Journal of Intelligent & Fuzzy Systems 47 (2024) 1053–1070
DOI:10.3233/JIFS-235930
IOS Press

RETRACTED: Exploring the practice of integrating innovation and entrepreneurship teaching in visual communication design professional courses using hybrid optimization based ANFIS

Wang Chongjuan*
Daqing Normal University College of Art & Design, China

1. Introduction

Development and business venture are the spirit of business, and understanding the combination of advancement and business schooling and the cooperative trial stage in universities and colleges is a significant method for advancing the improvement of business venture and working with greater business Craftsmanship and innovation have a holding relationship [1, 2].

The combination of advancement and business training with proficient schooling is a significant method for developing the pioneering soul of understudies and advancing great work and business in undergrads [3]. As well as giving great business and business ventures valuable open doors and a market

*Corresponding author. Wang Chongjuan, Daqing Normal University College of Art & Design, China. E-mail: scholar.wangchongjuan@gmail.com.

climate, it is more vital to advance the work and business of undergrads, and all the more significantly, to develop the enterprising soul of understudies from the wellspring of schooling and successfully work on the development and innovative capacity and social obligation of undergrads [4, 5]. Under the foundation of advancement-driven improvement methodology, the interest of society in imaginative and innovative abilities has become increasingly earnest. Advanced education is a significant method for developing imaginative and enterprising abilities, while higher professional instruction, as a significant piece of advanced education, plans to develop gifts with high abilities to meet the progressions of market interest and face the bleeding edge of creation, administration, and executives, so it is more applicable to do advancement and business training [6, 7].

The graphical structure in which the architectural efforts are relatively straightforward, while the visualization surface resides primarily in the plane of classic visual communication design. As the Internet grew and technology advanced, a single two-dimensional representation began to give way to three-dimensional or even four-dimensional representations. Simultaneous developments in artificial intelligence as well as visual communication through design integration also occurred. Traditional information delivery is no longer the only application for visual communication design.

Aesthetics and information transmission are combined in the design discipline of visual communication. The literature [8] presents an optimization technique for maritime landscapes based on visual communication, architecture, coloration, and decorative patterns, followed by a color matching procedure. The matching scheme of colors must be established first. Then, the chromaticity moments of the pixels in various connected blocks are computed using the Legendre polynomial method. The distance among the aggregation based on the separation between various colors types is extracted using the primary color features of the [9] marine landscape decorating architecture, and the color matching optimization of the layout is ultimately accomplished. The simulation results show that the recommended strategy has a definite matching effect and greatly improves the quality of the maritime landscape architecture. Six design philosophies enjoyment, effectiveness, narrative format, symbolic imagery, interactive features, and innovation were proposed by the literature [10] to strengthen the emotional appeal of visual communication design. The design ideas proposed in this study establish an entirely novel framework for emotionally enduring visual communication design that improves customer acceptability and makes products easier to hold for longer periods of time, all while contributing to ecological sustainability [11–13]. Visually appealing design has the power to shape consumers' aesthetic tastes and encourage the use of more ecologically friendly products. The semiotic significance of organizational logos and the logos used by different organizations in cities were both studied in the literature [14]. The shape and content of the visual elements in an assortment of 67 logos are explained using morphological, material, as well as linguistic investigations. These logos were [15] also categorized using the perspective of the human body, technological embodying, typography, recurring characters, cultural elements, ornamental tools, and developments in visual development.

In order to tackle the issue the work has adopted the questionnaire based method to analyze and characterize the development of innovation and entrepreneurship education in colleges and universities via VDC, as well as the practice of maker education using ANFIS based Hybrid optimization model. This work first suggests the development of innovation and entrepreneurship education in colleges and universities via VDC, as well as the practice of maker education using ANFIS based Hybrid optimization model for college instructors and students, in order to investigate the elements influencing quality. Along with the graphics are first ordered, and their representation is subsequently calculated utilizing the fixed value technique to get the objective arrangement function. The goal function is solved using an ant colony algorithm, which also helps to identify the best place for the graph's display. The image style transfer problem is transformed into a simple loss function by assuming that every alphabet that contains static constants has Boolean true values. The AI interface has improved the visual representation of information, the most favorable consumer's assessment, consistent distribution of the TGB awareness features, as well as among the greatest graphic contentment, according to the results of sampling its visual features using the integrated approach. This validates the practical value of the algorithm proposed in this paper. Furthermore, an examination of the IEE quality components is conducted, and a questionnaire survey (QS) is employed to validate the model's accuracy.

The remainder of this work is structured as follows: Section 2 goes with the associated work and research problem. Section 3 presents the recom-

mended methodology. Section 4 presents the findings and discussions, while Section 5 ends the paper.

2. Literature survey

Djamen, A.C. and Batmetan, J.R., 2023 [16] A great option for online learning during the COVID-19 pandemic is interactive multimedia. Building engaging, dynamic multimedia is challenging for many teachers because it takes specialized knowledge and a well-established structure. The purpose of this study is to clarify how learning media are created and how an integrated interactive multimedia framework is implemented in the process of learning. Researchers describe how the behavioral activity, cognitive/metacognitive activity, and elements of the learning environment are integrated with the multi-media framework. By incorporating these three elements into visual communication instruction, the researchers were able to create an interactive multimedia learning tool that accurately reflects every facet of classroom instruction. The work draw the conclusion that the three elements working together produce high-quality interactive learning materials.

Qi et al. 2022 [17] In order to increase the effectiveness of imaging picture acquisition, a three-dimensional imaging technique was proposed in this study based on actual requirements. Additionally, the visual communication effect was strengthened by applying the imaging information display method. Then, to increase the algorithm's overall accuracy and effectively regulate error, virtual reality technology was integrated with convolutional neural network-related methods at the algorithm level. According to the trial findings, VR technology that has been optimized leads the entire stage in regard to mean square error. The erroneous control effectiveness of the optimized virtual reality technology is suboptimal, as evidenced by the fact that, after 400 samples were tested in the two studies, the optimum error control performance was 0.07.

Zong et al. 2022 [18] The use of multimedia teaching in education has become a hot topic for teaching reform in recent years due to the quick advancement of multimedia technology and the increase in public awareness of this approach. The methods and tools used to create courseware are likewise always evolving. It offers a wider creative space for multimedia teaching, from creating basic electronic lesson plans to create multimedia courseware and network courseware that integrates audio, video, animation, and graphics to show instructional content. This article investigates the classroom teaching of visual communication design specialty based on technology for multimedia, enhances the content of the element, and creates the talent training strategy of keeping pace with the times in order to cultivate more applicable skills in visual communication design.

Gu et al. 2023 [19] in this research, the establishment of an artificial intelligence (AI)-based visual communication system was presented. By using this method, the image can be magnified and has a wider range of views in addition to being clearer. Simultaneously, the system was used to innovate in the field of modern art design. According to the experimental results, the standard sample had a maximum distortion of roughly 20%, while the system designed in this work had a maximum distortion of roughly 15%. This approach offers significant advantages over traditional samples when it comes to graphics modification. To enhance the imaging impact, the optical system's chromatic aberration can also be adjusted.

