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Informatics

Multi-Attribute Group Decision Making Method Based on Evidence Theory: Application in Determination of the Best Emergency Rescue Point for the Victims in a Road

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It is known that, in emergency situations, multi-attribute group decision making (MAGDM) models are characterized by insufficient objective data and a lack of time to respond to the task. Evidence theory or Dempster-Shafer belief structure is an effective tool for describing such incomplete information in decision-making models when the expert and his knowledge are involved in the estimations of the MAGDM parameters. However, evidence theory has the limitation that the argument data bodies of a compositional data body must be independent. This condition cannot be met in decision-making models based on expert knowledge. This is due to the fact that expert assessments are often overlapping and vague. That is why we consider a new emergency decision-making model, where expert judgments are represented in intuitionistic fuzzy numbers and the data structure is described within the evidence theory. First of all, for each emergency plan, each expert presents his evaluations in the decision-making matrix with intuitionistic fuzzy numbers. Then, based on the intuitionistic fuzzy similarity relation defined on the expert evaluations, the similarity between the experts themselves is established. The weights of the experts are also determined. The model attribute weights are assumed to be known. Intuitionistic fuzzy representations of expert assessments are transformed into focal probabilities of the body of data, the same basic probability distributions (focal probabilities or basic probability assignments). After that, the expert decision-making plan will be revised and the a priori focal probabilities will be transformed into revised a posteriori focal probability. The latter will be aggregated into a unified focal probability in order to make a final decision. A numerical example in determination of the best emergency rescue point for the victims in a road emergency is discussed for demonstration of the new decision-making scheme. The results of the example show the effectiveness and reliability of the new approach. *© 2024 Bull. Georg. Natl. Acad. Sci.*

emergency MAGDM, intuitionistic fuzzy sets, fuzzy similarity relation, evidence theory, focal probabilities

In recent years, the number of emergency situations caused by natural disasters or other extreme events that occur in our society has increased significantly. All this has caused serious damage to world economic and social development and stability. In order to avoid these problems to a certain degree in the future, a new research direction is being created in the emergency logistics problem of the response phase. A science-based rapid and optimal response approach has become one of the hot spots of modern research [1]. It becomes clear that emergency decision-making problems have become one of the main foundations of emergency management. Emergency decision-making problems need to make quick decisions for different scenarios, as well as use incomplete information about multiple attributes to make uncertain decisions. Effective emergency decision-making models should be able to reduce the number of victims and material losses. In order to solve the mentioned problem, taking into account the knowledge and assessments of experts in the field under conditions of incomplete information, it becomes necessary to construct tools for effective aggregation of interacting attributes of different types in order to make emergency optimal decisions. For this purpose, interesting fuzzy emergency decision-making approaches have been developed in recent years [2-8]. The body of evidence approach [9,10] has one important advantage over other uncertainty description approaches. This is a relatively simple possibility of accumulating incomplete and uncertain information at the decision-making level [11]. The authors of [12] use the DS/AHP method in the problem of identifying focal elements of an incomplete decision matrix. A new approach solves the multi-attribute group decision-making problem in the environment of incomplete information. The authors of [13] used the fuzzy evidence theory to build a fuzzy risk analysis model in the environment of uncertain and incomplete information. Let us note that the evidence theory has negative properties as well. The body of evidence is a subjective phenomenon that can change at the discretion of the expert. Moreover, the condition of independence between bodies of evidence may not be fulfilled. In emergency management, as a rule, many qualified experts are called to coordinate the decision-making of the relevant department. Therefore, in the process of presenting expert information, the independence of bodies of evidence becomes particularly visible. In our approach, it is assumed that experts make judgments in intuitionistic fuzzy values. This is logical and natural, because the expert's intellectual activity is aimed at making assessments not only with the degree of membership, but also with the degree of non-membership [14]. Transforming vague evaluations into independent evidence can better solve emergency problems in real life. In evidence theory, the plausibility function and the basic probability assignment can be used to describe upper and lower bounds on the degree of belief in certain evidence. This has a one-to-one correspondence with the membership function in the intuitionistic fuzzy set and the remaining part except the non-membership function. The intuitionistic fuzzy set [15] can well represent the uncertainty of expert evaluations (hesitation) in the decision-making process. As mentioned, intuitionistic fuzzy estimation incorporates both compatibility and noncomputability degrees to describe the three qualitative states of the system. These are: support, opposition, and hesitation. For the problem mentioned above with unknown and uncertain weights, this work proposes an emergency decision-making method based on the multi-attribute intuitionistic fuzzy sets and evidence theory.

