OCTAGONAL FUZZY ASSIGNMENT PROBLEM USING DIFFERENT RANKING METHOD

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Abstract

Assignment problems in the real world havevariousapplicationsintherealworldbecause oftheirwideapplicationsinmarketing,production management, informationtechnology,etc. Traditional assignment problem cannot be efficaciously used for real-life problem, therefore the use of fuzzy assignment problems is extra-considered necessary.

In this paper, the fuzzy assignmentproblem is formulated to crisp assignmentproblem using Different Ranking Techniquesand the Hungarian method has been applied tofindan optimalsolution.

Keywords-OctagonalFuzzy Numbers,RankingMethods,

AssignmentProblem(Hungarian method)

Introduction

Allocation models are also a unique class of line ar programming problems in which the goal is t o allocate the same amount of work to machines of the same type with the least total cost**.**.It is also a particular case oftransportationproblems.Zadeh(1965) added the idea of fuzzy units to deal with Vagueness and ambiguity in practical lifein real-life conditions.Since then, exquisite efforts had been spent; tremendous advances had been made in the improvement of several methodologies and their utility to various selection troubles.

The objective of the fuzzy assignment proble m is to find the minimum fuzzy assignment c ost among workers with different job skills. F uzzy assignment problems are more realistic t han classical assignment problems because m ost realworld environments are uncertain. Sev eral authors have discussed the fuzzy assignm ent problem in different ways.

Anil gotmare dealt with fuzzy assignment problem with qualitative data,lingustic variable which helps to convert qualitative data into quantitative data.

Chen designed a fuzzy assignment model in which all individuals are considered to have same skills and proved theromes related to assignment problems.

Kuhn has discussed the hungarian method for solving assignment problem. Hlayel abdallah ahmed has used best candidate method to solve optimization methods.

Thorani et.al has discussed the fuzzy assignment problem with generalised fuzzy numbers. Pranab biswas and Santanu kumar gosh solved assignment problem with the lingustic costs.

The purpose of allocation is to distribute multiple tasks to multiple machines with minimal cost.Fuzzy assignmentproblems have been causedby the developmentofnumerousmethodologiesa ndtheirapplicationstovariousdecisionpro blems.

Fuzzy assignment troubles have acquired a first-rate interest in the latest years.

The Hungarian method proposed by Kuhn (1955) is extensively used to solve APs.Thechoice of a ranking method is vital indecision-making.

Thereareseveralwaystorank fuzzy numbers and there is no uniqueway to order the fuzzy numbers using existingranking techniques.

Furthermore, some of theranking techniques are giving differentranking orders in different α-cuts.
Decision makers should consider the different characteristics of classification methods to determine if the selected fuzzy classification method can support the characteristics of the decision problem**.**

2.Preliminaries

Definition2.1 FuzzySet

If X is a collection of objects denoted generally by x,then a fuzzy set A in X is a set of ordered pairs:

$$A=\{(x,\mu_A(x))|x€X\}$$

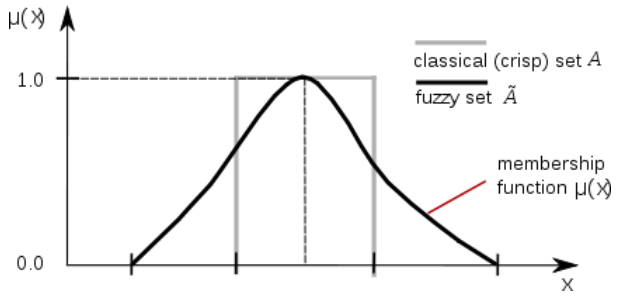
Where μ_A (x) is called the membership function or grade of membership.
Consequently,the fuzzy set is a vague boundary set'compared with the

crispset.