Liu et al. 2022 [20] This article first explains the technology of visual communication design, then it examines and evaluates the technology of animation special effects design, and last it looks into and evaluates the practical applications of visual communication design. This article's experiments demonstrate how production of animation special effects based on visual communication design can both draw in 15% of younger age groups and save development businesses at least 5% of their development expenditures. The most crucial thing is to increase the distribution of animated films and television shows.

Rui Xia Ang et al. 2022 [21] The research work interviewed twelve d/Deaf signers and eight ASL interpreters in total, as well as held four co-design sessions to better understand the special needs for engaging in videoconferencing (VC) using a visual-gestural language like ASL and to identify useful design considerations for signer-inclusive videoconferencing. The work discovered that the current VC platforms do not adequately address the access needs of participants with relation to information consumption (e.g., visual clarity of signs), communication (e.g., garnering attention of others), and collaboration (e.g., working with interpreter teams). the research present new perspectives on participating in and leading signer-accessible video conferences, suggest future directions for VC design, and offer recommendations for working remotely on research projects including d/Deaf signers.

Authors	Techniques	Depiction	Findings	Limitations
Djamen, A.C. and Batmetan, J.R., 2023 [16]	Learning through multimedia	display of the content in several formats	Using both words and images to deliver the information	Restricted to just two formats words and pictures as this differentiation is most pertinent to cognitive psychology research.
Qi et al., 2022 [17]	Acquisition of information	Presumptions on the characteristics of the learning material, students, instructors, and the goal of the multimedia presentation.	To impart knowledge to students in an efficient manner.	It might be difficult to make and use.
Zong, H., 2022 [18]	Creation of knowledge	To obtain meaning, students attempt to construct a rational psychological model using the information supplied.	Knowledge cannot be precisely transmitted from one person's brain to another; rather, it is produced by the learners themselves.	Time-consuming, distracted, reliant on technological advances, and with little control.
Gu et al., [19]	artistic colour blending	In the animation, geometric shapes and muted colours were combined.	Greatly enhances learning.	Challenging to conjure up fresh visual sensations.
Liu, X., 2022 [20]	Integrated Video and Image Keying Systems	Inverse method of the combination method.	To combine numerous images to create intricate digital visuals. Takes a long time and a lot of work to make.	It is unable to assess each student's proficiency in a class.
Rui Xia Ang et al., 2022 [21]	Technology for Video Keying and Synthesis	To roughly split the image, and subsequently determine the opacity using the Bayesian keying procedure.	Efficient computation accuracy and speed.	Greater sampling validation is necessary.

3. Methodology

Computer technology is the source of artificial intelligence, and computer vision systems play a significant role in artificial intelligence as a whole. Giving artificial intelligence (AI) in computer vision systems human-like vision, hearing, and vision capabilities would increase the systems' recognition accuracy and comprehension of written, image, and video content. AI systems are currently used in a variety of social contexts, including businesses, organizations, and societies. This study presents a set of optimizations intended for the new AI system in order to optimize visual communication in terms of both quality and efficacy. Figure 2 displays the created AI working framework.

Figure 2 illustrates how the artificial intelligence device's visual recognition module synthesizes the collected images twice. Second, a light sensor is used to communicate the re-synthesized image. Ultimately, the precise location is determined by depending on the global positioning system's accuracy. Once the theories of optimal design are finished, experiments are conducted to verify their scientific validity. Four advantages artificial intelligence has over humans are as follows: (1) greater processing power; (2) prolonged, uninterrupted labor; (3) large memory and database support; and (4) consistent, independent of subjective factors producing results. These benefits allow for the continuous exploration of new ideas, which allows for the resolution of purely intellectual difficulties. These benefits enable the constant exploration of novel options, experience organizing, comparison of solutions, iterative optimization of solutions, and ultimate convergence on the optimal way to solve purely intellectual challenges.

3.1. Automatic organization method for graphic design language in visual communication

In visual communication design, this is accomplished through three links: determining the dimensions and placement of the graphic display, explaining the graphic language, and creating the control flow for the automatic arrangement of the graphic language. Inaccurate results are obtained from the typical algorithm's computation of the graphic display size and location since it uses irrational approaches. In the graphics language

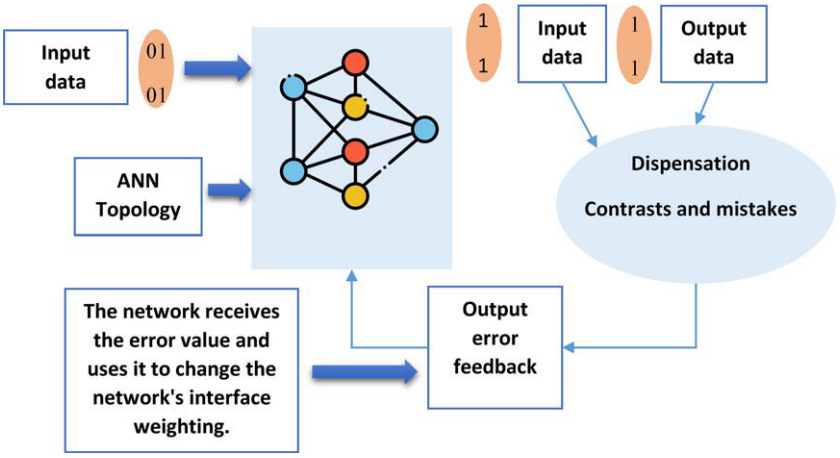

Fig. 1. AI- based conceptual framework.

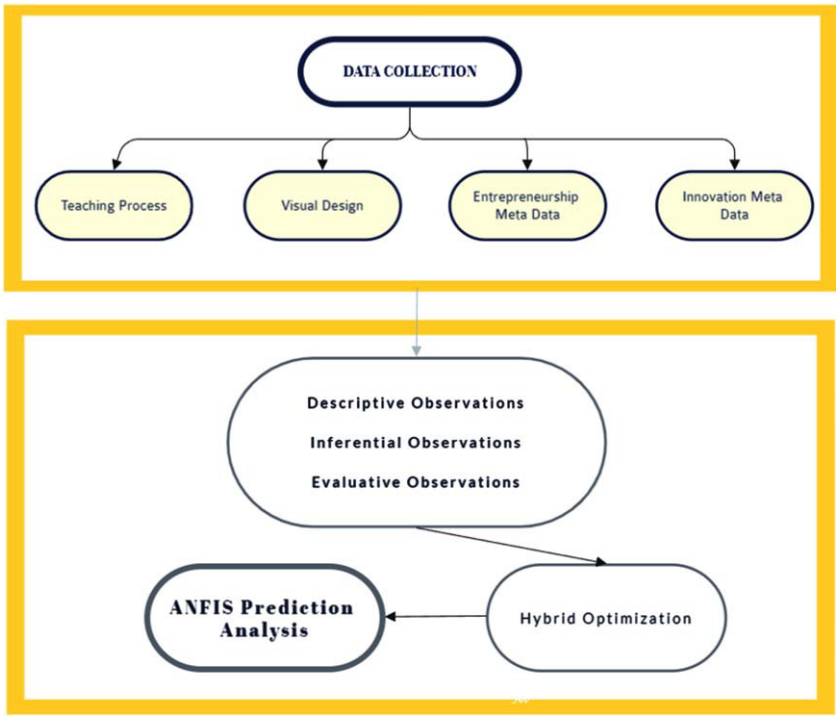

Fig. 2. Conceptual model.

description step, which is usually carried out by a meta-model, the lack of a strict standard leads to imprecise model description outcomes and complicates the effective support of graphics language choreography management. A revolutionary automatic graphic language arrangement method in visual communication design is proposed to accomplish this goal with improved outcomes and high user satisfaction.