The second section describes the main aspects of intuitionistic fuzzy sets. A general definition of the relation of similarity of such sets is given. This section also provides basic definitions of the evidence theory. Focal probabilities for intuitionistic fuzzy sets are constructed using similarity relations. The third section presents the scheme for making new emergency decisions. The fourth section describes the Case Analysis. The fifth section is devoted to the conclusions part, where the main results and future perspectives of the research are presented.

Preliminary Concepts

Intuitionistic fuzzy sets

Definition 1 [14]. Let U be some universe. An intuitionistic fuzzy set (IFS) M on U is called the ordered set $M=\{(u,\mu_M(u),\nu_M(u))|u\in U\}$, where $\mu_M(u)$ and $\nu_M(u)$ represent the membership and non-membership of the element u in U belonging to M; for any $u\in U$, $\mu_M(u)\in[0,1]$, $\nu_M(u)\in[0,1]$ and $0\le\mu_M(u)+\nu_M(u)\le 1$.

The value $\pi_M(u)=1-\mu_M(u)-\nu_M(u)$ represents the hesitation that the element u in U belongs to M. It is clear that $\pi_M(u)\in[0,1]$. Let $IFSs(U)$ denotes the set of all intuitionistic fuzzy sets on U.

Definition 2. The binary relation Sim, $Sim: IFSs(U)\times IFSs(U)\to[0,1]$ is called a similarity relation if for any three IFSs M,N and K on U the following properties are true:

$0\le Sim(M,N)\le 1$;

if $M=N$, then $Sim(M,M)=1$; $Sim(M,N)=Sim(N,M)$;

if $M\subseteq N\subseteq K$ $M,N,K\in IFSs(U)$, then $Sim(M,K)\le Sim(M,N)$, $Sim(M,K)\le Sim(N,K)$.

On Dempster-Shafer believe Structure

Definition 3. The complete set of mutually incompatible basic propositions is called the recognition framework $Q=\{q_{1,},q_2,...q_i,...q_n\}$, which represents all possible answers to a certain question, but only one answer is correct.

The power set of the recognition frame refers to the set consisting of all the subsets of the recognition frame Q, expressed as $2^Q=\{\phi,\{q_1\},\{q_2\},...,\{q_n\},\{q_1,q_2\},...,Q\}$.

Definition 4 [15]. Let Q be the recognition framework, the basic probability assignment (BPA) or focal probability (FP) m is a mapping $m:2^Q\to[0,1]$, for which $\forall A$, $A\subseteq Q$, $m(A)\ge 0$ and

$$\begin{cases} m(\phi)=0; \\ \sum_{A\subseteq Q} m(A)=1. \end{cases}$$

If $A\subseteq Q$, $m(A)>0$ then A is called a focal element. The set of all focal elements is denoted by Φ. Q always belongs to Φ. The pair $<\Phi,m>$ is called a body of evidence.

Definition 5 [16]. Suppose $m_1,m_2,...,m_l$ are l number of BPAs with same set of focal elements $\Phi=\{B_1,B_2,...,B_q\equiv Q\}$ on the same recognition framework Q. Then the synthesis rule has the following face:

$$\begin{cases} m(\phi)=0\ ; \\ m(A)=\dfrac{\sum_{B_{i_1}\cap...\cap B_{i_l}=A}\prod_{j=1}^{l} m_j(B_{i_j})}{1-\sum_{B_{i_1}\cap...\cap B_{i_l}=\phi}\prod_{j=1}^{l} m_j(B_{i_j})} \end{cases}. \tag{1}$$

Construction of Emergency Decision-Making Model

Let for some emergency multi-attribute group decision-making problem with unknown and uncertain weights, there are decision schemes as alternatives $D=\{d_1,d_2,...,d_n\}$, experts $E=\{e_1,e_2,...,e_m\}$, and decision attributes $B=\{b_1,b_2,...,b_p\}$ included in the MAGDM. Let the evaluation of the scheme d_i with respect to the attribute b_j by the expert e_k is expressed in the intuitionistic fuzzy value $c_{ij}^k=(\mu_{ij}^k,\nu_{ij}^k)$. Then the emergency decision-making evaluation matrix $C^k=\left[c_{ij}^k\right]_{p\times n}$ of the expert e_k's IFS can be presented as:

