EAI Endorsed Transactions
on Context-aware Systems and Applications

Research Article ICST.ORG

Assistance to assessing rating students by language tuple-4 scale

Le Ngoc Hung [1,*], Vu Minh Loc [2] and Huynh Nguyen Thanh Luan[3]

[1]Sai Gon University, Vietnam, email: lnhung@sgu.edu.vn
[2]Ba Ria-Vung Tau University, Vietnam, email: vuminhloc@gmail.com
[3]Ho Chi Minh City Industry and Trade College, Vietnam, email: hntluan2005@gmail.com

Abstract

In this paper, we introduce an assistance to assessing rating the annual learning and process training of students in the opinion of experts, the approach of hedge algebra. It is advisary to make optimally fuzzy parameters with neural network in order to scale tuple-4 in accordance with current regulations on student assessment annual ranking including 7 levels.

Keywords: Hedge algebra;similar fuzzy space;language tuple-4 scale.

Received on 27 December, 2015, accepted on 28 January, 2016, published on 09 March, 2016

doi: 10.4108/eai.9-3-2016.151115

1. Introduction

The problem supports the decision on evaluating based on the expert opinions upon the valuation for the treatment of linguistic terms for the professionals often to make judgment about a plan, which is the aggregation of the fuzzy values to get the results that each expert feels happy because it is close to their evaluation. There are many approaches according to the fuzzy tuple theory as the authors [1-2-3-4], focusing mainly on using the same operator as Iowa. The hedge algebraic approach uses a scale of tuple-4 to record the comments of the experts. The advantages of this approach are preserving semantic results in aggregating the evaluations and optimally facilitating the fuzzy parameter tuple to summarize the results of the feedbacks from the experts on the same object to be close to each expert's evaluation of that object.

In [5] we mentioned building tools to assist to rate students with the scale of the previous standard fuzzy tuples. The result of evaluating each student is a vector where each component is an evaluation criterion implemented by the experts (teachers or school organizations). In this paper we use a fuzzy scale (Fuzzy grade sheet) to record the students evaluated by the experts as in [5], but the rating system is tuple-4 mentioned above. The results of evaluating each student is the sum of the opinions of the experts on those students. The results are ranked according to the degrees Poor, Weak, Average, Fair Average, Fair, Good, Excellent. The problem is of fuzzy classification. Then we optimize the fuzzy parameters by means of neural network using the supervised reverse statutory, based on the evaluation of specialized data recorded simultaneously with the figures and linguistic terms. The rest of the paper consisting of the parts of section two introduces hedge algebra of two hedges and the tuple-4. Section 3 presents the support of deciding on grading students with the tuple-4. Section 4 gives optimal algorithm of fuzzy parameter tuples and concluding remarks.

2. Hedge algebra and construction of tuple-4

Full linear hedge algebra AX of language variable X is a set of six components AX= (X, G, H, Σ, Φ,≤) where X = Dom(X), G = {c−, c+}∪{0, 1, W} is the set of generative elements, H is the set of hedges H = H−∪H+, H− = {h−q,…, h−1}, H+ = {h1, h2,…, hp} satisfying h−q >… >h−1 and h1 <h2 <…<hp,and Σ, Φ are 2 expanding operators, while "≤" is the relationship to X with induced semantics of natural language. Unlike the fuzzy sets in which the semantic is represented via fuzzy sets, in hedge algebra the semantics is represented by the order structures between the linguistic

[*]Corresponding author. Email: lnhung@sgu.edu.vn

values. This relationship indicates the relative and quantitative semantics of linguistic values in X, such as weak≤rather weak≤fairly good≤good≤very good. This structure is also the basis for quantifying qualitative semantics of the elements in hedge algebra.

Quantitative semantics is also represented by fuzzy notion of the elements in X and is defined as the "size" of the set H (x), where H (x) is the set of elements of X generated from x by hedges. So quantitative opacity of x is defined as follows:

Definition 1.1 [8]. Given a complete hedge algebra AX= (X, G, H, Σ, Φ,≤). Function fm: X → [0,1] is called a function measuring the fuzzy space of the elements in x, if:

fm1) fm(c–)+fm(c+)=1 and $\sum_{h\in H} f_m(hu) = f_m(u)$, with ∀u ∈X;

fm2) fm(x) = 0, ∀ x for H(x) = {x}. Especially, fm(0) = fm(W) = fm(1) = 0;

fm3) ∀x, y∈X,∀h ∈ H, $\frac{f_m(hx)}{f_m(x)} = \frac{f_m(hy)}{f_m(y)}$, this rate does not depend on x, y and it is called the degree measuring the opacity of hedge h, signified μ(h).

fm4) Putting $\sum_{-q\le i\le -1}\mu(h_i) = \alpha$ and $\sum_{1\le i\le p}\mu(h_i) = \beta$ we have $\alpha+\beta=1$ and $\alpha+\beta>0$.

