Multi-attribute Group Decision Making of Internet Public Opinion Emergency with Interval Intuitionistic Fuzzy Number

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Abstract—*In this paper, an emergency group decision method is presented to cope with internet public opinion emergency with interval intuitionistic fuzzy linguistic values. First, we adjust the initial weight of each emergency expert by the deviation degree between each expert's decision matrix and group average decision matrix with interval intuitionistic fuzzy numbers. Then we can compute the weighted collective decision matrix of all the emergencies based on the optimal weight of emergency expert. By utilizing the interval intuitionistic fuzzy weighted arithmetic average operator one can obtain the comprehensive alarm value of each internet public opinion emergency. According to the ranking of score value and accuracy value of each emergency, the most critical internet public emergency can be easily determined to facilitate government taking related emergency operations. Finally, a numerical example is given to illustrate the effectiveness of the proposed emergency group decision method.*

Keywords— Internet Public Opinion Emergency, Interval Intuitionistic Fuzzy Number, Group decision, Weighted arithmetic average operator, Deviation degree.

I. INTRODUCTION

In recent years, with the enhancing enthusiasm of netizen participating in discussing public events, the rapid spread of internet public opinion which is made of complicated social emotions, attitude and opinion has triggered many unconventional emergencies. Obviously, the risk of this type of internet public opinion are increasing rapidly, severely impairing the harmony and stability of society. Consequently, it is supposed to make some effective policies and mechanisms to cope with Internet Public Opinion Emergency (IPOE) [1] . Meanwhile, the establishment of emergency decision-making attributes is the key to evaluate the Internet Public Opinion Emergency. In the light of causes and effects of Internet Public Opinion Emergency, referring to studies [2−3], we select five attributes, scale of spreading internet opinion, sensitivity of internet opinion content, critical degree of emergency, attention from publics and economic losses respectively. Because the attributes are fuzzy and qualitative, it is reasonable to utilize fuzzy linguistic value to evaluate the Internet Public Opinion Emergency. Nowadays, many scholars have utilized the fuzzy linguistic value to solve decision making problem. Liu [4] presented an approach based on 2-tuple to solve Multiple attribute decision making (MADM) problem. Xu [5] utilize the interval intuitionistic fuzzy number developed by Atanassov [6] in MADM problem. Among the decision-making methods towards Internet Public Opinion Emergency, MADM [7] is an important method. Not only can it aggregate experts' experience from various departments, but also it can avoid the false decision from individual due to the lack of knowledge. Nevertheless, while aggregating the decisions from different experts, it is significant to adjust the weights of experts after they make decision so that the final decision will be more easily adopted by each expert. In this paper, we will boost group consensus by measuring the deviation degree between individual decision and collective decision.

II. GROUP DECISION FOR INTERNET PUBLIC OPINION EMERGENCY

1.1 Basic notations and operational laws

Definition 1 [6] Let X be a nonempty set, then $\tilde{A} = \left\{ \langle \chi, \tilde{\mu}_A(\chi), \tilde{\nu}_A(\chi) \rangle \middle| \chi \in X \right\}$ is call an interval intuitionistic fuzzy set, verifying $\sup \tilde{\mu}_A(\chi) + \sup \tilde{\nu}_A(\chi) \le 1, \chi \in X$, where $\tilde{\mu}_A(\chi) \subset [0,1]$ and $\tilde{\nu}_A(\chi) \subset [0,1], \chi \in X$.