To achieve automatic visual language orchestration, specifics on the size and placement of the visual exhibit, the explanation of the graphical language acquisition, the design and implementation of its control flow, and the process of writing and executing a program in the language are all provided.

The fixed value approach determines the display size of the buffer picture in the visual communication design. The procedure is as follows.

In visual communication design, when the required number of layout pages is decreased and surface usage is raised, the layout target function can be expressed as follows:

$$\min = (n-1)\,Z + i \tag{1}$$

Where i represents the height of the most recent layout in use and n the number of pages.

The most optimal approach or the most effective exhibition positioning for graphical in visual design is found using Equation (1). This formula is also used as the objective function to determine the best display position for different images.

The rules-based grammatical representation methodology establishes the mathematical relationships between graph elements and provides information about the graph elements' positions. One way to summarize this descriptive method is as follows:

$$H = (R, BH, DH) \tag{2}$$

The definition of the term is as follows, where H stands for the grammar of the graphic language, R for the set of infinite graph parts, and BH for the set of abstraction grammar rules.

$$BH = \{t \,|t(r_1, r_2, o); r_1 \in R, r_2 \in R\} \tag{3}$$

When r_1 is the current stage graph element, D_{from} is used to express the connection from r_2 to r_1, and t is used to explain the connection relationship between graph elements, including D_{from} and D_{to}. A natural integer called o is used to express how many connections there are. The following phrase uses DH to define a complete set of syntactic rules:

$$DH = \{(r, render, layout) \,|r \in R, render \in S, layout \in M\} \tag{4}$$

Where as *render* describes the relationship between graphical elements, *layout*describes the various graphical element classes, q describes the graphical element symbol system, S describes the set of graphical element appearance types, and M describes the set of graphical element location relations.

ASM design in visual communication realizes the graphic language's semantic description, which serves as the foundation for the automatic arrangement of the graphic language. ASM belongs to the dynamic algebra, which has the following definition on a particular alphabet summation:

$$\sum = \left\{g_1^0, g_2^0, ..., g_{lM}^0, g_M^1, g_{lw}^{\pi}\right\} \tag{5}$$

The M-element function symbols, which comprise both static and dynamic function symbols, are described by g^0 in this instance. Program variables are the name for 0-element dynamic function symbols, whereas constants are the name for 0-element static function symbols. The algebra's current state is indicated by the subscript, the static constants are denoted by M, and the dynamic constants are denoted by lM. In order to make the description of some functions easier, it is assumed that every letter in the alphabet that contains static constants is a Boolean true value.

ANAS converts the image style transfer problem into a problem of minimizing the loss function by using trained extracted content characteristics and style aspects of the image to create a loss function:

$$M_{total}(P, J, T) = \mu_1 M_{content}(P, J) + \mu_2 M_{style}(P, T) \tag{6}$$

$$M_{content}(P, J) = \frac{1}{2}\sum_{m=1}^{M}\alpha_1 \sum_{jk}(G_1[P] - G_1[J])_{jk}^2 \tag{7}$$

$$M_{style}(P, T)\sum_{m=1}^{M}\alpha_m \frac{1}{4O_m^2 E_m^2}\sum_{jk}(H_m[P] - H_m[T])_{jk}^2 \tag{8}$$

The content loss term (represented by M) between the target image J and the resultant image O is the total of the content feature errors between O and J across all convolutional layers. M is the style loss term, which is the total of the style feature errors between J and S in each convolution layer, between the final picture O and the reference image T. Grammatical matrix:

$$H_m[\bullet] = G_m[\bullet]G_m[\bullet]^U \in S^{O_m \times O_m} \tag{9}$$

Where j is the feature matrix's subscript and indicates the style feature matrix of layers m and j, k. The LoG operator is used to extract the edge feature matrices of the three color channels from both the target and resultant images. Next, the disparities between the target image and the resultant image's edge feature matrices for each of the three color channels are computed. Lastly, the subject structure loss term is represented by the error total of the three color channels. The following is the subject structure loss

term:

$$M_f(P, J) = \frac{1}{2}\sum_{d=1}^{3}\sum_{jk}(F[P_d] - F[J_d])_{jk}^2 \quad (10)$$

Where the d-nd color channel is indicated by d. The components of the target image's d-th color channel are represented by J and O, respectively, in the resultant image.

Assuming that X appropriately captures the fundamental connection between cognition category and concentration intensity and that CI_{yz} and CD_{yz}, in turn, characterize the amount of gaze and gaze duration, the model used for testing is, in overall, the following, taking into account the results of user evaluations of many techniques:

$$CI_{yz} = X(W_1, W_2, W_3 | \Gamma_1, \Gamma_2) \quad (11)$$

$$CD_{yz} = X(W_4, W_5 | \Gamma_1, \Gamma_2) \quad (12)$$

The letter W_1 stands for each of the five aspects of cognitive style: active, sensory, regulation, attraction, and anxiety. All four of the visual communication design styles complex, indirect, mainstream, and following are referred to as y. The letters $y = 1, 2, 3$ stand for multimedia integration, graphic use configuration, and sequential text layout. Γ_1 and Γ_2 are the control variables.

The connection function's independent factor is the participant's adherence to a specific cognitive approach in communication through visual design, as defined by υ_s, $\upsilon \in (0, 1)$. The initial compensation quantities CI_{yz} and CD_{yz} are obtained by dividing the user's attention to the visual area I_{yz} and their cognitive style affiliation D_{yz} by the corresponding area adjustment factor ζ_{yz}. These values can then be divided by CI_{yz} and CD_{yz} to yield the values of BI_{yz} and BD_{yz}, as shown in the expression below:

$$\begin{cases} CI_{yz} = I_{yz}/\zeta_{yz} \\ CD_{yz} = D_{yz}/\zeta_{yz} \end{cases} \quad (13)$$

$$\begin{cases} BI_{yz} = CI_{yz}/WI_y \\ BD_{yz} = CD_{yz}/WD_y \end{cases} \quad (14)$$

BD_{yz} describes the average gaze volume in each zone and BI_{yz}, consequently, the average glance time in each location. WI_y describes the whole glance time, and WD_y describes the entire gaze region.

