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A GENERALIZED NET DESCRIBING A PROCESS OF DECISION MAKING WITH INTUITIONISTIC FUZZY EXPERT SCORES

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Abstract

We propose a description of a decision making process via a Generalized Net.

1 Generalized Nets and Decision Making

Let us have k experts $E_1, ..., E_k$ who are to evaluate some situation/object/event using given criteria. A Generalized net (GN, see [1]) describing their work is construced and discussed. The process of Descision Making (DM) of the experst is described in [3].

Initially, token α enters place a_1 with initial characteristic

"*situation/object/event for estimation*",

token β enters place b_1 with initial characteristic

"*criteria for DM*",

and tokens $\gamma_1, ...\gamma_k$ $(k \geq 1)$ enter place $c_1, ..., c_k$ with initial characteristics

"$\langle E_i, \mu_i^E, \nu_i^E \rangle$",

where $1 \leq i \leq k$ and for i-th expert E_i μ_i^E and ν_i^E are degrees of correctness and incorrectness, i.e., degrees of its score. These degrees generate intuitionistic fuzzy couples, because for each $i = 1, ..., k$

$$\mu_i^E + \nu_i^E \leq 1$$

(for intuitionistic fuzziness see [2]).

The GN contains $k + 4$ transitions that have the following forms.

$$Z_1 =< \{a_1, b_1, b_2, c_1, ..., c_k\}, \{a_2, b_2, c_{k+1}, c_{2k}\},$$

	a_2	b_2	c_{k+1}	...	c_{2k}
a_1	$true$	$false$	$false$	...	$false$
b_1	$false$	$true$	$false$	...	$false$
b_2	$false$	$true$	$false$	...	$false$
c_1	$false$	$false$	$true$	...	$false$
⋮	⋮	⋮	⋮	...	⋮
c_k	$false$	$false$	$false$	...	$true$

$$\wedge(a_1, b_1, c_1, ..., c_k) > .$$

Token α enters place a_2, without a new characteristic.

Token β enters place b_2, where it will unite with all next β-tokens and will enter the net, obtaining as a current characteristic

"*list of all criteria for decision making*".

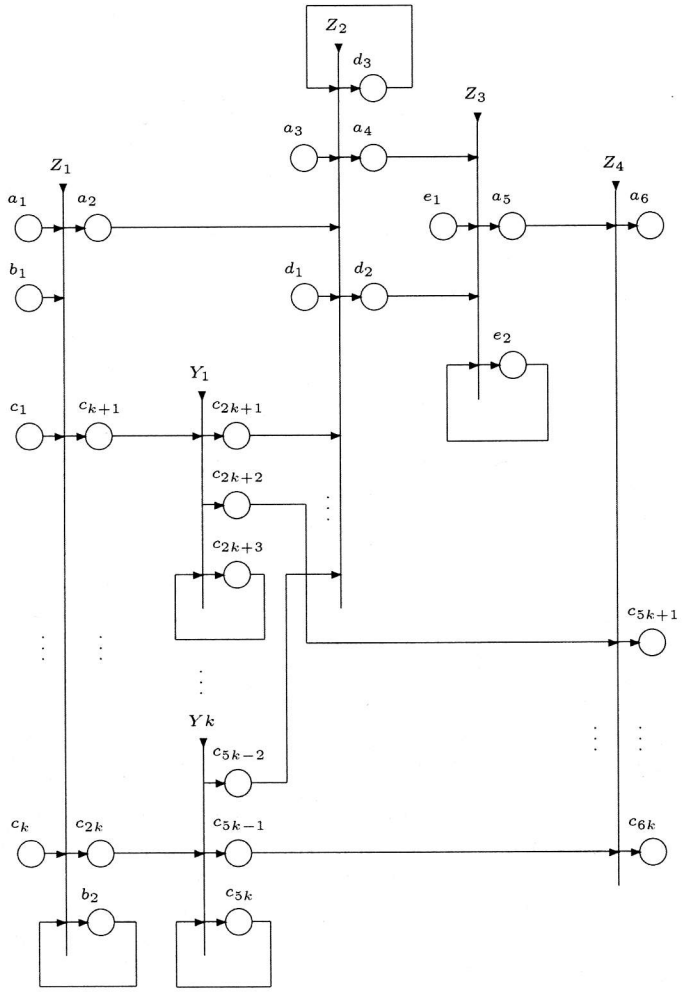

Fig.1 GN describing a process of decision making

The i-th token γ_i enters place c_i with a characteristic

"*list of criterie for DM, that will be used by expert* E_i".

Below we shall describe the form of i-th transition Y_i, where $1 \leq i \leq k$.