The quantification of the word semantics allows to put the relationship between the assessment of the information on the label criteria and the assessment according to traditional methods. Quantitative semantics is a mapping assigning real values to the language values given by the definition:

Definition 1.2 [8] f_m is a function measuring the fuzzy space over X and complete linear hedge algebra AX = (X, G, H, Σ, Φ,≤). Quantitative semantic function υ in AX in combination with f_m is defined recursively as follows:

υ(W) = θ = fm(c–), υ(c–) = θ–αfm(c–)=βfm(c–), υ(c+) = θ +αfm(c+), 0 <θ< 1;

ii)

$$\upsilon(h_j x) = \upsilon(x) + Sgn(h_j x)\{\sum_{i=Sgn(j}^{j} \mu(h_i)\, fm(x) - \omega(h_j x)\mu(h_j)\, fm(x)\}$$

, where

$$\omega(h_j x) = \frac{1}{2}[1 + Sgn(h_j x)Sgn(h_p h_j x)(\beta-\alpha)] \in \{\alpha,\beta\}$$

, j∈ {j: –q ≤ j ≤ p & j ≠ 0} = [–q^p];

iii) υ(Φc⁻) = 0, υ(Σc⁻) = θ = υ(Φc⁺), υ(Σc⁺) = 1, and with j∈ [–q^p],

we have:

υ(Φh_jx) = υ(x) + $Sgn(h_j x)\{\sum_{i=sign(j)}^{j-1}\mu(h_i)\, f_m(x)\}$;

υ(Σh_jx) = υ(x) + $Sgn(h_j x)\{\sum_{i=sign(j)}^{j}\mu(h_i)\, f_m(x)\}$.

The functionality of hedges generates set H(x). With that property of set H(x), it is taken as a model of the fuzzy from x and its size is considered the fuzzy measurement of x, denoted fm(x) ∈ [0,1].

We see fm(x) completely determined if we give the values fm(c–), fm(c+) and μ(h), h∈H(x), called the parameters of the fuzzy space of X. These parameters are very important for the computation of other quantitative characteristics.

Definition 1.3. [6] Given $AX^2, \forall x \in X (k = l(x))$ the class length from x, approximately equivalent fuzzy level g $(g \ge 1)$ of x is roughly made up of two adjacent fuzzy space about the same level k+g including $\upsilon(x)$ called inside point, denoted ℑg(x) defined as follows:

i) If $\upsilon(x)=0$ or $\upsilon(x)=1$ then $\Im_g$(x) = $\Im_{k+g}$(y), for $y \in X_{k+g}$, $\upsilon x) \in \Im_{k+g}$(y)

Vice sersa,

ii) $\Im_g$(x) = $\Im_{k+g}(y_i)\oplus\Im_{k+g}(y_j)$, for $y_i, y_j \in X_{k+g}$, rmp ($\Im_{k+g}(y_i)$)= $lmp(y_j)) = \upsilon(x)$

Where ⊕ is the combination of the two adjacent fuzzy spaces.

Definition 1.4. [6] Given $AX^2, (k \ge 1)$, the similar fuzzy space of set $X_{(k)}$ denoted $\zeta_{(k)}$ is a set of similar fuzzy space of all grades from $X_{(k)}$ for $\forall x \in X_{(k)}$, ℑg(x) $\in \zeta_{(k)}, g + l(x) = k$ unchanged (ie $\forall x \in X_{(k)}$, ℑg(x) made up of the same fuzzy space of level k^*) and $\zeta_{(k)}$ is a partition of [0,1].

Definition 1.5. [6] Given $AX^2, k \ge 1, \forall x \in X_{(k)}$ identify the similar fuzzy space ℑg(x) $\in \zeta_{(k)}$ definition of the compatibility level $g = k + 2 - l(x)$ of quantitative value v for Grade x to be a mapping $s_g : [0,1]\times X \to [0,1]$ determined based on the distance from v to $\upsilon(x)$ and two similar fuzzy space close to ℑg(x) as follows:

$$s_g(v,x) = \max\left(\min\left(\frac{v-\upsilon(x)}{\upsilon(x)-\upsilon(y)}, \frac{\upsilon(x)-v}{\upsilon(z)-\upsilon(x)}\right), 0\right)$$

Where y,z are two grades defining two similar fuzzy space neighbors left and right of ℑg(x).