Definition 2 [8] The elements of $\tilde{A}$ are called Interval Intuitionistic Fuzzy Numbers (IIFNs), each of which interval of membership degree and interval of non-membership degree consist. Let the general form of IIFN shortly denoted as $([a,b],[c,d])$, where $[a,b] \subset [0,1], [c,d] \subset [0,1]$ and $b + d \le 1$. We will use

5 IIFNs to express 5 linguistic labels, showed as follows:

$$\begin{aligned} Extremely\ Poor\ (EP) &: ([0.00,\ 0.00],\ [0.75,\ 0.95]) \\ Poor\ (P) &: ([0.00,\ 0.20],\ [0.50,\ 0.70]) \\ Fair\ (F) &: ([0.25,\ 0.45],\ [0.25,\ 0.45]) \\ Good\ (G) &: ([0.50,\ 0.70],\ [0.00,\ 0.20]) \\ Extremely\ Good\ (EG) &: ([0.75,\ 0.95],\ [0.00,\ 0.00]) \end{aligned}$$

Definition 3 [5] For any two linguistic interval variables, $\alpha_1 = ([a_1, b_1], [c_1, d_1])$, $\alpha_2 = ([a_2, b_2], [c_2, d_2])$, the operation law as follows:

$$\alpha_1 \cap \alpha_2 = ([\min(a_1, a_2), \min(b_1, b_2)], [\max(c_1, c_2), \max(d_1, d_2)]);$$

$$\alpha_1 + \alpha_2 = ([a_1 + a_2 - a_1 a_2, b_1 + b_2 - b_1 b_2], [c_1 c_2, d_1 d_2]);$$

$$\lambda \alpha_1 = \left(\left[1-(1-a_1)^{\lambda}, 1-(1-b_1)^{\lambda}\right], \left[c_1^{\lambda}, d_1^{\lambda}\right]\right), \lambda > 0.$$

Apply operation laws of IIFNs in Definition 3, we can obtain the weighted arithmetic average operator of IIFNs.

Theorem 1 [5] Let $\alpha_j = ([a_j, b_j], [c_j, d_j])\ (j = 1, 2, \cdots, n)$ be a collection of IIFNs. A weighted arithmetic average operator of IIFNs is defined as:

$$f^{\omega}(\alpha_1, \alpha_2, \cdots, \alpha_n) = \left(\left[1-\prod_{j=1}^{n}(1-a_j)^{\omega_j}, 1-\prod_{j=1}^{n}(1-b_j)^{\omega_j}\right], \left[\prod_{j=1}^{n} c_j^{\omega_j}, \prod_{j=1}^{n} d_j^{\omega_j}\right]\right). \quad (1)$$

Where $\omega = (\omega_1, \omega_2, \cdots, \omega_n)^T$ is the weight vector of $\alpha_j\ (j = 1, 2, \cdots, n)$, $\omega_j \in [0,1]$, $\sum_{j=1}^{n} \omega_j = 1$.

Xu [5] illustrated weighted arithmetic average operator and weighted geometry average operator to aggregate IIFNs. The weighted arithmetic average operator emphasizes the effect of group while the weighted geometry average operator emphasizes the effect of individual. Therefore, we adopt the weighted arithmetic average operator to aggregate IIFNs.

Definition 4 [5] Let $\alpha_1 = ([a_1, b_1], [c_1, d_1])$ and $\alpha_2 = ([a_2, b_2], [c_2, d_2])$ be two IIFNs, $s(\alpha_1) = \frac{1}{2}(a_1 - c_1 + b_1 - d_1)$ and $s(\alpha_2) = \frac{1}{2}(a_2 - c_2 + b_2 - d_2)$ be the scores of α_1 and α_2, $h(\alpha_1) = \frac{1}{2}(a_1 + c_1 + b_1 + d_1)$ and $h(\alpha_2) = \frac{1}{2}(a_2 + c_2 + b_2 + d_2)$ be the accuracy degrees of α_1 and α_2, respectively, then

If $s(\alpha_1) < s(\alpha_2)$, then α_1 is smaller than α_2, denoted by $\alpha_1 < \alpha_2$;

If $s(\alpha_1) = s(\alpha_2)$, then

(1) If $h(\alpha_1) = h(\alpha_2)$, then α_1 is equivalent to α_2, denoted by $\alpha_1 < \alpha_2$;

(2) If $h(\alpha_1) < h(\alpha_2)$, then α_1 is smaller than α_2, denoted by $\alpha_1 < \alpha_2$.