$$C^k=\begin{matrix} & d_1 & d_2 & \dots & d_n \\ b_1 & (\mu_{11}^k,\nu_{11}^k) & (\mu_{12}^k,\nu_{12}^k) & \dots & (\mu_{1n}^k,\nu_{1n}^k) \\ b_2 & (\mu_{21}^k,\nu_{21}^k) & (\mu_{22}^k,\nu_{22}^k) & \dots & (\mu_{2n}^k,\nu_{2n}^k) \\ \dots & \dots & \dots & \dots & \dots \\ b_p & (\mu_{p1}^k,\nu_{p1}^k) & (\mu_{p2}^k,\nu_{p2}^k) & \dots & (\mu_{pn}^k,\nu_{pn}^k) \end{matrix}.$$

Decision-making steps

Step 1: Construct the BPAs. Taking the scheme set $D=\{d_1,d_2,...,d_n\}$ as the recognition framework ($Q=D$), the expert e_k makes the evaluations in the intuitionistic fuzzy numbers vector $c_j^k=\left[(\mu_{1j}^k,\nu_{1j}^k),...,(\mu_{pj}^k,\nu_{pj}^k)\right]$. Let only single element focal sets are selected: $\Phi=\{\{d_1\},\{d_2\},...,\{d_n\},D\}$ in the role of body of evidence. Then a priori basic probability assignments $m_j^k(.)$ is expressed as [16]:

$$m_j^k(.)=\begin{cases} m_j^k(\phi)=0\ ; \\ m_j^k(\{d_i\})=\dfrac{\mu_{ij}^k}{\sum_{i=1}^{p}(1-\nu_{ij}^k)}\ ; \\ m_j^k(D)=1-\sum_{i=1}^{n}m_j^k(d_i). \end{cases} \tag{2}$$

Step 2: Calculate the intuitionistic fuzzy similarity relation among experts, determine the weight of experts. Calculate a posteriori basic probability assignment. Today's developed methods for measuring the similarity of intuitionistic fuzzy sets are mainly based on the concept of distance between them [17-20]. That is, the distances between their membership attribution and non-membership non-attribution functions are measured. The distances between the hesitant indices are also often measured here. The total aggregation of all three types of distances gives the final distance between IFSs, and from this the similarity relation between them is also defined. We also took this path.

Let $M=\{(u_i,\mu_M(u_i),\nu_M(u_i))|u_i\in U\}$, $N=\{(u_i,\mu_N(u_i),\nu_N(u_i))|u_i\in U\}$ be two IFSs on $U=\{u_1,u_2,...,u_n\}$, let $g(u)=(1/2)(\mu(u)+1-\nu(u))$, , the fuzzy similarity relation on IFSs is defined as:

$$Sim(M,N)=1-\frac{1}{n}\sum_{i=1}^{n}\left[\begin{array}{l}\dfrac{|\mu_M(u_i)-\mu_N(u_i)|+|g_M(u_i)-g_N(u_i)|+|\nu_M(u_i)-\nu_N(u_i)|}{6}+\\ +\dfrac{\max(|\mu_M(u_i)-\mu_N(u_i)|+|g_M(u_i)-g_N(u_i)|+|\nu_M(u_i)-\nu_N(u_i)|)}{2}\end{array}\right]. \tag{3}$$

If we use formula (3), we can measure the similarity between experts e_s and e_t, as the similarity between their intuitionistic fuzzy estimates $M=c_j^s=\left[(\mu_{1j}^s,\nu_{1j}^s),...,(\mu_{pj}^s,\nu_{pj}^s)\right]$ and

$N = c_j^t = \left[(\mu_{1j}^t, \nu_{1j}^t), ..., (\mu_{pj}^t, \nu_{pj}^t)\right]$ made with respect to the fixed attribute *j*. After that, we define the weight of the expert e_k in relation to the attribute j with similarities $Sim(c_j^s, c_j^t),\ s,t \in E,$ as: $\lambda_j^k = \dfrac{\sum_{s=1, s\neq k}^{m} Sim(c_j^s, c_j^k)}{\sum_{s=1}^{m}\sum_{t=1}^{m} Sim(c_j^s, c_j^t)}$. By normalizing these weights in [0,1], we get discount factors: $\alpha_j^k = \dfrac{\lambda_j^k}{\max\{\lambda_1^k, \lambda_2^k, ..., \lambda_n^k\}},\ j = 1,...,n.$ Taking discount factors into account, it is already possible for each expert e_k to correct a priori base probability distributions $m_1^k,\ m_2^k, ...,\ m_n^k$ to a posteriori base probability distributions $\widehat{m}_1^k, \widehat{m}_2^k, ..., \widehat{m}_n^k$:

$$\widehat{m}_j^k(.) = \begin{cases} \widehat{m}_j^k(\phi) = 0; \\ \widehat{m}_j^k(d_i) = \alpha_j^k \cdot m_j^k(d_i)\ ,\ i = 1,...,n; \\ \widehat{m}_j^k(D) = 1 - \sum_{i=1}^{n} \widehat{m}_j^k(d_i). \end{cases} \tag{4}$$