Theorem 1.1. [6] Given AX^2 hedge fuzzy parameter $0 < f_m(c^-), \mu(L) < 1$ (note that $f_m(c^+) = 1 - f_m(c^-), \mu(V) = 1 - \mu(L)$ with $u, v \in [0,1], u \ne v,$ always exist a similar partition level $k, \zeta_{(k)}$ (respectively set $X_{(k)}$ for $u \in$ ℑ(x), $v \in$ ℑ(y) , ℑ(y) $\in \zeta_{(k)}$ (or $x, y \in X_{(k)}$) and $x \ne y$.

Corollary 1.2. [6] Given AX^2, hedge fuzzy parameter $0 < f_m(c^-), \mu(L) < 1$ (note that $f_m(c^+) = 1 - f_m(c^-), \mu(V) = 1 - \mu(L)$ subset

$E \subset [0,1]$ always exists a similar partition level $k, \zeta_{(k)}$ (respectively set $X_{(k)}$) for

$u, v \in E, u \neq v, !\exists x \neq y, u \in \Im(x), v \in \Im(y), \Im(x), \Im(y) \in \zeta_{(k)}$

The classes of the fuzzy of X form a base of the topology of X, that is, it defines a topology on [0,1] for each open set of [0.1] to be a set of fuzzy space numbers. Considering the fuzzy of the Xk+2 and parting the spaces into the grades Ck(x), x∈X(k), so that they contain at least 2 fuzzy spaces of Xk+2 but their common ends are quantitative value υ(x).

Put Sk(x) = ⋃{ℑk+1:ℑk+1∈Ck(x)}. The class {Sk(x): x∈X(k)} is a partition of [0,1] and each Sk(x) called similar space level k of x∈X(k) of the same relation of level k, denoted as Sk (see [8]). In summary, the similar spaces have the following characteristics:

(i) $\{S_k(x): x \in X_{(k)}\}$ makes up a partition [0,1].

(ii) $\upsilon(x) \in S_k(x)$ and is the common ends of at least 2 spaces of X_{k+2}.

Definition 1.6 [7]. Given the fuzzy parameter values, performing tuple 4 of x $\in X_{(l)}$

set 4: (x, υ(x), r, $S_l(x)$), with r$\in S_l(x)$

where υ(x) is the quantitative value of x, $S_l(x)$ is the same semantic space of level l of x, called the same level. There is always υ(x) $\in S_l(x)$ and the meaning of υ(x) like the center (core) of a fuzzy tuple, meaning that it is compatible with the values of semantics of x. ■

Value r appears in the third component in the performance of tuple-4, where r∈δ(x)

Offset $r - \upsilon(x)$ is called the appropriate semantic deviation of value r . There is

Clause 1.2.[8] If r≤r' , words x(r) and x(r') in the representation of tuple-4 of r and r' satisfy inequality x(r) ≤x(r').

Definition 1.7. [7] The language scale of tuple-4 consists of verbal values of tuple- 4 as follows:

$$\{(x, \upsilon(x), r, S_l(x)): x \in S, r \in [0,1]\}. ■$$

3. Constructing a verbal scale assessing students

3.1. Constructing a verbal scale

Regarding the method, the different number scales as 5, 10, 20, 100, ... may provide for a scale of 10 to build a scale of language. Because application-oriented approach is to evaluate the results related to the students, so we should take the example of ranking the learning outcomes, student's training as a base for building.

The classification of the learning and training outcomes of students (based on the criteria available) out of 10 is defined as follows:

Excellent	: from 9 to 10 marks;
Good	: from 8 to 9 marks;
Fair	: from 7 to over 8 marks;
Fair-average	: from 6 to under 7 marks;
Average	: from 5 to under 6 marks;
Weak	: from 3 to under 5 marks;
Poor	: under 3

Since hedge algebra indicates naturally quantitative semantics, symmetry, that is, the graph structure demonstrates the order relation between the elements generated from c^-, the symmetric with neutral element with the graph denoting the order relation between elements generated from c^+, and our goal is to build a scale of language instead of a scale of 10, so we use hedge algebra with:

Generated element: Good, Bad

Hedge: V (very) ,L(Little), with H^+={V}, H^-={L}, β=μ(V), α=μ(L).