2.2 The MADM Problem

Let $X = \{X_1, X_2, \cdots, X_m\}$ be a finite set of Internet Public Opinion Emergency (IPOE) proposed by government. For comprehensiveness of the decision-making, we invite experts $E_k\ (k = 1, 2, \cdots, q)$ from different departments to make decision and suppose $\lambda = \{\lambda_1, \lambda_2, \cdots, \lambda_q\}$ be the initial weight vector of decision experts, where λ_k means the initial decision weight of the expert E_k about IPOE. In order to evaluate IPOE better, we choose attributes $A_j\ (j = 1, 2, \cdots, n)$ from different aspects to evaluate IPOE and suppose $\omega = \{\omega_1, \omega_2, \cdots, \omega_n\}$ be the weight vector of attributes. Assume that the making-decision matrix of IPOEs $R_k = \left(r_{ij}^{(k)}\right)_{m \times n}$ is constructed by the decision expert E_k, where $r_{ij}^{(k)}$ is an interval intuitionistic fuzzy number (IIFN), which indicates the value of attribute A_j of IPOE X_i.

2.3 Adjust the weights of experts

While solving the MADM problem, the decision-making weights is reliable to affect the weights of experts. For increasing the accuracy of the final decision, we firstly aggregate decision matrix $R_k\ (k = 1, 2, \cdots, q)$ together by initial weight vector of q experts to obtain collective decision matrix $R^*_{m \times n}$. Then compute the scores of IPOE X_i in decision matrix $R_k\ (k = 1, 2, \cdots, q)$, $R^*_{m \times n}$ and define the scores as $s(X_i)^{(k)}$,

$s(X_i)^*\ (i=1,2,\cdots,m)$ respectively. Finally adjust the initial expert weight vector $\lambda=\{\lambda_1,\lambda_2,\cdots,\lambda_q\}$ by evaluating the deviation degree between $s^{(k)}$ and s^*.

In order to synthesize the decision from different experts, we utilize initial expert weight vector $\lambda=\{\lambda_1,\lambda_2,\cdots,\lambda_q\}$ to aggregate all decision matrices $R_k=\left(r_{ij}^{(k)}\right)_{m\times n}\ (k=1,2,\cdots,q)$ into a collective decision matrix $R^*=\left(r_{ij}^{*}\right)_{m\times n}\ (i=1,2,\cdots,m,\ j=1,2,\cdots,n)$. As $r_{ij}^{(k)}$ is IIFN, let $r_{ij}^{(k)}=\left(\left[a_{ij}^{(k)},b_{ij}^{(k)}\right],\left[c_{ij}^{(k)},d_{ij}^{(k)}\right]\right)(i=1,2,\cdots,m,j=1,2,\cdots,n,k=1,2,\cdots,q)$ and apply weighted arithmetic average operator (1) to aggregate, obviously r_{ij}^* is IIFN$\left(r_{ij}^*=\left(\left[a_{ij}^*,b_{ij}^*\right],\left[c_{ij}^*,d_{ij}^*\right]\right)\right)$, so r_{ij}^* is defined as

$$r_{ij}^*=\left(\left[1-\prod_{k=1}^{q}\left(1-a_{ij}^{(k)}\right)^{\lambda_k},1-\prod_{k=1}^{q}\left(1-b_{ij}^{(k)}\right)^{\lambda_k}\right],\left[\prod_{k=1}^{q}\left(c_{ij}^{(k)}\right)^{\lambda_k},\prod_{k=1}^{q}\left(d_{ij}^{(k)}\right)^{\lambda_k}\right]\right) \tag{2}$$

Both $r_{ij}^{(k)}$ in R_k and r_{ij}^* in R_* mean the evaluation value of attribute A_j of IPOE X_i, but $r_{ij}^{(k)}$ represents the value from expert E_k and r_{ij}^* represents the aggregated value from all experts. So according weight vector of attributes $\omega=\{\omega_1,\omega_2,\cdots,\omega_n\}$, we can aggregate the attributes in R_k and R^* to obtain aggregated value $(X_i)^{(k)}$ and $(X_i)^*$ of IPOE X_i by applying weighted arithmetic average operator (1), obviously $(X_i)^{(k)}$ and $(X_i)^*$ are IIFNs.