Step 3: Aggregation of expert decision. Based on the Dempster-Shafer belief structure bodies synthesis formula (1), we obtain the final total focal probability m_{Total} from the a posteriori base probability distribution,

$$m(\phi) = 0,\ m(d_i) = \frac{\sum_{j=1}^{n}\sum_{k=1}^{m} \widehat{m}_j^k(d_i)}{1 - \sum_{j=1}^{n}\prod_{k=1}^{m} \widehat{m}_j^k(d_i)},\ i = 1,...,n;\ \ m(D) = 1 - \sum_{i=1}^{n} m(d_i), \tag{5}$$

whose values $m_{Total} = \{m(d_1), m(d_2), ..., m(d_n),\ m(D)\}$ represent the relation of ranking of alternatives $\succ$. We say that the alternative d_i is better than the alternative d_j if $m(d_i) > m(d_j)$:

$$d_i \succ d_j \Leftrightarrow m(d_i) > m(d_j). \tag{6}$$

Case Analysis

In this section, an example from [21] is discussed concerned a road emergency case. Our goal is to show that the method presented in the paper, which is based on intuitionistic fuzzy sets and the evidence theory, is usable, effective and appropriate.

After a traffic accident, our model will be used to determine the best rescue point among the four emergency response points. Let's say these points are $D = \{d_1, d_2, d_3, d_4\}$. Suppose that the group of invited experts consists of three persons. Let the assessment attributes consist of four units $B = \{b_1, b_2, b_3, b_4\}$. These are: travel capacity (b_1), reserve capacity (b_2), dispatch capacity (b_3) and logistics support capacity (b_4). Suppose that the group of experts agreed on the following attribute weights $W = \{w_1, w_2, w_3, w_4\} = \{0.35, 0.20, 0.25, 0.20\}$. Table 1 presents expert ratings for possible alternatives with respect to all attributes. Estimates are represented in intuitionistic fuzzy values.

Let us go through the steps of the scheme presented in the previous paragraph on the data of Table 1:
Step1: Construction of the base probability assignment (BPA). Insert the data from Table 1 into Formula 2 to obtain the base probability assignments. The results are shown in values m_j^k.

Table 1. Experts' intuitionistic fuzzy estimates of rescue points - $c_{ij}^k = (\mu_{ij}^k, \nu_{ij}^k)$

Attributes	Experts\Rescue Points	d_1	d_2	d_3	d_4
b_1	e_1	(0.35,0.55)	(0.65,0.15)	(0.45,0.35)	(0.15,0.65)
	e_2	(0.65,0.35)	(0.55,0.25)	(0.65,0.15)	(0.75,0.15)
	e_3	(0.45,0.45)	(0.85,0.15)	(0.55,0.15)	(0.65,0.25)
b_2	e_1	(0.25,0.45)	(0.45,0.15)	(0.95,0.15)	(0.85,0.15)
	e_2	(0.55,0.25)	(0.45,0.35)	(0.55,0.15)	(0.35,0.25)
	e_3	(0.15,0.35)	(0.25,0.35)	(0.45,0.155)	(0.25,0.35)
b_3	e_1	(0.55,0.15)	(0.65,0.25)	(0.65,0.15)	(0.75,0.15)
	e_2	(0.55,0.25)	(0.75,0.25)	(0.55,0.35)	(0.75,0.25)
	e_3	(0.55,0.25)	(0.85,0.15)	(0.55,0.25)	(0.75,0.25)
b_4	e_1	(0.55,0.3)5	(0.55,0.25)	(0.75,0.35)	(0.75,0.25)
	e_2	(0.55,0.25)	(0.65,0.15)	(0.75,0.25)	(0.75,0.25)
	e_3	(0.65,0.25)	(0.65,0.25)	(0.75,0.25)	(0.65,0.25)