Hedge W is selected to ensure maximum symmetry of the language labels and thus it ensures all hedges are of the same nature yin-yang.

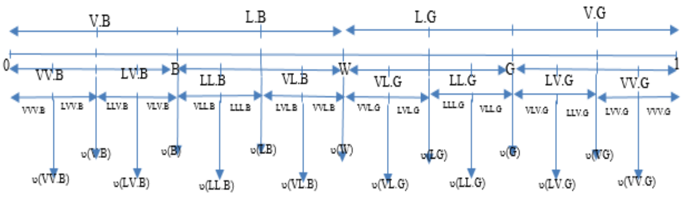

Figure 1. Similar space partition segment [0,1] by hedge algebra 2

As a rule, the evaluation results should put on a scale of 100 and ranking. The results presented in Item a. ensure that we always have a quantitative mapping with precision acceptable enough to move the assessments of language labels on a scale of 10 or 100.

At the end of the school-year, each student should have the evaluation results of their training. The results are based on a synthesis of the results evaluated by criterion 27. Each criterion has corresponding evaluation scale in 100. Based on the contents of each criterion and self discipline of students, members of the board (in class) will give points. These points are in form of qualitative assessment, ie the language comments. Through quantitative functions in hedge algebra, qualitative points will be converted to scores on the interval [0,1], then the provisions will be made into 100 point scale. Pursuant to the provisions on the evaluation and grading of students annual assessment of students, we build supporting systems rated by fuzzy classification method based on hedge algebras 2 (HA 2) (see table 1).

3.2. Building rules

5 experts (EXP(i), i = 1,2,3,4,5), who each represents a organization or a collective participating in evaluating and grading students. Specifically:

- The first expert (EXP (1)): Evaluating the sense of observing discipline and the academic performance of students.

- The second expert (EXP (1)): Evaluating the sense and the results to follow the rules - regulations at school.

- The third expert (EXP (1)): Evaluating the sense and the results participating in the political and social activities, culture, arts, sports, prevention of social evils.

- The fourth expert (EXP (1)): Assessing the civic quality and community relations.

- The fifth expert (EXP (1)): Assessing the sense and the participation results in charge of classes.

According to a rating of 100 students of a university and method of generating fuzzy rule based on similar space systems [7], we have a system of 19 following rules:

r_1:=if (Ev-exp(1)=(LG,2.5)) and (Ev-exp(2)=(LVG,2.0)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.9)) and (Ev-exp(5)=(VLG,0.6)) then Eval =(VG,8.1).

r_2:=if (Ev-exp(1)=(LG,3.0)) and (Ev-exp(2)=(LVG,2.5)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.4)) and (Ev-exp(5)=(VLG,1.0)) then Eval =(VVG,9.9).

r_3:=if(Ev-exp(1)=(W,1.5))and(Ev-exp(2)=(LG,1.7)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(LVG,1.5)) and (Ev-exp(5)=(LB,0.3)) then Eval =(LG,7.0).

r4:=if(Ev-exp(1)=(VG,3.0)) and(Ev-exp(2)=(VG,2.5)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(VLG,0.6)) then Eval =(VG,9.6).

r5:=if(Ev-exp(1)=(LG,2.0)) and (Ev-exp(2)=(VG,2.5)) and (Ev-exp(3) =(LVG,1.5)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(LB,0.3)) then Eval =(LG,7.8).

r_6:=if (Ev-exp(1)=(W,1.5)) and (Ev-exp(2)=(VG,2.5)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(VG,1.0)) then Eval =(VG,8.5).

r_7:=if (Ev-exp(1)=(WB,0.0)) and (Ev-exp(2)=(LLB,0.7)) and (Ev-exp(3) =(W,1.0)) and (Ev-exp(4)=(VG,1.9)) and (Ev-exp(5)=(VLG,0.6)) then Eval =(LVB,4.2).

r_8:=if (Ev-exp(1)=(LB,0.8)) and (Ev-exp(2)=(WLB,1.0)) and (Ev-exp(3) =(W,1.0)) and (Ev-exp(4)=(VLB,0.5)) and (Ev-exp(5)=(LLB,0.4)) then Eval =(LVB,3.8).

r_9:=if (Ev-exp(1)=(VLB,1.0)) and (Evexp(2)=(VLG,1.5)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(LB,0.3)) then Eval =(VLG,6.3).