So $s(X_i)^{(k)}\ (i=1,2,\cdots,m,k=1,2,\cdots,q)$ and $s(X_i)^*$ are defined respectively as follows:

$$(X_i)^{(k)}=\left(\left[1-\prod_{j=1}^{n}\left(1-a_{ij}^{(k)}\right)^{\omega_j},1-\prod_{j=1}^{n}\left(1-b_{ij}^{(k)}\right)^{\omega_j}\right],\left[\prod_{j=1}^{n}\left(c_{ij}^{(k)}\right)^{\omega_j},\prod_{j=1}^{n}\left(d_{ij}^{(k)}\right)^{\omega_j}\right]\right)$$

$$(X_i)^{*}=\left(\left[1-\prod_{j=1}^{n}\left(1-a_{ij}^{*}\right)^{\omega_j},1-\prod_{j=1}^{n}\left(1-b_{ij}^{*}\right)^{\omega_j}\right],\left[\prod_{j=1}^{n}\left(c_{ij}^{*}\right)^{\omega_j},\prod_{j=1}^{n}\left(d_{ij}^{*}\right)^{\omega_j}\right]\right)$$

Apply definition 4, we can obtain scores of $(X_i)^{(k)}$ and $(X_i)^*$ as follows:

$$s\left((X_i)^{(k)}\right)=\left(1-\prod_{j=1}^{n}\left(1-a_{ij}^{(k)}\right)^{\omega_j}-\prod_{j=1}^{n}\left(c_{ij}^{(k)}\right)^{\omega_j}+1-\prod_{j=1}^{n}\left(1-b_{ij}^{(k)}\right)^{\omega_j}-\prod_{j=1}^{n}\left(d_{ij}^{(k)}\right)^{\omega_j}\right)\div 2 \tag{3}$$

$$s\left((X_i)^{*}\right)=\left(1-\prod_{j=1}^{n}\left(1-a_{ij}^{*}\right)^{\omega_j}-\prod_{j=1}^{n}\left(c_{ij}^{*}\right)^{\omega_j}+1-\prod_{j=1}^{n}\left(1-b_{ij}^{*}\right)^{\omega_j}-\prod_{j=1}^{n}\left(d_{ij}^{*}\right)^{\omega_j}\right)\div 2 \tag{4}$$

Definition 5 Let $R_k=\left(r_{ij}^{(k)}\right)_{m\times n}$ and $R^*=\left(r_{ij}^{*}\right)_{m\times n}$ be two making-decision matrix of IPOEs, the deviation degree between R_k and R^* is defined as

$$d\left(R_k,R^*\right)=\sqrt{\sum_{i=1}^{m}\left(s(X_i)^{(k)}-s(X_i)^*\right)^2} \tag{5}$$

$d\left(R_k,R^*\right)$ showed in definition 5 reflects the reliability of expert E_k's decision, the bigger of $\tilde{R}^*$ $d\left(R_k,R^*\right)$, the wider of the opinion deviation between expert E_k and group E ,which can be reflected by weight.[9] Therefore, adjust the weights of expert $E_k\ (k=1,2,\cdots,q)$ as follows.

$$\lambda_k^*=\frac{\frac{1}{d\left(R_k,R^*\right)}}{\sum_{k=1}^{q}\frac{1}{d\left(R_k,R^*\right)}}(k=1,2,\cdots,q) \tag{6}$$