In the instance of $y = 0$, BI_{yz}, and BD_{yz}, in turn, provide the lowest values for the average quantity and duration of attention in each region. When $y \neq 0$occurs, meaning that the two variables average both the quantity and duration of gazes over multiple communities, then get:

$$BI_{0z} = \left(\sum_{y=1}^{4} BI_{yz}\right)/h \quad (15)$$

$$BH_{0z}\left(\sum_{y=1}^{4} BD_{yz}\right)/h \quad (16)$$

To implement the AI-based visual communication approach the visual features of the AI interface are sampled using a 4×4 chunked combination model; face image acquisition and 2D feature reconstruction are done using the frame scanning technique; the vector-based weighing of the AI interaction the visual communication image retrieval is represented by the target template matching matrix $\upsilon_1, \upsilon_2, ..., \upsilon_{ej}$; and the edge contouring characteristics of the AI interface are computed using the adaptive hierarchical analysis approach. Through the use of adaptive hierarchical analysis, the set of edge contour features of the AI interface is determined. In accordance with the observation that the AI interface's depending system connection the distribution is represented visually with a length of $M = y_{\max} - y_{\min}$, width of $X = y_{\max} - y_{\min}$, and sparse joint features of $I = a_{\max} - a_{\min}$, the 3D spatial rebuilding method is utilized to obtain the topology of the reconstructed image of the AI interface. The network topology of this graphic is portrayed through all four a reference templates vectors, y_1, y_2, y_3 and y_4, that follow:

$$\begin{cases} y_1 = q_1 - n \\ y_2 = q_2 - n \\ y_3 = q_3 - n \\ y_4 = n \end{cases} \quad (17)$$

Where n the referencing template vector instances of one of the frames of the interactive user interface $J(y, z)$ in the entire reconstructed geometric space are calculated, and N is the edge division scale of the visually conveyed image of the AI interface in the neighborhood. The regional distribution basis function of the visually transmitted image of the AI interface is derived as follows when combined with the sparse feature fusion:

$$h(y, z) = g(y, z) + \varepsilon(y, z) \quad (18)$$

$g(y,z)$, $h(y,z)$, $\delta(y,z)$ among them stands for, accordingly, the pixel intensity of the AI interfaces visually conveyed image. In order to achieve the visual communication information improvement processing of the AI interface, it thus merged with the cross-sectional fusion of information technologies. Following that, enhance the AI technology's visually communicated image's edge envelope feature and strengthen its capacity for innovative visual communication.

With the assistance of the hybrid optimisation-based adaptive network-based fuzzy inference system (ANFIS) depicted in Fig. 2, the goal is to provide students with theoretical background topics and entrepreneurial intentions, as well as the values of entrepreneurial culture, and assist them in obtaining the education required to enable them to materialise their ideas. The suggested method aids in providing high-relevance visualisation of entrepreneurial and innovative courses that cover a variety of topics, including the fundamentals of starting a business, investigating financing, trying to manage, business management topics, technological tools (ICT), developing business plans, SWAT analyses, marketing, and many others. The students are also given examples of successful businesses, applications, products, and entrepreneurs that have been examined.

3.2. Questionnaire based data collection

Evaluation of quality in institutions of higher education is the goal. The QS based on classroom teaching process of college teachers and students is created based just on QS of ANFIS subscale against the backdrop of ANFIS. The QS has two components, as depicted in Fig. 3.

Figure 3 shows that perhaps the QS are divided into two sections: teaching satisfaction and fundamental data about teachers and students. There are 42 total questions, with 3 and 39 in each of the first and next portions, correspondingly. The second component also includes nine dimensions. The QS is scored using a Likert's 5-point system, with 1–5 denoting "totally inconsistent" to "entirely consistent," accordingly.

3.2.1. Strict distribution and recovery of questionnaire study

Absolutely, 320 QSs are appropriated, 310 ones are recuperated, and the eight invalids are prohibited, including 302 legitimate QSs, with a powerful recuperation pace of 94.38%. Then, IBM SPSS 22.0 is utilized to process and dissect the information. The vitally factual strategies incorporate clear examination, free example *t*-test, relationship investigation, and relapse investigation. The essential element appropriation of tests is introduced in beneath:

3.2.1.1. Descriptive Observations. Descriptive statistics is a means of describing features of a data set by generating summaries about data samples. It's often depicted as a summary of data shown that explains the contents of data.

To average out these derived values in a specific area, the simple average, also called the mean, $\bar{A}$is calculated on a subset of variables. Standard deviation σ has also been used to quantify the average variation from the mean return of a certain area, in addition to mean. The computation formulas are as follows:

$$\bar{A} = \sum \frac{A}{N} \tag{19}$$

$$\sigma = \sqrt{\frac{\sum \left(A - \bar{A}\right)^2}{N}} \tag{20}$$

Where, N = Number of Observations

3.2.1.2. Inferential Observation. To compare the variations between the groups treated, inferential statistics are frequently used. Statistical techniques use data from the experiment's sample of individuals to compare the treatment groups and draw conclusions about the subject population as a whole. There are numerous inferential statistics kinds, including the t-test and others, and each is suitable for a particular research design and sampling methods.

(A) t-test:

Further, in order to analyze the mean differences in scheme norms and value index norms paired *t*-test has been applied by using the following formula.

$$t = \frac{\sum A}{\sqrt{N}\sum d^2 - \left(\sum d\right)^2 \sqrt{N-1}} \tag{21}$$

N = Number of Observations

d = Mean difference between of Scheme norm and values index norm

Harry Markowitz's portfolio theory of performance measurement offered a novel viewpoint and radically changed people's conceptions of the topic. Risk and return characteristics were taken into consideration when creating performance indicators for managed portfolios.