r10:=if (Ev-exp(1)=(W,1.6)) and (Ev-exp(2)=(VLB,0.9)) and (Ev-exp(3) =(LB,0.9)) and (Ev-exp(4)=(W,0.6)) and (Ev-exp(5)=(W,0.5)) then Eval =(W,5.0).

r11:=if (Ev-exp(1)=(VLB,1.4))and(Evexp(2)=(VG,2.5)) and (Evexp(3) =(LVLB,1.1))and(Evexp(4)=(VLG,1.0)) and (Ev-exp(5)=(LB,0.3)) then Eval =(LG,6.2).

r12:=if (Ev-exp(1)=(LB,1.0)) and (Ev-exp(2)=(VG,2.5)) and (Ev-exp(3) =(VLG,1.5))and(Ev-exp(4)=(VLG,1.0) and (Ev-exp(5)=(LB,0.3)) then Eval =(LG,6.3).

r13:=if (Ev-exp(1)=(W,1.5)) and (Ev-exp(2)=(VG,2.5) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(W,0.6)) then Eval =(G,8.1).

r14:=if (Ev-exp(1)=(VLB,1.3))and(Ev-exp(2)=(VG,2.5)) and (Evexp(3)=(LVLB,1.1))and(Evexp(4)=(VLG,1.0)) and (Ev-exp(5)=(LB,0.3)) then Eval =(LG,6.1).

r15:=if (Ev-exp(1)=(W,1.5)) and (Ev-exp(2)=(VLB,1.0)) and (Ev-exp(3) =(LB,0.9)) and (Ev-exp(4)=(W,0.6)) and (Ev-exp(5)=(LB,0.2)) then Eval =(VLB,4.6).

r_{16}:=if (Ev-exp(1)=(LB,0.7)) and (Ev-exp(2)=(WLB,1.1)) and (Ev-exp(3) =(W,1.0)) and (Ev-exp(4)=(VLB,0.5)) and (Ev-exp(5)=(W,0.6)) then Eval =(LVB,3.9).

r_{17}:=if (Ev-exp(1)=(EB,0.0)) and (Ev-exp(2)=(WLB,1.1)) and (Ev-exp(3) =(W,1.0)) and (Ev-exp(4)=(VLB,0.5)) and (Ev-exp(5)=(W,0.6)) then Eval =(EB,3.2).

r_{18}:=if (Ev-exp(1)=(LG,2.0)) and (Ev-exp(2)=(VG,2.5)) and (Ev-exp(3) =(VLG,1.2)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(W,0.6)) then Eval =(LLG,7.8).

r_{19}:=if (Ev-exp(1)=(VLB,1.4)) and (Ev-exp(2)=(VG,2.5)) and (Ev-exp(3) =(LVLB,1.1)) and (Ev-exp(4)=(VLG,1.0)) and (Ev-exp(5)=(LB,0.3)) then Eval =(LG,6.2).

Inside:

a) Ev-exp (i), (i = 1, ... 5) and Eval is the symbol of the assessment of the experts numbered 1-5 and evaluation of school for students.

b) pairs (VG, 2.0) are simultaneous assessments by the score and the value of language in the scale tuple-4

Table 1. Expert's assessment card for rating students

ASSESSMENT CARD FOR COMPLEHENSIVE RATING STUDENTS ANNUALLY

FULL NAME: STUDENT'S CODE:

CLASS: FACULTY:

SCHOOL-YEAR:

Standard		1	2	3	4	5	6	7	8	9	Notes
EXP(1) (30)	St 1.1										
	St 1.2										
	St 1.3										
	St 1.4										
	St 1.5										
	St 1.6										
	Total										
EXP(2) (25)	St 2.1										
	St 2.2										
	St 2.3										
	St 2.4										
	Total										
EXP(3) (20)	St 3.1										
	St 3.2										
	St 3.3										
	Total										
EXP(4) (15)	St 4.1										
	St 4.2										
	St 4.3										
	St 4.4										
	St 4.5										
	St 4.6										
	St 4.7										
	Total										
EXP(5) (10)	St 5.1										
	St 5.2										
	St 5.3										
	St 5.4										
	St 5.5										
	St 5.6										
	St 5.7										
	Total										
TOTAL											

