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GENERALIZED NET MODEL OF PROCESS OF THE EUROPEAN AWARENESS SCENARIO WORKSHOP METHOD WITH INTUITIONISTIC FUZZY ESTIMATION

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Abstract: The present paper describes the process of the European Awareness Scenario Workshop Method. For the purpose we use Generalized Nets. The opportunity of using GNs as a tool for modelling such process is analyzed as well. The model uses intuitionistic fuzzy sets for determine estimation for a creation of the masterplan.

Keywords: Generalized nets, Modelling, European Awareness Scenario Workshop Method.

INTRODUCTION

In a preview paper [5] we present a generalized net model of the European Awareness Scenario Workshop Method [4]. Now we use intuitionistic fuzzy sets for determine estimation for a creation of the masterplan.

Intuitionistic Fuzzy Sets (IFSs) [1] are defined as extensions of ordinary fuzzy sets. All results which are valid for fuzzy sets can be transformed here too. Also, all research, for which the apparatus of fuzzy sets can be used, can be used to describe the details of IFSs.

On the other hand, there have been defined over IFSs not only operations similar to those of ordinary fuzzy sets, but also operators that cannot be defined in the case of ordinary fuzzy sets.

Let a set E be fixed. An IFS A in E is an object of the following form:

$$A = \{<x, \mu_A(x), \nu_A(x)> | \ x \in E\},$$

where functions $\mu_A : E \rightarrow [0, 1]$ and $\nu_A : E \rightarrow [0, 1]$ define the degree of membership and the degree of non-membership of the element $x \in E$, respectively, and for every $x \in E$:

$$0 \leq \mu_A(x) + \nu_A(x) \leq 1$$

For every $x \in E$, let

$$\pi_A(x) = 1 - \mu_A(x) - \nu_A(x).$$

Therefore, the function π determines the degree of uncertainty.

Obviously, for every ordinary fuzzy set $\pi_A(x) = 0$ for each $x \in E$, these sets have the form:

$$\{<x, \mu_A(x), 1-\mu_A(x)> | \ x \in E\}.$$

Let a universe E be given. One of the geometrical interpretations of the IFSs uses figure F on *Fig*.1:

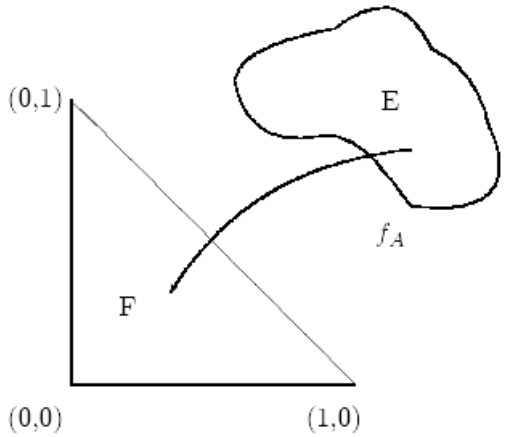

Fig.1

In the context of the present model we include some possibilities for the possible ways for evaluation of the European Awareness Scenario Workshop Method (EASWM). To do this we can apply estimations of the IFS on the basis of which some amendments may be undertaken.

The estimations are represented by ordered pairs <μ, ν> of real numbers from the set [0,1], where:

$$\mu = \frac{S_1}{S}$$

where:

S_1 – number of the people who vote positive on current voting.

S – number of the all people who can vote on current voting (usually the number is 4);

$$\nu = \frac{S_2}{S}$$

where S_2 – number of the people who vote negative on current voting.

The degree of uncertainty $\pi = 1 - \mu - \nu$ reflects the number of peoples who abstain from voting.

A GN-MODEL

The GN-model (see Fig. 2) is the reduced one from the model from [5].

It contains 5 transitions and 24 places. There are transitions that forming intuitionistic fuzzy sets for determine estimation for a creation of the masterplan (from Z_3 to Z_7).

Initially the following tokens enter in the GN:

in place l_{11} -α_{11} - token with characteristic:

$$x_0^{\alpha_{11}} = \text{“Group 1, The list of the key words”;}$$

in place l_{12} -α_{12} - token with characteristic:

$$x_0^{\alpha_{12}} = \text{“Group 2, The list of the key words”;}$$

in place l_{13} -α_{13} - token with characteristic:

$$x_0^{\alpha_{13}} = \text{“Group 3, The list of the key words”;}$$

in place l_{14} -α_{14} - token with characteristic:

$$x_0^{\alpha_{14}} = \text{“Group 4, The list of the key words”;}$$

in place l_{thr} - β_{thr}-token with characteristic

$$x_0^{\beta_{thr}} = \text{“}\mu_{\text{thr}}, \nu_{\text{thr}}\text{”;}$$

where:

μ_{thr}- threshold value for μ;

ν_{thr}- threshold value for ν.