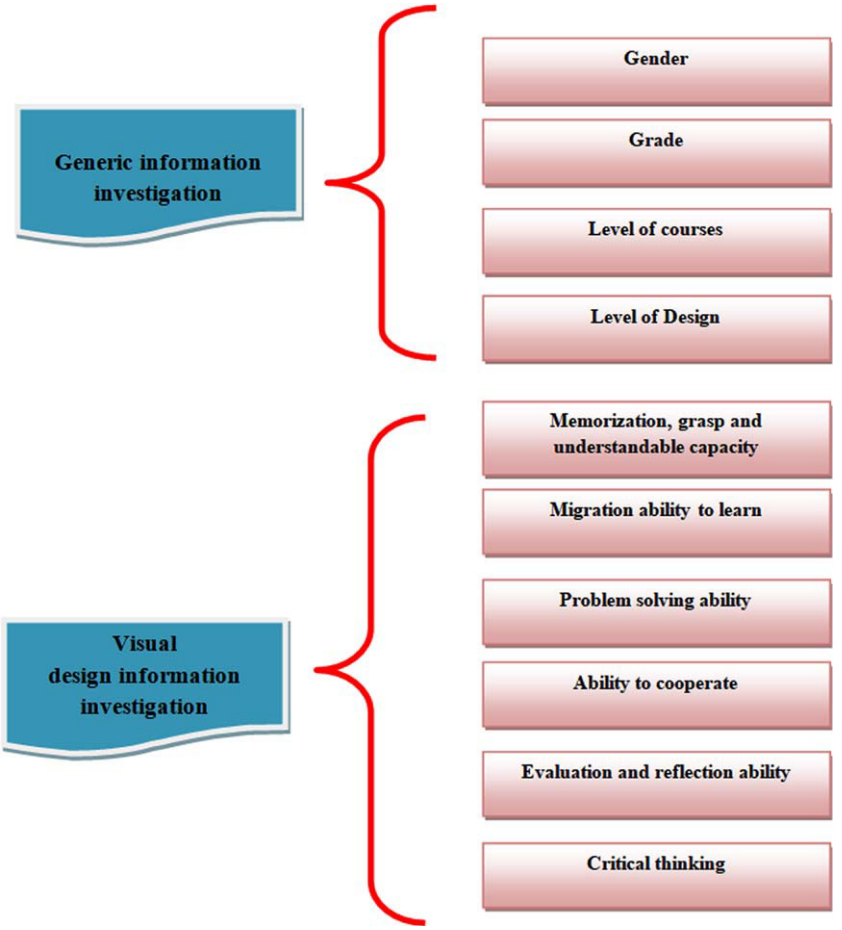

Fig. 3. QS Components.

3.2.1.3. Evaluative Observation. Giving the data that was gathered a meaningful value is part of evaluation. Evaluation, as one might guess, is the process of giving the measurement that was taken a "value." The data might be compared to a reference population (also known as "norm-referencing") or to a particular standard (also known as "criterion-referencing").

(A) Correlation

How closely two or more variables are related is determined by correlation. When talking about a relationship between two variables, the term "simple correlation" (r) is used, whereas "multiple correlations" refers to a relationship between more than two variables. (R). Two variables—scheme return and market benchmark return, or BSE SENSEX—are examined in this study. Thus, basic correlation is used and determined as follows:

$$t = \frac{N\sum AB - \sum A \sum B}{\sqrt{N\sum A^2 - \left(\sum A\right)^2 - N\sum B^2 - \left(\sum B\right)^2}} \tag{22}$$

N = Number of observations
A = Scheme Returns
B = Value Returns

Finally the extracted features are framed into data frame i.e.

$$\Gamma = [\Gamma_1, \Gamma_2, \Gamma_3, ...\Gamma_n] \tag{23}$$

3.3. *Reliability Analysis of Innovation and Entrepreneurship teaching for Teachers and Students Based on ANFIS*

As a general rule, the reasoning system, rationale, and perception of the general climate are regularly unclear and questionable. Hence, the customary insightful strategies that offered fresh worth outcomes frequently neglect sufficient for genuine situations. The fuzzy set hypothesis can be productively applied to determine equivocal and unsure information articulation and transmission. The crit-

ical thought behind the fluffy set hypothesis is that a component has a level of participation in a fluffy set that is characterized by enrollment capability. The most generally involved range for communicating the level of enrollment capability is the unit stretch [0, 1]. A fluffy set envelopes components that have various levels of enrollment in them, as shown in Fig. 3.

While applying ANFIS, too many information factors cause numerous boundaries for preparation, and this makes the framework convoluted, reducing its materiality. To tackle this issue, the primary predictions of factors such as individual qualities (IC), individual inspirations (IM), individual hindrances (IB), visual design inspirations (VDI), visual design boundaries (VDB), ecological inspirations (EM), and natural boundaries (EB) are utilised as information factors. The result of the ANFIS model is the degree of achieving a better exploration of entrepreneurship and innovation via visual design courses.

The observational information was gathered by a survey, as shown in Fig. 4. Polls are productive information-gathering devices in terms of specialist time, energy, and expenses. Likewise, polls are a productive information assortment system in situations where specialists know precisely what is required and how to quantify the significant factors. The majority of surveys were finished by email and the web, and some of them were finished by mail.

Circle hub on the ANFIS layer addresses the non-versatile hub, while the square addresses versatile hub, and that implies the worth of the boundary can be changed by the learning gave. A full depiction of the construction of ANFIS the layers are as per the following. a. b. c. d. The main layer is the versatile fluffy guidelines; every boundary can be changed by the capability hub, as displayed in condition (24).

$$L_{1,i} = \beta_{A_i}(X) \tag{24}$$

A condition (20) show that X is the contribution to hub i, and A_i simulated intelligence is the etymological mark. $L_{1,i}$ is a participation capability that decides the level of enrollment as per the given X. There are multiple ways of deciding participation capability, for instance with a trapezoidal capability. The subsequent layer is a no versatile layer, the capability of this layer is to duplicate all approaching qualities to deliver a result esteem, as displayed in condition (21).

$$L_{2,i} = w_i = \beta_{A_i}(X).\beta_{B_i}(\psi), i = 1, 2 \tag{25}$$

Each result hub addresses the terminating strength of a standard. The third layer is a no versatile layer, use to standardize the terminating strength. Standardization IS finished as displayed in condition (26).

$$L_{3,i} = \bar{w}_i = \frac{w_i}{w_1 + w_2}, i = 1, 2 \tag{26}$$

The fourth layer is a versatile layer, which worth can be tweaked by ensuing boundaries. The capability of this layer displayed in condition (27),

$$L_{4,i} = \bar{w}_i F_i = \bar{w}_i(s_i X + r_i \Psi + q_i) \tag{27}$$

Where $\bar{w}_i$ is the boundary set and is the third layer's result $s_i, r_i\ q_i$. The fifth layer is made up of a flexible hub that aggregates data from all sources and shows the results in condition (28).

$$L_{5,i} = \sum \bar{w}_i F_i = \frac{\sum_i w_i F_i}{\sum_i w_i} \tag{28}$$

Preparing set is utilized to fix the boundaries of the versatile layer. Preparing in ANFIS utilizes back engendering calculation. On the back engendering learning, the ensuing boundaries are made super durable. Mistakes that happen between versatile organization yield and the real result engendered back utilizing slope drop to fix the boundaries of the reason. The learning stage is called epoch.

4. Results and discussion

The work analysis the integrating innovation and entrepreneurship teaching in visual communication design professional courses. The primary data sets are collectively extracted as questionnaire data and based on that rule based ANFIS model is created and the degree of achieving a better exploration of entrepreneurship and innovation via visual design courses is observed.