4. Optimal parameters and conclusion

4.1. Optimal parameters for the tuple-4 scale to match purposes

Considering the tuple-4 scale of 9 ranks in form of $(x, \upsilon(x), r_i, I_2(x))$. Where $I_2(x)$ is the similar space of x, including $\upsilon(x) \in I_2(x), r_i \in I_2(x)$,

Where $x \in$ {E_bad, V_bad, bad, L_bad, medium, L_good, good, V_good, E_good}.
According to parameters fm(bad)=W and μ(L) we have:
$\upsilon($E_bad$)$ = fm(VVV.bad) = $w\mu^3(L)$;
$\upsilon($V_bad$)$ = fm(V_bad) = $w.(1-\mu^2(L))$;
$\upsilon($bad$)$ = $w.(1-\mu(L))$; $\upsilon($L_bad$)$ = $w.(1-\mu(L)+\mu^2(L))$; $\upsilon($L_good$)$ = $w+(1-w).\mu(L).(1-\mu(L))$;
$\upsilon($good$)$= $w+(1-w).\mu(L)$;
$\upsilon($V_good$)$ = $w+(1-w).\mu(L).(2-\mu(L))$;
$\upsilon($VVV.good$)$= $1-(1-w).(1-\mu(L))^3$;
The tuple-4 scale of 9 ranks as follows:
(E_bad, $\upsilon($E_bad$)$, r_1, $(0,\upsilon(VV.bad))$;
(V_bad, $\upsilon(V_{bad}), r_2, [\upsilon(VV.bad), \upsilon(LV.bad))$;
(bad, $\upsilon(bad), r_3, [\upsilon(LV,bad), \upsilon(LL.bad))$;
(L_bad, $\upsilon($L_bad$)$, $r_4, [\upsilon(LL.bad), \upsilon(VL.bad))$;
$(medium, W, r_5, [\upsilon(VL.bad), \upsilon(VL.good))$;
$(L\_good, \upsilon(L\_good), r_6, [\upsilon(VL.good), \upsilon(LL.good))$;
$(good, \upsilon(good), r_7, [\upsilon(LL.good), \upsilon(LV.good))$;
$(V\_good, \upsilon(V\_good), r_8, [\upsilon(LV.good), \upsilon(VV.good))$;
$(E\_good, \upsilon(VVV.good), r_9, [\upsilon(VV.good), 10))$.

Compared to the current 10-point scale used to assess students in the universities, the values of language in the end roughly similar in the tuple-4 scale should satisfy the following conditions:

$\upsilon(VL.bad)$ is the left adjacency of average rank, so
$\upsilon(VL.bad) =$ $w.(1-\mu(L)+2\mu^2(L)-\mu^3(L)) = 5$

$$\leftrightarrow \mu(L)-2\mu^2(L)+\mu^3(L) - \frac{W-5}{W} = 0 \quad (1)$$

$\upsilon(VL.good)$ is the left adjacency of fair average rank, so:

$$\upsilon(VL.good) = w + (10-w).\mu(L) - 2\mu^2(L) + \mu^3(L) = 6$$

$$\leftrightarrow \mu(L) - 2\mu^2(L) + \mu^3(L) - \frac{w-5}{w} = 0 \quad (2)$$

$\upsilon LL.good)$ is the left adjacency of fair rank, so:

$$\upsilon(LL.good) = w + (10-w).(\mu(L) - 2\mu^2(L) + \mu^3(L) = \frac{7-w}{10-w}$$

$$\leftrightarrow \mu(L) - \mu^2(L) + \mu^3(L)) - \frac{7-w}{10-w} = 0 \quad (3)$$

$\upsilon(LV.good)$ is the left adjacency of good rank, so:

$$\upsilon(LV.good) = w + (10-w).(2\mu(L) - 2\mu^2(L) + \mu^3(L)) = 8$$

$$\leftrightarrow 2\mu(L) - 2\mu^2(L) + \mu^3(L) - \frac{8-5}{10-w} = 0 \quad (4).$$

In the fact of the assessment of students, the distinction between fair adjacency (ie head at the fair top) and fair as the distinction between good adjacency (ie, they are in the good top) and good enough is required to take a closer look as well as evaluating a student not to achieve average rank should be prudent. The poor students are usually disciplined in the school-year, while the outstanding students are rare and demonstrate the clear superiority. So it is found that for the tuple-4 scale to match the current scale for assessing and ranking, the fuzzy parameters are required to satisfy the conditions (1), (3) and (4), including the binding inferred from (1) and (2): 5 <w <6 and μ (L) <0.5.