Definition2.2Degree Of Membership Function

AFuzzysetischaracterizedbyamembershipfunction mapping element domain, space, oruniverse of discourse X(range of all possiblevalues for input to a fuzzy system)to theunitinterval[0,1].
(i.e)$A=\{(x,\mu_A(x))|x€X\}$

Here, μA: X→[0,1] is a mapping referred to as the degree of membership function of the fuzzy set A, and μA(x) is referred to as the membership value of x€X in the fuzzy set. These membership grades are often represented through real numbers starting from [0,1]



Definition2.3Fuzzy Number

AfuzzysetA on,a setofrealnumbers is calleda fuzzy numberwhich satisfies at least thefollowingthreeproperties:

1) Amustbeanormalfuzzyset.
2) A^{α} mustbeaclosedintervalfor everyα €(0,1].
3) Thesupportof A, A^{0+}bounded.

Definition2.4
OctagonalFuzzy Number

A real fuzzy number ã is a octagonalfuzzy number denoted by(a_1,a_2,a_3,a_4,a_5,a_6,a_7,a_8)wherea$_1$, a_2,a_3,a_4,a_5,a_6,a_7,$a_8$arerealnumber sand the membership function $\mu_{\tilde{a}}$ (x) isgivenbelow

$$\mu_{\tilde{A}}(x)=\begin{cases} 0 & x<a_1 \\ 1/2(x-a_1/a_2-a_1) & a_1\le x\le a_2 \\ 0.5 & a_1\le x \\ 1/2+1/2(x-a_2/a_4-a_2) & a_3\le x\le a_4 \\ 1, & a_4\le\le a_5 \\ 1/2+1/2(a_6-x/a_6-a_5) & a_5\le x\le a_6 \\ 0.5, & a_6\le x\le a_7 \\ 1/2(a_8-x/a_8-a_7), & a_7\le x\le a_8 \\ 0 & x\ge a_8 \end{cases}$$

3.Algorithm To Solve Fuzzy Assignment Problem

Step1:Firsttestwhetheror not the given fuzzy cost matrix of a fuzzy assignment problem is balanced. If not alternate this unbalanced assignment problem right into a balanced one with the aid of including the number of dummy rows/columns and the values for the entries are 0.If it is a balanced one(i.e.number of persons is equal to the number of works)
Step2:Defuzzifythefuzzycostbyusingranking methods.
Step 3: Apply the assignment Algorithm tocalculatethebestcombinationtoproducethesmalles t costs, where oneperson should beassigned to only one work and onework requiresonlyoneperson.

3.1 Algorithm For HungarianMethod

Step 1:Locatethelowestcostelementineachrowofthecostm atrix.Thensubtract thissmallestelementfromeachelementinthatrow.Asar esult,thereshallbe at leastperzeroinone and allrow of thenew grid.
Step 2: Now consider one and all column of the reduced cost grid from step 1 an d find the smallest element in it. Subtracts the min imum value from each item in the column. There will again be at least per zero in one and all column of the second reduced cost grid.
Step 3:
Draw a minimum of various horizontal and vertic al morphs to cover all 0 elements, an equal numbe r of morphs drawn, so the number of rows/column s is the best answer. Go to step 6. If the number of rows is less than the number of rows and columns , go to step 4.
Step 4:
Select the smallest uncovered cost element f rom the modified matrix from step 3. Subtra cts this element from all uncovered elements and adds it to each value at the intersection

of two lines.
Step 5:Repeatstep 3 and 4till an optimalsolutionis obtained (i.e. number of lines a drawn-equalnumberof columns/rows.
Step 6:Makefeasiblejobassignments onzeroelements.