Table 2. Apriori base probability assignments - m_j^k

Attributes	Expert	d_1	d_2	d_3	d_4	D
b_1	m_1^1	0.1211	0.2401	0.1621	0.0410	0.4357
	m_1^2	0.1716	0.1416	0.1917	0.2022	0.2929
	m_1^3	0.1350	0.3500	0.0563	0.2874	0.1713
b_2	m_2^1	0.0507	0.1310	0.2626	0.2325	0.3232
	m_2^2	0.1465	0.1351	0.1465	0.1048	0.4671
	m_2^3	0.0432	0.0568	0.1432	0.0568	0.7000
b_3	m_3^1	0.1329	0.1813	0.1616	0.2010	0.2932
	m_3^2	0.1710	0.2357	0.1714	0.2356	0.1863
	m_3^3	0.1614	0.2326	0.1614	0.2024	0.2422
b_4	m_4^1	0.1765	0.1569	0.2532	0.2438	0.1696
	m_4^2	0.1417	0.1719	0.2027	0.2024	0.2813
	m_4^3	0.1776	0.1778	0.2385	0.1674	0.2387

Step 2: For each attribute, let us calculate the expert similarity relations, represented in intuitionistic fuzzy values. Let us calculate the experts weights. Calculate the posteriori base probability assignments. Using formula (3), we calculated the values of the similarity relation of experts $Sim(c_j^s, c_j^t)$, $j = 1,...,4$, with respect to a specific attribute. We got the following results:

$Sim(c_1^s, c_1^t) \equiv \{Sim(c_1^1, c_1^2),\ Sim(c_1^1, c_1^3),\ Sim(c_1^2, c_1^3)\} = \{0.7215, 0.0685, 0.8410\}$,

$Sim(c_2^s, c_2^t) = \{0.8405, 0.7015, 0.8285\}$, $Sim(c_3^s, c_3^t) = \{0.5905, 0.9005, 0.9554\}$,

$Sim(c_4^s, c_4^t) = \{0.9285, 0.9089, 0.9237\}$.

We then substitute the obtained similarity values into formula (4) to calculate the values of the posteriori basis probability assignments (calculations are omitted here).

$$m_1 = \{0.1688, 0.3145, 0.2085, 0.1898\}\ 0.1214$$
$$m_2 = \{0.1269, 0.1453, 0.3297, 0.2254\}\ 0.1727$$
$$m_3 = \{0.1787, 0.2841, 0.1524, 0.2915\}\ 0.0933$$
$$m_4 = \{0.2180, 0.1573, 0.2194, 0.3341\}\ 0.0712\ .$$

Step3: The attribute weight is known, and the evidence is synthesized. Then we use the formula (5) and calculate the values of the total base probability assignments.

$$m_{total} = \{m(d_1), m(d_2), m(d_3), m(d_4)\} = \{0.1627, 0.3029, 0.2357, 0.2652\}.$$

As we noticed, this distribution generates the relation of ranking of alternatives (formula (6)).

Ranking Alternatives and Comparing Results

The results obtained here and the ranking of the alternatives are compared with the corresponding results of the study [9,22] (see Table 3). In both cases, the scheme A_2 is optimal, i.e., the point A_2 is recommended for emergency assistance. However, we have a difference in the second, third and fourth optimal alternatives. This is due to the fact that our approach takes into account the similarity between experts and uses the transition from a priori estimates of base probability assignments to a posteriori estimates using expert similarity. Also, since the similarity relation of experts is presented in intuitionistic fuzzy values, it completely excludes estimation errors and meets the condition of independence of bodies of evidence, providing a more accurate and objective decision-making environment.

Table3. Comparison of the results of the two methods

Results of this article		Paper [12] results	
m_{total}	Sort	S_{Total}	Sort
0.3029	A_2	0.3375	A_2
0.2652	A_4	0.3007	A_1
0.2357	A_3	0.1854	A_4
0.1627	A_1	0.1567	A_2