The conditions (1), (2), (3) are the system of Level 3 equations with two unknowns w and μ (L), therefore the answer is merely approximate; or otherwise, the conditions agree with only allowed errors. Therefore we use regression neural network with 3 layers in which the input layers have two buttons for entering parameters, the hidden layer has 3 and the output has 5 to announce after achieving the results with allowed errors.

The following table presents 20 results with good errors. (see Table 2)

Table 2. 20 results with good errors

fm(B)	**μ(L)**	**υ(VL.B)=0.5**	**υ(LL.G)=0.7**	**υ(LV.G)=0.8**
0.5500000	0.4924000	0.4802211	0.7161977	0.8286718
0.5510000	0.4920000	0.4801679	0.7160642	0.8285353
0.5520000	0.4930000	0.4823100	0.7164984	0.8289760
0.5499000	0.4930000	0.4802138	0.7163353	0.8288012
0.5664000	0.4910000	0.4943489	0.7260090	0.8344553
0.5666000	0.4880000	0.4941148	0.7252554	0.8335424
0.5687000	0.4840000	0.4954138	0.7253153	0.8330299
0.5700000	0.4236963	0.4897807	0.7076419	0.8126643
0.5710000	0.4237000	0.4908962	0.7077400	0.8102700
0.5700100	0.4240000	0.4908852	0.7077910	0.8128094
0.5720000	0.4230000	0.4907274	0.7049592	0.8124465
0.5710000	0.4236960	0.4950640	0.7080338	0.8125356
0.5740000	0.4237631	0.49450064	0.7104229	0.8144429
0.5750000	0.4045774	0.49522542	0.7024555	0.8079048
0.5751000	0.4045773	0.49252541	0.7055246	0.8079040
0.5800000	0.3870000	0.49565489	0.7039980	0.8035617
0.5800000	0.3860000	0.49559814	0.7036969	0.8032389
0.5800000	0.3868338	0.49564539	0.7039334	0.8035546
0.5800000	**0.3868000**	**0.49567097**	**0.7039220**	**0.8035542**

With the final result (green line in the table) we have the tuple-4 scale to evaluate the results of students' learning and training as follows:
(E_bad, 0.82, r_1, [0, 1.33)); (V_bad, 2.2,r_2, [1,33, 2.71)); (bad, 3.56, r_3, [2.71, 4.10)); (L_bad, 4.42, r_4, [4.1, 5,0)) (Medium, 5.8, r_5, [5.0, 6,4)); (L_good, 6.80, r_6, [6.40, 7.0)); (Good, 7.42, r_7, [7.0, 8.0)); (V_good, 8.42, r_8, [8.0, 9.0)); (E_good, 9.62, [9.0, 10]).

According to this scale tuple-4 and the assessment of experts in pair of number values and the value of language, we have calculated the reliability and the support of each rule to corporate and select the system of 19 rules in 3.2 and the results of the system include the following rules:

r_1:=if (Ev-exp(1)=(LG,2.5))and(Ev-exp(2)=(LVG,2.0)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.9)) and (Ev-exp(5)=(VLG,0.6)) then Eval =(VG,8.1).

r_2:=if (Ev-exp(1)=(LG,3.0)) and(Ev-exp(2)=(LVG,2.5)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.4)) and (Ev-exp(5)=(VLG,1.0)) then Eval =(VVG,9.9).

r_4:=if (Ev-exp(1)=(VG,3.0)) and (Ev-exp(2)=(VG,2.5)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(VLG,0.6)) then Eval =(VG,9.6).

r_5:=if (Ev-exp(1)=(LG,2.0)) and (Ev-exp(2)=(VG,2.5)) and (Ev-exp(3) =(LVG,1.5)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(LB,0.3)) then Eval =(LG,7.8).

r_8:=if (Ev-exp(1)=(LB,0.8))and(Ev-exp(2)=(WLB,1.0)) and (Ev-exp(3) =(W,1.0)) and (Ev-exp(4)=(VLB,0.5)) and (Ev-exp(5)=(LLB,0.4)) then Eval =(LVB,3.8).

r_9:=if (Ev-exp(1)=(VLB,1.0))and(Evexp(2)=(VLG,1.5)) and (Ev-exp(3) =(VG,2.0)) and (Ev-exp(4)=(VG,1.5)) and (Ev-exp(5)=(LB,0.3)) then Eval =(VLG,6.3).

r_{10}:=if (Ev-exp(1)=(W,1.6))and(Ev-exp(2)=(VLB,0.9)) and (Ev-exp(3) =(LB,0.9)) and (Ev-exp(4)=(W,0.6)) and (Ev-exp(5)=(W,0.5)) then Eval =(W,5.0).

r_{15}:=if (Ev-exp(1)=(W,1.5))and(Ev-exp(2)=(VLB,1.0)) and (Ev-exp(3) =(LB,0.9)) and (Ev-exp(4)=(W,0.6)) and (Ev-exp(5)=(LB,0.2)) then Eval =(VLB,4.6).