4.1. Data collection

In light of ANFIS, the QS based on college instructors' and students' classroom instruction is developed using only the ANFIS subscale's QS [22]. Teaching satisfaction and basic information about teachers and students make up the two components of the QS. There are 42 questions in all, with 3 and 39 questions in the first and subsequent sections, respectively. There are nine dimensions in the second component as well. Likert's 5-point rating system is used

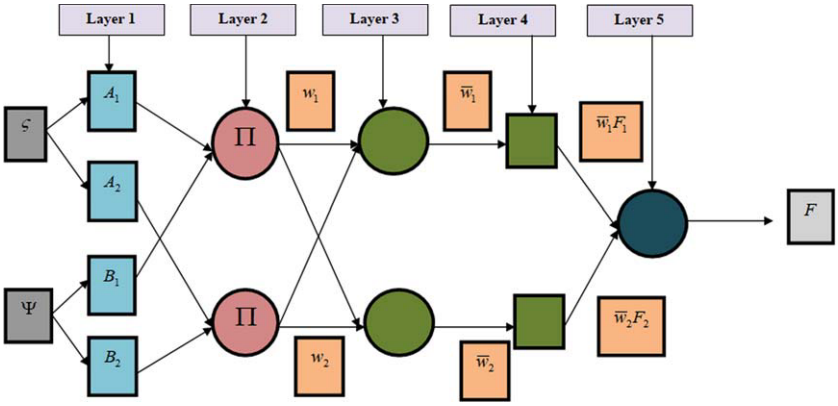

Fig. 4. ANFIS Architecture.

Table 1
Statistical data sample analysis

Q	Question	SD	Mean	SEM	t
3	institute has a learning platform or virtual learning environment	1690	160	0.390	85
4	use of internet at institute in the last 6 months	1974	189	0.217	85
5	Have a sense of harvest in learning innovative entrepreneurship courses	2136	201	0.661	85
6	Innovative entrepreneurship is permeated in the setting of professional courses	2170	210	0.712	85
7	The school will often invite successful entrepreneurs to give lectures	280	25.3	0.131	85
8	School IE education mainly focuses on Teachers' theoretical explanation	2516	231	0.909	85
9	The school has an innovative entrepreneurship Association	3348	321	0.888	85
10	Teachers of innovative entrepreneurship course have rich experience in independent Entrepreneurship	332	32.1	0.375	85
11	The school provides sufficient innovative entrepreneurship support funds	622	59.5	1	85
12	Teachers can solve problems in time in the process of innovative entrepreneurship	707	68	1	85
13	The innovative entrepreneurship activities held by the school are highly related to the theoretical courses	948	92	1	85
14	The school practice platform meets the needs of undergraduates' innovative entrepreneurship	1320	122	0.737	85

to rate the QS; 1–5 represents "totally inconsistent" to "entirely consistent," respectively.

4.2. Discussion

An ellipsoid model is built based on ANFIS, and a theoretical model is designed using DL. Reliability research reveals that, on general, UGs lack critical and innovative thinking. The development of students' critical and innovative thinking is mostly dependent on their willingness to learn and their capacity for cooperation. Thus, educators should focus on developing students' critical thinking skills as well as their motivation to learn and ability to collaborate with others. They should also encourage parents and other relevant social departments to support entrepreneurial education and give students access to a real entrepreneurial environment. In addition to improving students' capacity for innovation, seeing business opportunities, and engaging

in entrepreneurial activity, a more diverse education system that integrates IEE with professional education must be established. IEE's foundational courses ought to be more comprehensive, focused, and useful. The ellipsoid model can be used to assess the dependability of entrepreneurial classroom instruction, and the theoretical model developed can be applied to practise through research and analysis. The findings demonstrate that students' cooperative ability is crucial to classroom instruction, with path coefficients of 0.9 and 0.66 for cooperative ability to critical thinking and inventive thinking, respectively.

4.3. Performance analysis

Based on the sample questionnaire data various analyses have been made with respect to various metrics. Standard deviation (SD), mean, standard error mean (SEM), *t* test, MAE, MAPE, RMSE, R2, and correlation are the performance metrics. The high-level parameters are represented by the stated parameters. Parametric and non-parametric statistical approaches are the two most used categories. Parametric statistical analysis is *t*-test and Non-Parametric fried man test. Each of them has its own presumptions, characteristics, goals, and methods. Samples of questionnaires are taken for performance analysis and based on the questions Standard deviation (SD), Mean, Standard error Mean (SEM) and *t* test is validated in Table 1.

Table 1 illustrates the statistical validation of the extracted features via several parameters. From the observation, it can be said that the questionnaire collection is highly relevant to analyzing the E&I via VDC. As it can be seen, the spread of the data is forming a normal distribution, and the values are not that skewed, indicating high creativity. It can be stated that the data obtains an overall mean of between 250 and 400, and the data deviation is the maximum achieved between the ranges of 280 and 3348. The data maximum falls within the 2nd-order standard deviation. The obtained In that they allow the investigator to create confidence intervals around the sample statistic collected, standard error statistics are a form of inferential statistics that operate rather like descriptive statistics. The interval in which the population parameter will fall is estimated using the confidence interval that has been thusly created. This parameter estimation guide helps prepare appropriate data samples to analyse the work over VDC. Finally, the *t* test states the uniqueness of the data by saying that one questionnaire mean group is different from the other.

Table 2
Non-statistical samples of (Friedman test) analysis

N	22
Chi-square	52.342
Df	3
Asymp. Sig.	0.0

All the questions obtain a t-value of 85, which states that the groups are highly independent of each other and are unique to the work.

The Table 2 shows Inferential statistics, in particular the non-parametric Friedman test, were used to statistically analyse the data gathered at each of the intervention's four phases. The training had a statistically significant ($p < 0.01$) impact on the participant instructors' English language pedagogical competence, according to the results.

Figure 6 graphically demonstrates the data sample distribution. From figure it can be said that the data distributed is two tailed skewed normal distribution that illustrates a highly independent data understanding.

Table 3 gives the ANFIS-based regression analysis of the data. The primary metrics tested during hypothesis testing are the hypothetical model's MAE, MAPE, RMSE, R2, and correlation. 302 QSs were gathered and analysed using AMOS 21.0. Figure 6 displays the model fitting degree's assessment criteria and fitting outcomes. MAE elaborates the mean square sum of progressive residuals and shows how to assign less importance to outliers that don't make sense for the job; MAPE provides the good fit index; RMSE gives more priority to the highest error; R2 and correlation perform the comparative fitting index.

The value of MAE lies in the range of 16 to 16.88, which indicates that the ANFIS is robust against the outliers. Thereafter, the work obtains an MAPE, RMSE, and R2 overall ranging between 2.7 and 4, 12 to 14.77, and 0.1 to 0.5, demonstrating a high level of fitness. Values greater than 0.8 show a highly reliant model that analyses I&E improvements through VDC. The information above demonstrates that the theoretical model based on the ANFIS process fits the facts from the actual research and the degree of uncertainty well, achieving a better exploration of entrepreneurship and innovation via visual design courses.

The accuracy performance comparison of several machine learning models with the suggested model is displayed in Table 4.