Also initially, when no suggestions has been existing in places l_{18}, l_{21}, l_{24}, l_{27} and l_{29} all estimations take on initial values of <0,0>.

The Generalized Net [2, 3] contains the following set of transitions:

$$A = \{ Z_3, Z_4, Z_5, Z_6, Z_7\},$$

where the following transitions represent:

Z_3 – The work of the group 1;

Z_4 – The work of the group 2;

Z_5 – The work of the group 3;

Z_6 – The work of the group 4;

Z_7 – Creation of the Masterplan.

The forms of the transitions are the following.

$$Z_3 = <\{ l_{11}, l_{31}, l_{18}\}, \{ l_{16}, l_{17}, l_{18}\}, r_3, \vee (l_{11}, l_{31}, l_{12})>$$

where:

$$r_3 = \begin{array}{c|ccc} & l_{16} & l_{17} & l_{18} \\ \hline l_{11} & False & False & True \\ l_{31} & False & False & True \\ l_{18} & W_{18,16} & W_{18,17} & True \end{array},$$

$W_{18,16}$ = “The suggestions from group 1 are specified” or “a token from place l_{31} is arrived”,

$W_{18,17} = W_{18,16}$.

The α_{11} token from places l_{11} that enter place l_{18} do not obtain new characteristic. It generates two β-tokens (β_{16} and β_{17}) with characteristic

"Suggestion$_{11}$, <μ_{11}, ν_{11}>;
Suggestion$_{12}$, <μ_{12}, ν_{12}>;
….
Suggestion$_{1n}$, <$\mu_{1\,n}$, $\nu_{1\,n}$>;".

for the n-suggestions.

$$Z_4 = <\{ l_{12}, l_{32}, l_{21}\}, \{ l_{19}, l_{20}, l_{21}\}, r_4, \vee (l_{12}, l_{32}, l_{21})>$$

where:

$$r_4 = \begin{array}{c|ccc} & l_{19} & l_{20} & l_{21} \\ \hline l_{12} & False & False & True \\ l_{32} & False & False & True \\ l_{21} & W_{21,19} & W_{21,20} & True \end{array},$$

$W_{21,19}$ = "The suggestions from group 2 are specified" or "a token from place l_{32} is arrived",

$W_{21,20} = W_{21,19}$.

The α_{12} token from places l_{12} that enter place l_{21} do not obtain new characteristic. It generates two β-tokens (β_{19} and β_{20}) with characteristic

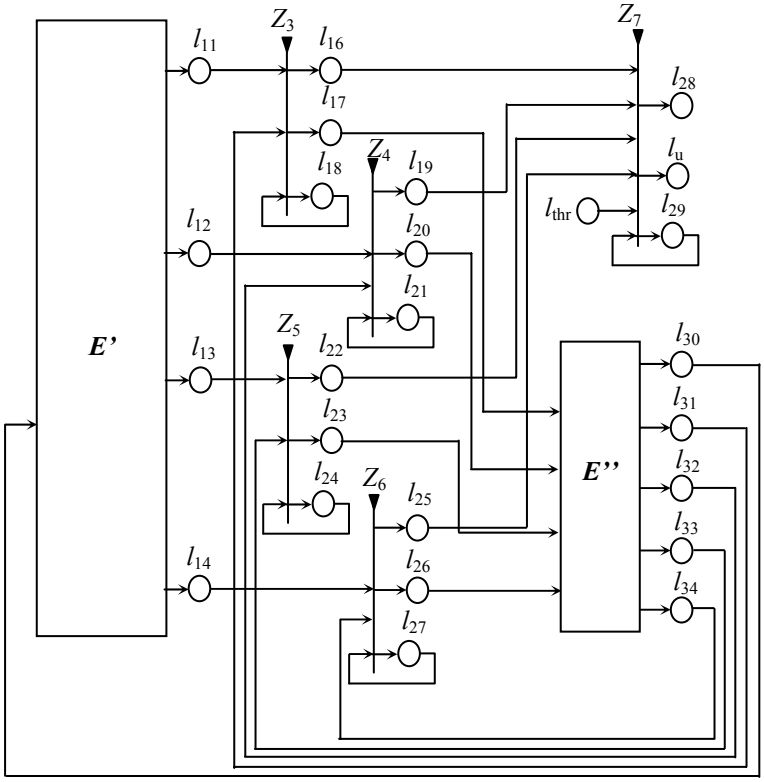

Figure 2: GN model of process of the EASWM with intuitionistic fuzzy estimation

"Suggestion$_{21}$, <μ_{21}, ν_{21}>;
Suggestion$_{22}$, <μ_{22}, ν_{22}>;
….
Suggestion$_{2n}$, <$\mu_{2\,n}$, $\nu_{2\,n}$>",

for the *n*-suggestion.