Conclusion

Emergency decision-making problems are usually characterized by complex nature attributes and little or no objective information. In modeling, it becomes necessary to include experts' knowledge in the decision-making matrix in order to provide their assessments. Because experts operate in a group by sharing knowledge with each other, their own knowledge capacities and interdependencies are reflected in their assessments. Therefore, using the Dempster-Shafer confidence structure becomes problematic because the composition of bodies of evidence is acceptable if they are independent. Moreover, in the evaluation of each decision-making plan (alternative), there may be conflicting parts. We demonstrate the solution to this problem in this work. The study proposes a new emergency decision-making method based on intuitionistic fuzzy sets and the Dempster-Shafer confidence structure. First, for the emergency decision-making problem, the weights are assumed to be uncertain in nature, and the invited experts make evaluations of the alternatives with respect to the attributes in intuitionistic fuzzy values. Then a method is developed by constructing an intuitionistic fuzzy relation, which represents the similarity relation of experts. By this

relation, the base probability assignments are corrected to the a posteriori distributions. The latter are aggregated by the principle of composition into the total base probability assignment, which in turn induces a binary ranking relationship between the alternatives. Finally, the constructed decision-making model is illustrated by an example in determination of the best emergency rescue point for the victims in a road emergency. The obtained results demonstrate the efficiency and reliability of the new approach.

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მტკიცებულებათა თეორიაზე დაფუძნებული მრავალატრიბუტული ჯგუფური გადაწყვეტილების მიღება: გამოყენება საგზაო გადაუდებელ სიტუაციებში დაზარალებულთათვის საუკეთესო სამაშველო პუნქტის განსაზღვრაში

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ცნობილია, რომ საგანგებო სიტუაციებში მრავალატრიბუტული ჯგუფური გადაწყვეტილების მიღების (MAGDM) მოდელები ხასიათდება არასაკმარისი ობიექტური მონაცემებით და დროის ნაკლებობით დავალებაზე რეაგირებისთვის. მტკიცებულებების თეორია, ანუ, დემპ-სტერ-შეფერის ნდობის სტრუქტურა ეფექტური ინსტრუმენტია გადაწყვეტილების მიღების მოდელებში ასეთი არასრული ინფორმაციის აღსაწერად, როდესაც ექსპერტი და მისი ცოდნა ჩართულია MAGDM პარამეტრების შეფასებაში. თუმცა, მტკიცებულების თეორიას აქვს შეზღუდვა, რომ კომპოზიციურ მონაცემთა ტანის არგუმენტების ფოკალური ელემენტები დამოუკიდებელი უნდა იყოს. ეს პირობა არ შეიძლება დაკმაყოფილდეს ექსპერტულ ცოდნაზე

დაფუძნებული გადაწყვეტილების მიღების მოდელებში. ეს გამოწვეულია იმით, რომ ექსპერტთა შეფასებები ხშირად გადაფარვადი და ბუნდოვანია. სწორედ ამიტომ განვიხილავთ გადაუდებელი გადაწყვეტილების მიღების ახალ მოდელს, სადაც ექსპერტთა დასკვნები წარმოდგენილია ინტუიციურ ფაზი-რიცხვებში და მონაცემთა სტრუქტურა აღწერილია მტკიცებულების თეორიაში. უპირველეს ყოვლისა, ყოველი საგანგებო გეგმისთვის, თითოეული ექსპერტი წარმოადგენს თავის შეფასებებს გადაწყვეტილების მიღების მატრიცაში ინტუიციური ფაზი-რიცხვებით. შემდეგ, ექსპერტთა შეფასებებზე განსაზღვრული ინტუიციური ფაზი-მსგავსების მიმართებაზე დაყრდნობით, დგინდება მსგავსება თავად ექსპერტებს შორის. ასევე განისაზღვრება ექსპერტების წონებიც. ითვლება რომ, მოდელის ატრიბუტების წონები ცნობილია. ექსპერტთა შეფასებების ინტუიციური ფაზი-წარმოდგენები გარდაიქმნება მონაცემთა ერთობლიობის ფოკალურ ალბათობებად, იგივე ძირითადი ალბათობების განაწილებად (ფოკალური ალბათობები, ანუ, ძირითად ალბათობათა დავალებები). ამის შემდეგ გადაიხედება საექსპერტო გადაწყვეტილების მიღების გეგმა და აპრიორული ფოკალური ალბათობები გარდაიქმნება აპოსტერიულ ფოკალურ ალბათობებად. ეს უკანასკნელი გაერთიანდება ერთიან ფოკალურ ალბათობაში საბოლოო გადაწყვეტილების მისაღებად. გადაწყვეტილების მიღების ახალი სქემის დემონსტრირებისთვის განხილულია რიცხვითი მაგალითი საგზაო საგანგებო სიტუაციებში დაზარალებულთათვის საუკეთესო გადაუდებელი სამაშველო პუნქტის დასადგენად. მაგალითის შედეგები აჩვენებს ახალი მიდგომის ეფექტურობასა და სანდოობას.

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