1. **Age:**
   - 19
   - 20
   - 21
   - Above 21

2. **Gender:**
   - Boy
   - Girl

3. **Does your institute have a learning platform or virtual learning environment?**
   - Yes
   - No

4. **Have you used the internet at institutein the last 6 months?**
   - Yes
   - No

5. **Have a sense of harvest in learning innovativeentrepreneurship courses?**
   - Yes
   - No

6. **Did Innovative entrepreneurship is permeated in the setting ofprofessionalcourses?**
   - Yes
   - No

7. **Did institute will often invite successful entrepreneurs to givelectures?**
   - Yes
   - No

8. **Did institute IE education mainly focus on Teachers' theoreticalexplanation?**
   - Yes
   - No

9. **Did The institutehave an innovative entrepreneurship Association?**
   - Yes
   - No

10. **Did the Teachers of institute entrepreneurship course have richexperience in independent Entrepreneurship?**
    - Yes
    - No

11. **Did The instituteprovide sufficient innovative entrepreneurshipsupport funds?**

Fig. 5. Questionnaire data samples.

Figure 7 shows that every path in the new structural model's significance test and rationality test meets the required number, and the test result is legitimate.

Figure 8 demonstrates that while learning routes have not enhanced students' critical and inventive thinking, the process of I&E instruction in

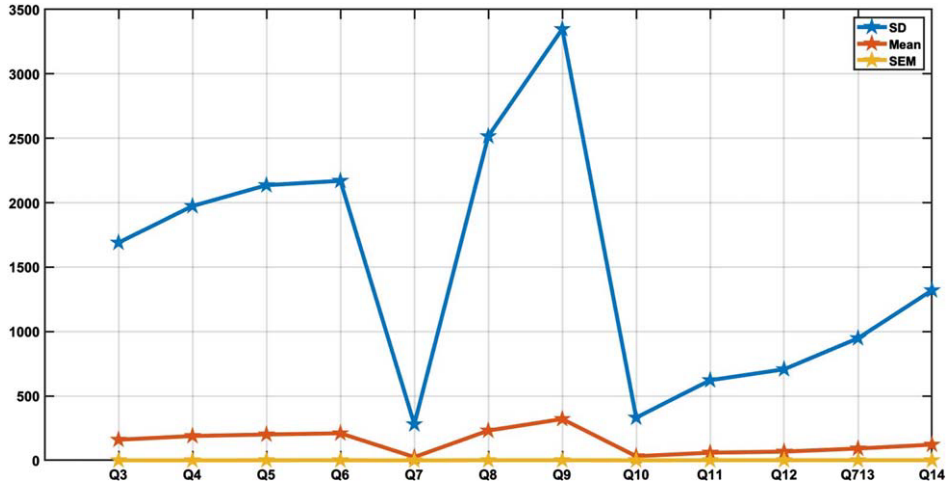

Fig. 6. Graphical demonstration of SD, Mean and SEM analysis.

Table 3
ANFIS based data analysis based on various parameters

Question	MAE	MAPE	RMSE	R2	Correlation
Q3	16.37	3.7	14.77	0.1	1
Q4	16.48	3.8	14.12	0.5	0.96
Q5	16.41	3.5	14.11	0.1	1
Q6	16.80	2.9	14.56	0.4	0.94
Q7	16.11	2.7	14.11	0.1	1
Q8	16.37	2.7	14.01	0.1	1
Q9	14.37	3.7	12.88	0.1	1
Q10	16.55	2.7	14	0.1	1
Q11	16.37	2.7	14.22	0.2	0.9
Q12	14.37	2.7	12	0.2	0.9
Q13	16.88	3.7	14.01	0.2	0.9
Q14	16	4	14.22	0.1	1

Table 4
Performance comparison

S.No	Algorithm	Accuracy	AUC	Chi-square	Df	Asymp. Sig.
1	Bayesian network	91.06	0.5	52.1	2.78	0.03
2	Neural network	92.18	0.172	52.20	2.98	0.04
3	Random tree	96.72	0.573	51.45	3.12	0.02
4	ANFIS	99.68	0.9988	52.342	3	0.0

higher education institutions will greatly alter learners' problem-solving capacity and evaluation and reflection ability. For learners to learn superficially, learning motivation is essential to their learning process. According to the aforementioned computation, learners' cooperative ability fosters both critical and inventive thinking, as seen by the route coefficients of cooperative ability for those two types of thinking.

The suggested algorithm has a mean user satisfaction value of 7.65, which is much higher than the scores of the computer vision algorithm and the linear discriminant algorithm, as indicated in Table 5. This result further validates the dependability of the suggested algorithm by showing that people are satisfied with its impact on the visual communication design style.

Table 5
Test of user satisfaction

Profession	Proposed	Computer Vision	Linear discrimination
Students	8.12	5.4	5.9
Designers	7.95	4.36	4.65
Other	6.89	4.85	6.47
Average	7.65	5.12	5.69