2.4 Determination of the most critical Internet Public Opinion Emergency

After obtaining the adjusted expert weights, we can utilize the weighted arithmetic average operator of IIFNs (1) to aggregate all $R_k\ (k=1,2,\cdots,q)$ into a collective making-decision matrix $\tilde{R}^*=\left(\tilde{r}_{ij}^*\right)_{m\times n}$, obviously $\tilde{r}_{ij}^*$ is IIFN $\left(\tilde{r}_{ij}^*=\left(\left[\tilde{a}_{ij}^*,\tilde{b}_{ij}^*\right],\left[\tilde{c}_{ij}^*,\tilde{d}_{ij}^*\right]\right)\right)$ as follows. $(i=1,2,\cdots,m)$, $(j=1,2,\cdots,n)$

$$\tilde{r}_{ij}^*=\left(\left[1-\prod_{k=1}^{q}\left(1-a_{ij}^{(k)}\right)^{\lambda_k^*},1-\prod_{k=1}^{q}\left(1-b_{ij}^{(k)}\right)^{\lambda_k^*}\right],\left[\prod_{k=1}^{q}\left(c_{ij}^{(k)}\right)^{\lambda_k^*},\prod_{k=1}^{q}\left(d_{ij}^{(k)}\right)^{\lambda_k^*}\right]\right) \tag{7}$$

Then utilize the weighted arithmetic average operator of IIFNs (1) to aggregate all attributes $A_j\ (j=1,2,\cdots,n)$ into aggregated value to evaluate the each IPOE and we suppose the aggregated value as $\left(\tilde{X}_i\right)^*$

$$\left(\tilde{X}_i\right)^* = \left(\left[1-\prod_{j=1}^{n}\left(1-\tilde{a}_{ij}^*\right)^{\omega_j}, 1-\prod_{j=1}^{n}\left(1-\tilde{b}_{ij}^*\right)^{\omega_j}\right], \left[\prod_{j=1}^{n}\left(\tilde{c}_{ij}^*\right)^{\omega_j}, \prod_{j=1}^{n}\left(\tilde{d}_{ij}^*\right)^{\omega_j}\right]\right)$$

Apply definition 4, we can obtain scores of $\left(\tilde{X}_i\right)^*$ $(i=1,2,\cdots,m)$ as follows:

$$s\left(\left(\tilde{X}_i\right)^*\right) = \left(1-\prod_{j=1}^{n}\left(1-\tilde{a}_{ij}^*\right)^{\omega_j} - \prod_{j=1}^{n}\left(\tilde{c}_{ij}^*\right)^{\omega_j} + 1-\prod_{j=1}^{n}\left(1-\tilde{b}_{ij}^*\right)^{\omega_j} - \prod_{j=1}^{n}\left(\tilde{d}_{ij}^*\right)^{\omega_j}\right) \div 2 \quad (8)$$

According to comparison laws in definition 4, we can list the order of $s\left(\left(\tilde{X}_i\right)^*\right)$. Therefore, we can determine the most critical Internet Public Opinion Emergency.

III. ILLUSTRATIVE EXAMPLE

In the section our models and approaches are applied to a group decision problem of Internet Public Opinion Emergency (IPOE).

It is presumed that four Internet Public Opinion Emergencies happened in a city. The emergency decision department needs to find out the most critical Internet Public Opinion Emergency. In order to evaluate the IPOEs better, the emergency decision department construct 5 attributes as follows. The first attribute A_1 is scale of spreading internet opinion. The second one A_2 is sensitivity of internet opinion content. The third one A_3 is critical degree of emergency. The fourth one A_4 is attention from publics. The fifth one A_5 is economic losses. The weight vector of attributes in IPOEs as The decision-making section invited three experts E_k $(k=1,2,3)$ from different departments. In the light of their academic experience and domain experience, the emergency decision department determined the initial weights of experts in group decision as $\lambda=\{\lambda_1,\lambda_2,\lambda_3\}=\{0.5,0.2,0.3\}$.