4.2. Comments and conclusion

Our above suggested tuple-4 scale is corresponding to the point scale used to evaluate and rank students yearly currently:

Specifically.

E_good is corresponding to Excellent including from 9 to 10 points.

V_good is corresponding to Good including from 8 to nearly 9 points.

Good is corresponding to Fair including from 7 to nearly 8 points.

- Point 5 is the distinction level between average (Medium) and failing (L_bad) – including from poor 4.0 to nearly 5.

- For the median average rating (Medium) and above average (L_good) in provisions grading students in 6 points, in a tuple-4 scale we suggest 6.4. The rankings assesses "fairly average" is intended to motivate the students at the top rated as moderate, close to the ranking fair. So, in fact, many experts suggest that this point ranking must be narrow, from 6.5 to 7. We assign the semantics to two classes from Medium and L_good in the tuple-4 scale and it suitable with this view.

- The authors in [8] proposed a tuplet-4 scale and set out the requirement "To determine the semantics to be suitable with the practice, we choose the parameter values so that the score range from Medium has the left adjacency 5.0". In fact, this requirement is satisfied, but merely to distinguish ranks from average or above average and not average, the remaining boundaries between the "weak" and "medium"; "Fair" with "good" or "average" .... are not suitable for evaluation and grading scale with current students. It proves that the optimal fuzzy parameters matching the purposes with use of optimization methods and results that we proposed are correct and are of high practical value.

4.3. Fuzzy system used to assess students

Using fuzzy system and tuplet-4 scale to indicate and synthesize comments of the collective experts on the same object is consistent with the nature and habits of thinking. In this paper we propose a method of making up fuzzy systems towards building an automatic system of evaluating students based on expert opinion, responsible officials in a university, where the methodology is solving the fuzzy classification problem. In clinical legal steps we ask each expert to use concomitantly language values in the tuple-4 scale and scores to assess the same student. From this value pair, we synthesize the results of the evaluations of the number of students needed to calculate the reliability of each law and implement clinical law rules. So the law systems after clinical laws will suit the evaluation results of collective university experts. Finally the obtained legal system for building automatic systems of assessing a university student has been identified.

References

[1] F. Herrera and E. Herrera-Viedma and Luis. Martnez. A fusion approach for managing multi-granularity linguistic termsets in decision making, Fuzzy Sets and System 114(2000) 43-58.

[2] Ming and Yanjing Zhang, The OWA-VIKOR method for multiple attributive gruop decision making in 2-tuple linguistic setting, Journal of convergence information technology(JCIT) volume 7 number 2 february (2012) 184-191.

[3] Yan-PingJiang and Zhi-PingFan and JianMa, A method for group decision making withmulti-granularity linguistic assessment information, Information Sciences 178(2008) 1098–1109.

[4] F.Herrera and E.Herrera-Viedma, Linguistic decision analysis: steps forsolvingdecision problemsunder linguistic information, Fuzzy sets and system 115(2000) 67-82.

[5] Vu Minh Loc, Building fuzzy aggregation algorithms to form systems of support for student assessment decision making, Posts and Telecommunications Journal, Special issue of “Research and Development on Telecommunications and Information Technology”. Number.10 (2003) 103-109.

[6] Nguyen Cat Ho, Nguyen Thai Son Duong Thanh Long, Hedge Algebras with Limited Number of Hedges and Applied to Fuzzy Classification Problems, Journal of Science and Technology, vol 48 Number.5 (2010) 23-36.

[7] Nguyen Cat Ho, Tran Thai Son, Hedge algebraic approach in construction the language scale for assessment, Journal of Computer Science and Cybernetics Vol.28 number.3 (2012) 260-273.

[8] Nguyen Cat Ho, Nguyen Thanh Thuy, Nguyen Van Long, Le Ngoc Hung, On relation between syntax and semantics of terms in building methods for solving multi-criteria decision making problems, Journal of Science and Technology Vol.50 Number.2