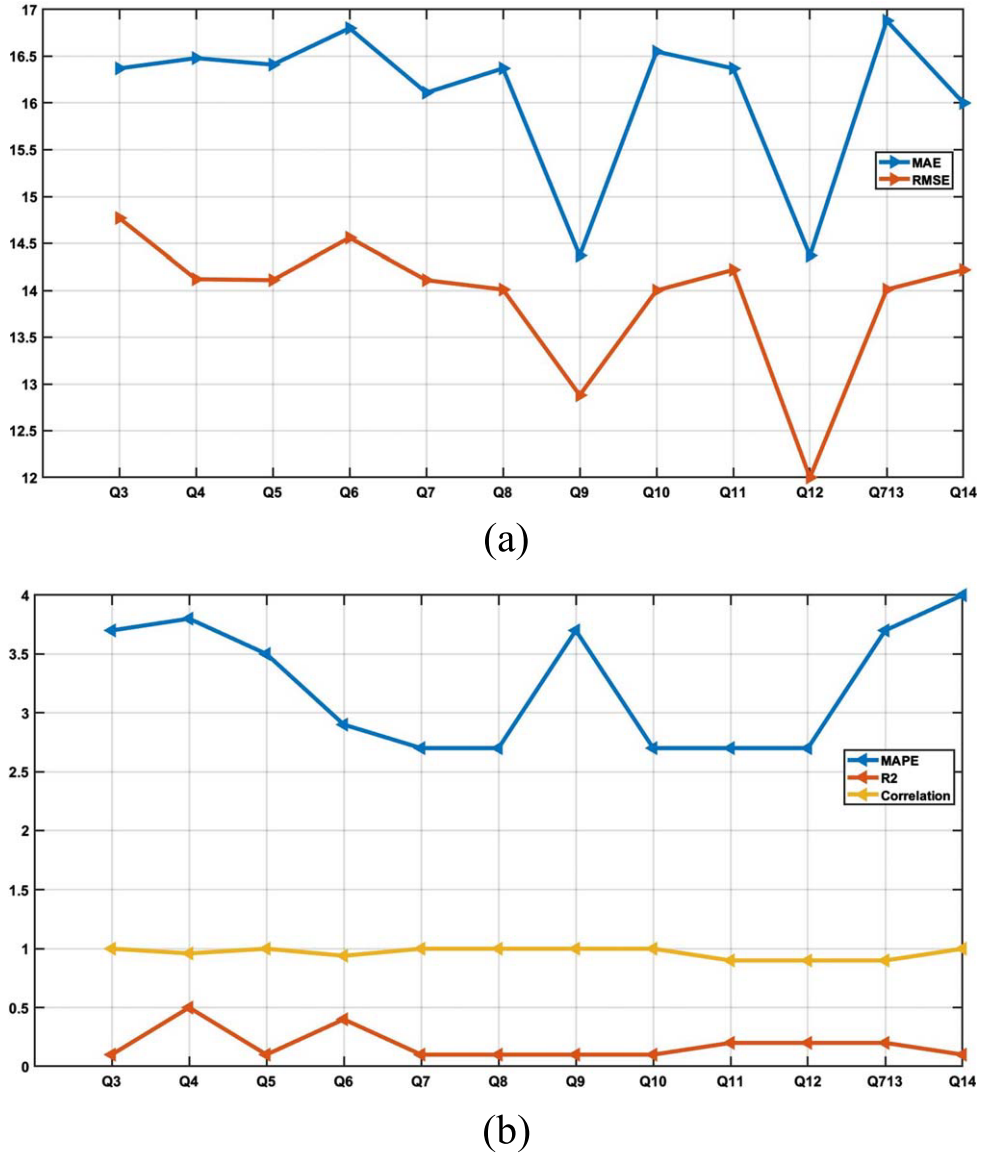

Fig. 7. Graphical analysis based on Regression parameters.

In conclusion, UGs typically lack critical and creative thinking when learning I and E. The keys to fostering the growth of students' critical and inventive thinking are, concurrently, their learning drive and cooperative skills. Overall, the designed questionnaires have good reliability, validity, and fitness.

5. Conclusions

Based on the four advantages of AI technology, this study develops the foundations of visual communication design. The artificial intelligence device's visual recognition module synthesizes the images it has gathered twice. A collection of rules specifies the logical relationship between the graphical elements based on the syntactic description of the automatic arrangement rules. To improve the processing of visual communication information, the regional distribution basis functions of visually communicated images of the AI interface are obtained and utilized for weak fusion of features. Along with this the work utilizes the ANFIS technique based on the hybrid optimization method and the software engineering method to assess the validity of entrepreneurship and innovation teaching for teachers and students,

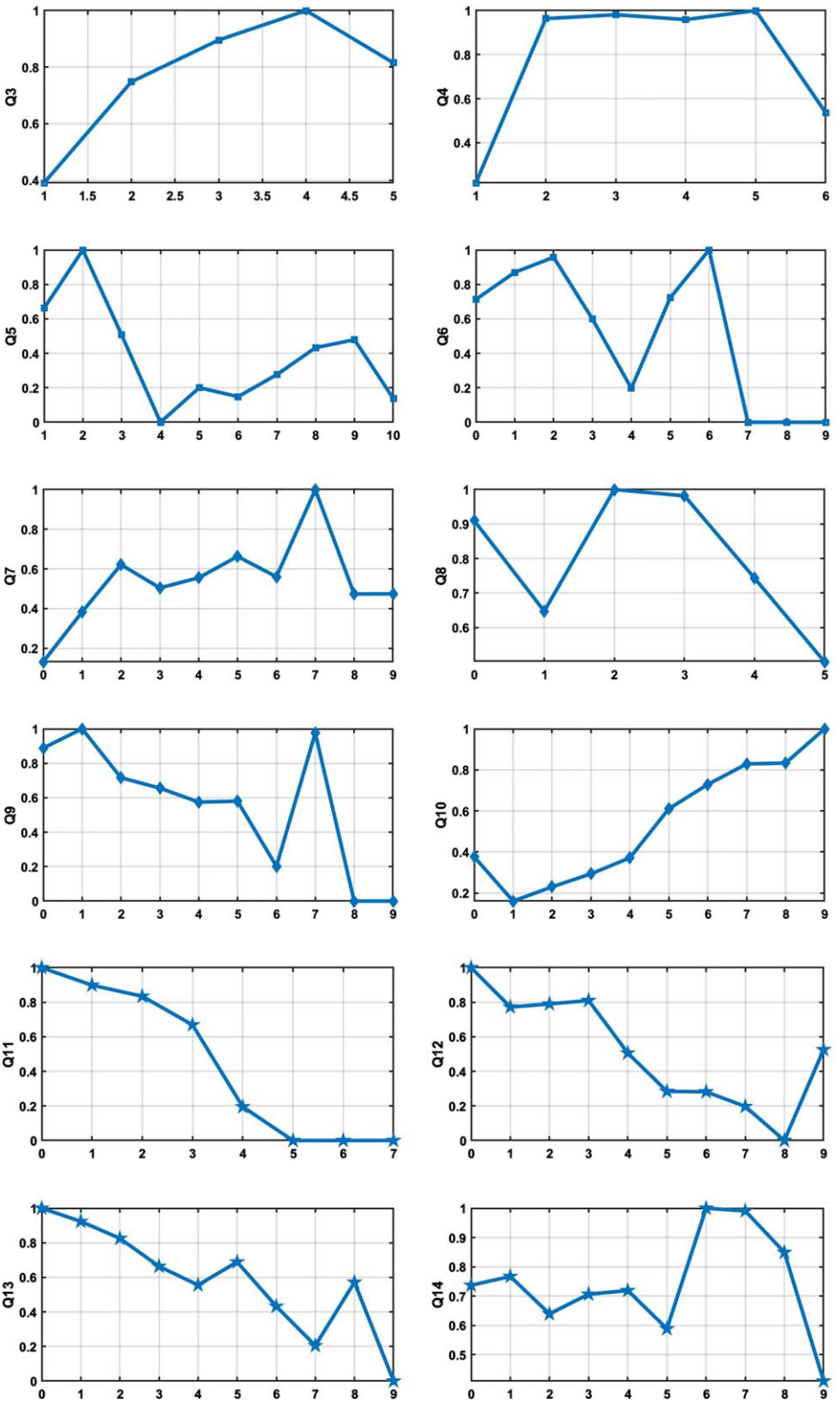

Fig. 8. Membership Functions for Each Question.

respectively. Following a thorough examination, the findings are outlined:

1) Once the theoretical model of ANFIS has been developed and assessed, elements from multiple dimensions influence the quality of learning about innovation through visual design courses, and there is a strategic alignment between all these components in terms of number and organisation.
2) The exploration strategy for informative data that effectively blends the topic of entrepreneurship and innovation with visual design is investigated using a hybrid optimisation analysis.

Novel AI algorithms are carried out, and the following findings are made:

1) A comparison between the proposed algorithm and the traditional linear discriminant method and computer vision method reveals that the mean value of satisfaction of the recommended algorithm is 7.65, which is greater than the linear discriminant algorithm and computer vision algorithm.
2) In the indoor visual saturation innovation discovery comparison experiment, AI-based technology outperforms traditional algorithm by 30%. It implies that by infusing rich elements into the work and fostering the creative expansion of the area, the proposed model can elevate the bar for visual communication creation.

Generally, it can be said that when examining novel ideas, powerful visual design seems to be more effective in developing an intuitive understanding of innovation and inspiring numerous novices to think creatively and decisively.

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