The experts' decision matrices of IPOEs are listed as:

Expert E_1's decision matrix $R_1=\left(r_{ij}^{(1)}\right)_{4\times5}$

	A_1	A_2	A_3		
X_1	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.00,0.20],[0.50,0.70])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.2
X_2	([0.75,0.95],[0.00,0.00])	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.00,0.20],[0.5
X_3	([0.00,0.20],[0.50,0.70])	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.2
X_4	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.00,0.20],[0.50,0.70])	([0.00,0.00],[0.7

Expert E_2's decision matrix $R_2=\left(r_{ij}^{(2)}\right)_{4\times5}$

	A_1	A_2	A_3		
X_1	([0.00,0.20],[0.50,0.70])	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.45])	([0.00,0.20],[0.50,0.7
X_2	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.45])	([0.00,0.20],[0.50,0.70])	([0.00,0.20],[0.50,0.7
X_3	([0.00,0.20],[0.50,0.70])	([0.50,0.70],[0.00,0.20])	([0.00,0.20],[0.50,0.70])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.4
X_4	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.00,0.20],[0.50,0.70])	([0.00,0.20],[0.50,0.7

Expert E_3's decision matrix $R_3=\left(r_{ij}^{(3)}\right)_{4\times5}$

	A_1	A_2	A_3		
X_1	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.00,0.20],[0.50,0.70])	([0.25,0.45],[0.25,0.45])	([0.00,0.20],[0.50,0.7
X_2	([0.75,0.95],[0.00,0.00])	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.00,0.20],[0.50,0.70])	([0.25,0.45],[0.25,0.4
X_3	([0.00,0.20],[0.50,0.70])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.4
X_4	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.00,0.20],[0.50,0.7

Utilize the formula (2), aggregate three decision matrices R_1, R_2, R_3 by applying initial weight vector of experts and then obtain initial collective decision matrix $R^*=\left(r_{ij}^*\right)_{4\times5}$ as:

	A_1	A_2	A_3		
X_1	([0.21,0.41],[0.29,0.49])	([0.50,0.70],[0.00,0.20])	([0.06,0.26],[0.44,0.64])	([0.25,0.45],[0.25,0.45])	([0.13,0.34],[0.35,0.56])
X_2	([0.71,0.93],[0.00,0.00])	([0.25,0.45],[0.25,0.45])	([0.46,0.66],[0.00,0.24])	([0.13,0.34],[0.35,0.56])	([0.08,0.29],[0.41,0.61])
X_3	([0.00,0.20],[0.50,0.70])	([0.44,0.64],[0.00,0.26])	([0.21,0.41],[0.29,0.49])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.45])
X_4	([0.50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.08,0.29],[0.41,0.61])	([0.00,0.11],[0.61,0.82])

Utilize weights of attributes $\omega=\{\omega_1,\omega_2,\omega_3,\omega_4,\omega_5\}=\{0.25,0.10,0.15,0.20,0.30\}$, aggregate five attributes in decision matrices R_1, R_2, R_3, R^* and obtain $(X_i)^{(1)}, (X_i)^{(2)}, (X_i)^{(3)}$, $(X_i)^*$. Then utilize formula (3), (4) to calculate the scores of them, $s\left(\left(X_i\right)^{(1)}\right), s\left(\left(X_i\right)^{(2)}\right), s\left(\left(X_i\right)^{(3)}\right)$, $s\left(\left(X_i\right)^{*}\right)$ as:

while

$i=1$

$$s\left(\left(X_1\right)^{(1)}\right)=0.1285, s\left(\left(X_1\right)^{(2)}\right)=-0.0044, s\left(\left(X_1\right)^{(3)}\right)=0.0307, s\left(\left(X_1\right)^{*}\right)=0.0744$$

while

$i=2$

$$s\left(\left(X_2\right)^{(1)}\right)=0.5534, s\left(\left(X_2\right)^{(2)}\right)=0.0946, s\left(\left(X_2\right)^{(3)}\right)=0.5674, s\left(\left(X_2\right)^{*}\right)=0.5203$$

