Internet of Things, Education cloud terminals, and Education cloud platforms. The details are shown in Figure 10.

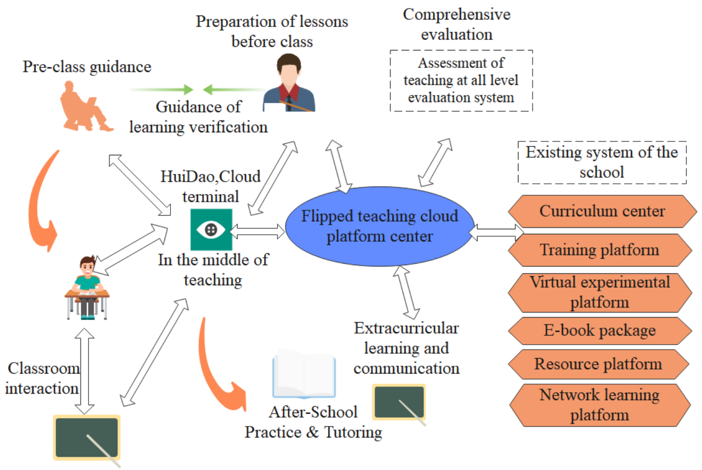


Figure 10: English intelligent teaching system.

As an intermediary, the innovative teaching system completely opens up all aspects of teaching, integrates teachers, students, and teaching resources in a new mode, and presents a multi-interactive teaching mode, as shown in the figure below.

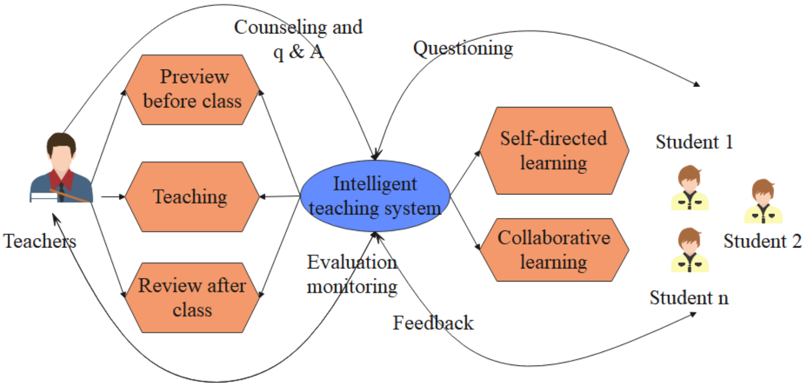


Figure 11: Teacher-student interaction mode based on intelligent teaching system.

This paper conducts experimental verification on the English teaching system based on artificial intelligence and fuzzy computing proposed in this paper. This paper combines simulation research to verify the system, counts the teaching data processing effect of the English teaching system based on artificial intelligence and fuzzy computing, and analyzes the improvement effect of this system on English teaching. The statistical test results are shown in Table 1.

Numbe r	Data processing	Teaching improvement	Numbe r	Data processing	Teaching improvement
1	89.02	71.86	24	91.66	77.50
2	88.33	71.59	25	90.92	78.66
3	89.06	73.84	26	90.93	72.13
4	89.29	66.30	27	93.06	76.07
5	89.21	65.53	28	87.86	80.06
6	88.23	78.99	29	91.86	74.10
7	87.49	77.79	30	89.59	68.63
8	88.59	71.77	31	89.11	64.63
9	92.51	79.89	32	87.96	75.31
10	90.55	72.03	33	93.16	64.18
11	91.88	65.14	34	93.54	78.28
12	92.93	75.29	35	93.51	64.86
13	89.71	68.24	36	90.10	64.56
14	92.24	74.92	37	91.16	80.79
15	90.67	74.48	38	87.38	80.42
16	89.82	76.26	39	88.20	75.06
17	91.67	67.44	40	90.34	73.10
18	91.28	71.18	41	90.39	77.17
19	90.66	68.67	42	91.97	80.25
20	91.80	73.87	43	93.37	67.26
21	87.78	75.79	44	89.90	79.98
22	89.15	70.24	45	89.70	67.66
23	90.42	64.23	46	88.70	64.11

Table 1: Effect verification of English teaching system based on artificial intelligence and fuzzy computing.

From the above experimental research, the English teaching system based on artificial intelligence and fuzzy computing proposed in this paper can effectively eliminate the shortcomings of traditional English teaching and improve the quality of English teaching.

5 CONCLUSION

The development time of English Education in Chinese colleges and universities is short, and the guidance of English subject theory with college characteristics needs to be improved. Moreover, there needs to be a clear training goal or direction for English in colleges and universities, and it is positioned at the low level of undergraduates. The courses offered and the selected teaching materials are outside the students' learning and reality, and they cannot adapt to society's requirements for working talents. This paper combines artificial intelligence and data fuzzy computing to research English teaching reform to improve the intelligence of English teaching. The experimental research shows that the English teaching system based on artificial intelligence and fuzzy computing proposed in this paper can effectively eliminate the disadvantages of traditional English teaching. Fueled by AI and data fuzzy computing, The cross-cultural transformation in language Education represents a pedagogical evolution and a step towards a more interconnected and understanding world. As we move forward, language learning becomes about mastering words and embracing the diverse stories and perspectives that language carries with it.

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