$$Z_5 = <\{ l_{13}, l_{33}, l_{24}\}, \{ l_{22}, l_{23}, l_{24}\}, r_5, \vee (l_{13}, l_{33}, l_{24})>$$

where:

$$r_5 = \begin{array}{c|ccc} & l_{22} & l_{23} & l_{24} \\ \hline l_{13} & False & False & True \\ l_{33} & False & False & True \\ l_{24} & W_{24,22} & W_{24,23} & True \end{array},$$

$W_{24,22}$ = "The suggestions from group 3 are specified" or "a token from place l_{34} is arrived",

$W_{24,23} = W_{24,22}$.

The α_{13} token from places l_{13} that enter place l_{24} do not obtain new characteristic. It generates two β-tokens (β_{22} and β_{23}) with characteristic

"Suggestion$_{31}$, <μ_{31}, ν_{31}>;
Suggestion$_{32}$, <μ_{32}, ν_{32}>;
….
Suggestion$_{3n}$, <$\mu_{3\,n}$, $\nu_{3\,n}$>",

for the *n*-suggestion.

$$Z_6 = <\{l_{14}, l_{34}, l_{27}\}, \{l_{25}, l_{26}, l_{27}\}, r_6, \vee (l_{14}, l_{34}, l_{27})>$$

where:

$$r_6 = \begin{array}{c|ccc} & l_{25} & l_{26} & l_{27} \\ \hline l_{14} & False & False & True \\ l_{34} & False & False & True \\ l_{27} & W_{27,25} & W_{27,26} & True \end{array},$$

$W_{27,25}$ = "The suggestions from group 4 are specified" or "a token from place l_{34} is arrived",

$W_{27,26} = W_{27,25}$.

The α_{14} token from places l_{14} that enter place l_{27} do not obtain new characteristic. It generates two β-tokens (β_{25} and β_{26}) with characteristic

"Suggestion$_{41}$, <μ_{41}, ν_{41}>;
Suggestion$_{42}$, <μ_{42}, ν_{42}>;
….
Suggestion$_{4n}$, <$\mu_{4\,n}$, $\nu_{4\,n}$>",

for the *n*-suggestion.

$$Z_7 = <\{l_{16}, l_{19}, l_{22}, l_{25}, l_{29}, l_{\text{thr}}\}, \{l_{28}, l_{29}, l_{\text{u}}\}, r_7, \vee (l_{16}, l_{19}, l_{22}, l_{25}, l_{29}, l_{\text{thr}})>$$

where:

$r_7 =$

	l_{28}	l_{29}	l_u
l_{16}	*False*	*True*	*False*
l_{19}	*False*	*True*	*False*
l_{22}	*False*	*True*	*False*
l_{25}	*False*	*True*	*False*
l_{29}	$W_{29,28}$	*True*	$W_{29,u}$
l_{thr}	*False*	*True*	*False*

,

$W_{29,28}$ = "The Masterplan is ready";

$W_{29,u}$ = "There are unused suggestions".

The β-tokens from places l_{16}, l_{19}, l_{22} and l_{25} that enter place l_{29} generate new β_{28}-token that enters place l_{28} with characteristic

"E ($S_1 \cup S_2 \cup \ldots \cup S_{n-1} \cup S_n$)" , where:

S_i – i-th suggestion, $i = 1,\ldots, n$,

E – function that sorts the suggestions in descending order by the degree of the acceptance of the suggestion$_i$ μ_i and $\mu_i \geq \mu_{thr}$ and $\nu_i \leq \nu_{thr}$.

The β-token that enter place l_u obtains characteristic

"list of unused suggestions".

CONCLUSION

The GN-model constructed in this way is the next in a series of research exercises which the authors are currently preparing. It can be used for simulation of the work of the European Awareness Scenario Workshop Method. The exchanged information can be evaluated by means of intuitionistic fuzzy estimations. The model use intuitionistic fuzzy sets for determine estimation for a creation of the masterplan.

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