while

$i=3$

$$s\left(\left(X_3\right)^{(1)}\right)=0.0971, s\left(\left(X_3\right)^{(2)}\right)=0.0477, s\left(\left(X_3\right)^{(3)}\right)=-0.1049, s\left(\left(X_3\right)^{*}\right)=0.0716$$

while

$i=4$

$$s\left(\left(X_4\right)^{(1)}\right)=0.1312, s\left(\left(X_4\right)^{(2)}\right)=0.1687, s\left(\left(X_4\right)^{(3)}\right)=0.2252, s\left(\left(X_4\right)^{*}\right)=0.1682$$

Utilize the formula (5) to evaluate the deviation degree between R_1, R_2, R_3 and R^* respectively, denoted as $d\left(R_1, R^*\right), d\left(R_2, R^*\right), d\left(R_3, R^*\right)$:

$d\left(R_1, R^*\right)=0.0060,$ $d\left(R_2, R^*\right)=0.1881,$ $d\left(R_3, R^*\right)=0.0385,$

Adjust the weights of experts by formula (6) and obtain $\lambda^*=\left\{\lambda_1^*, \lambda_2^*, \lambda_3^*\right\}$ as:

$\lambda_1^*=0.635,$ $\lambda_2^*=0.114,$ $\lambda_3^*=0.251,$

Utilize the formula (7), aggregate three decision matrices R_1, R_2, R_3 by applying adjusted weight vector of expert $\lambda^*=\left\{0.635, 0.114, 0.251\right\}$ and then obtain adjusted collective decision matrix $\tilde{R}^*=\left(\tilde{r}_{ij}^*\right)_{4\times5}$ as

	A_1	A_2		A_3
22,0.43],[0.27,0.47])	([0.50,0.70],[0.00,0.20])	([0.03,0.23],[0.46,0.67])	([0.25,0.45],[0.25,0.45])	([0.17,0.37],[0.32,0.5
73,0.94],[0.00,0.00])	([0.25,0.45],[0.25,0.45])	([0.48,0.68],[0.00,0.22])	([0.17,0.37],[0.32,0.53])	([0.07,0.27],[0.42,0.6
00,0.20],[0.50,0.70])	([0.45,0.65],[0.00,0.25])	([0.22,0.43],[0.27,0.47])	([0.25,0.45],[0.25,0.45])	([0.25,0.45],[0.25,0.4
50,0.70],[0.00,0.20])	([0.25,0.45],[0.25,0.45])	([0.50,0.70],[0.00,0.20])	([0.07,0.27],[0.42,0.63])	([0.00,0.08],[0.65,0.8

Utilize formula (8), obtain the final scores of four Internet Public Opinion Emergency as

$$s\left(\left(\tilde{X}_1\right)^{*}\right)=0.0904, \quad s\left(\left(\tilde{X}_2\right)^{*}\right)=0.5361, \quad s\left(\left(\tilde{X}_3\right)^{*}\right)=0.0784, \quad s\left(\left(\tilde{X}_4\right)^{*}\right)=0.1603,$$

Therefore, the order of Internet Public Opinion Emergency is $s\left(\left(\tilde{X}_3\right)^{*}\right)<s\left(\left(\tilde{X}_1\right)^{*}\right)<s\left(\left(\tilde{X}_4\right)^{*}\right)<s\left(\left(\tilde{X}_2\right)^{*}\right)$, the most critical emergency is X_3.

IV. CONCLUSION

In group decision making of Internet Public Opinion Emergency, because of the lack of time and incomplete information, decision experts is easier to evaluate the emergency with interval intuitionistic fuzzy numbers. To increase the accuracy of group decision making, a method based on deviation degree is proposed to adjust initial weights of experts from their individual decision matrices. Finally, apply the weighted arithmetic average operator to yield the collective decision matrix and determine the most critical Internet Public Opinion Emergency to assist the emergency decision department to make proper response.

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