3.2 Ranking Technique Based On Centroid Method

$$R(A_0) = G_A(x_0, y_0) = (2a_1+7a_2+10a_3+8a_4+8a_5+10a_6+7a_7+2a_8)*8w$$

$$\frac{}{54} \qquad \frac{}{27}$$

3.1 Robust Ranking Technique

$$R(\tilde{a}) = \int \tfrac{1}{2}[(a_2-a_1)\alpha+a_1,(a_4-(a_4-a_3)\alpha),(a_6-a_5)\alpha+a_5,a_8-(a_8-a_7)\alpha]0$$

NumericalExample

Considerabalancedfuzzyassignmentprobleminwhichalltheprofitcoefficientsareoctagonal fuzzynumbers

(-2,-1,0,1, 2,3,7,8)	(-4,-2,0,2, 4,6,8,10)	(-3,-1,1,3, 5,7,9,11)	(4,5,6,7, 8,9,10,11)	(-3,-2,-1,0, 1,2,5,6)
(1,3,5,7, 9,11,12,13)	(9,10,11,12, 13,14,15,16)	(2,4,5,7, 9,10,12,13)	(6,7,8,9, 10,11,12,13)	(-6,0,6,12, 18,24,30,36)
(-3,-1,0,1, 2,4,5,6)	(2,3,4,5, 6,7,8,9)	(3,6,7,8, 9,10,12,13)	(1,2,3,5, 6,7,8,10)	(0,1,2,3, 4,5,6,7)
(5,6,8,10, 12,13,14,15)	(-1,0,1,3, 5,7,9,10)	(9,10,11,12, 13,14,15,16)	(-3,-1,1,2, 3,4,7,10)	(-3,-1,1,3, 5,7,9,11)
(5,6,7,10, 12,14,15,17)	(-2,-1,0,1, 2,3,4,5)	(-1,0,1,2, 3,4,5,6)	(2,4,5,6, 7,8,9,11)	(2,3,4,5, 6,7,10,11)

UsingtheCentroidRankingMethodtheaboveproblemcanbereducedasfollows:

	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ
A	0.59	0.89	1.19	2.22	0.25
B	2.31	3.70	2.30	2.81	4.44
C	0.54	1.63	2.55	1.54	1.03
D	3.10	1.23	3.70	0.80	1.18
E	3.16	0.44	0.74	1.92	1.72

Proceedingby HungarianMethod,theoptimal allocationsare:therefore

	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ
A	0.34	0.64	0.94	1.97	**0**
B	0.01	1.41	**0**	0.51	2.14
C	**0**	1.09	2.01	1	0.49
D	2.3	0.43	2.9	**0**	0.38
E	2.72	**0**	0.3	1.48	1.28

A→Ⅴ;B→Ⅲ;C→Ⅰ;D→Ⅳ;E→Ⅱ

TheFuzzyOptimalCost:

OptimalCost=0.25+2.30+0.54+0.80+0.44

=4.33

Usingthe Robust Ranking Methodtheaboveproblemcan bereduced asfollows:

	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ
A	4.5	6	8	15	2
B	15.5	25	15.5	19	30
C	4	11	17.5	10	7
D	20.5	8.5	25	5.5	8
E	21	3	5	13	12

ProceedingbyHungarianMethod,theoptimalallocationsare:therefore

	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ
A	2.5	4	6	13	**0**
B	0	9.5	**0**	3.5	14.5
C	**0**	7	13.5	6	3
D	15	3	19.5	**0**	2.5
E	18	**0**	2	10	9

A→ Ⅴ;B→ Ⅲ;C→ Ⅰ; D→ Ⅳ;E→ Ⅱ

TheFuzzyOptimalCost:

OptimalCost=2+15.5+4+5.5+3

=30

By comparing the resultsofthe Optimal Solutionforthe OctagonalFuzzyAssignment Problem the Optimal Cost can bereduced by using the Centroid Ranking methodunderthe Hungarian method.

It is concluded that the Centroid Ranking methodhasgivenbetterresultsthantheexistingmethod.

1. **Conclusion:**

In this paper, the fuzzy costs of an Octagonal Fuzzy Assignment Problem have been defuzzified into crisp values through the use of the Centroid Ranking method, and the Robust Ranking method, and it's solved by way of the Hungarian approach.