We shall assume that each expert evaluates the given situation/object/event, using the criteria that he/she determine (as the characteristic from place c_{k+i} of the token that represents the respective expert's list of criteria). Therefore, the separate expert can use different list of criteria. We shall assume that each evaluation use one elementary GN-time-step. Hence, the number of tokens cycles in place l_{k+i} can be different.

$$Y_i =< \{c_{k+i}, c_{2k+3i}\}, \{c_{2k+3i-2}, c_{2k+3i-1}, c_{2k+3i}\},$$

	$c_{2k+3i-2}$	$c_{2k+3i-1}$	c_{2k+3i}
c_{k+1}	$false$	$false$	$true$
c_{2k+3i}	$W_{2k+3i,2k+3i-2}$	$W_{2k+3i,2k+3i-1}$	$W_{2k+3i,2k+3i}$

,

$$\vee(c_{k+i}, c_{2k+3i}) >,$$

where

$W_{2k+3i,2k+3i-2}$ = "the expert finishes his/her evaluation and token δ does not enter place d_1",

$W_{2k+3i,2k+3i-1}$ = "the expert finishes his/her evaluation or token δ enters place d_1",

$W_{2k+3i,2k+3i}$ = "the expert does not finish his/her evaluation and token δ does not enter place d_1",

where $\neg P$ is the negation of predicate P.

The GN must be constructed so, that the place d_1 has the higher priority than each one of places $c_1, ..., c_k$. Therefore, token δ will enters plaxce d_1 before γ-tokens and we can calculate correctly the above three predicates.

Token γ_i obtains the following characteristics. In place c_{2k+3i} it is

"*current evaluation of situation/object/event on the basis of the current used criterion*".

When the expert finishes evaluation of the situation/object/event using all the criteria that he/she wishes to use, and when there is not a token in place d_1, then the token γ_i, representing the expert splits to two tokens γ_i' and γ_i'' that, respectively, enter places $c_{2k+3i-2}$ and $c_{2k+3i-1}$ obtaining characteristics

"*aggregated evaluation of situation/object/event on the basis of all used criteria by the i-th expert*"

and

"*the i-th expert is not ready with his/her evaluation* "	if the expert does not finish his/her evaluation or token δ enters place d_1
"*the i-th expert is ready with his/her evaluation* "	if the expert finishes his/her evaluation and token δ is not enters place d_1

In some moment token α' enters place a_3 with initial characteristic

"*information for changings of the situation/object/event*".

When the process of experts' evaluation must stop, token δ enters place d_1 without an initial characteristic.

$$Z_2 =< \{a_2, a_3, c_{2k+1}, ..., c_{5k-2}, d_1, d_3\}, \{a_4, d_2, d_3\},$$

	a_4	d_2	d_3
a_2	$W_{2,4}$	$false$	$false$
a_3	$W_{3,4}$	$false$	$false$
c_{2k+1}	$false$	$false$	$true$
$\vdots$	$\vdots$	$\vdots$	$\vdots$
c_{5k-2}	$false$	$false$	$true$
d_1	$false$	$true$	$false$
d_3	$false$	$W_{3,2}$	$W_{3,3}$

,

$$\vee(\wedge(a_2, a_3), \vee(c_{2k+1}, ..., c_{5k-2}, d_3), \wedge(d_1, d_3)) >,$$

where
$W_{2,4}$ = "there is a token in place a_3",
$W_{3,4}$ = "there is a token in place a_2",
$W_{3,2}$ = "there is a token in place d_1",
$W_{3,3} = \neg W_{3,2}$.

Tokens α and α' unite in place a_4 to token α, that obtain characteristic

"*final form of the situation/object/event*".

Each γ-token that is in the input place of transition Z_2 (therefore, this is before the moment in which token δ enters place d_1) enters place d_3 and all these tokens unite in one token γ with characteristic

"*current aggregation of the evaluations of the situation/object/event on the basis of the aggregated estimations of the experts, who finished his/her research*".

Token δ enters place a_2 where it unites with token γ obtaining the characteristic

"*final aggregated evaluation of the situation/object/event on the basis of the aggregated estimations of all experts, who finished his/her research*".

In some moment tokens (one or more) ε enter place e_1 with initial characteristic

"*criterion for comparison of the experts' evaluations and the real informations for the situation/object/event*".

$$Z_3 =< \{a_4, d_2, e_1, e_2\}, \{a_5, e_2\},$$

	a_5	e_2
a_4	$true$	$false$
d_2	$true$	$false$
e_1	$false$	$true$
e_2	$false$	$true$

$$\vee(\wedge(a_4, d_2), e_1, e_2) > .$$

Tokens α and δ enter place a_5 and unite in token α with a characteristic

"results of the comparison of the experts' evaluations and the real informations for the situation/object/event".

Token(s) ε are united in place e_2 with a characteristic

"list of criteria for comparison of the experts' evaluations and the real informations for the situation/object/event".

$$Z_4 =< \{a_5, c_{2k+2}, ..., c_{5k-1}\}, \{a_6, c_{5k+1}, c_{6k}\},$$

	a_6	c_{k+1}	...	c_{2k}
a_1	$true$	$false$	...	$false$
c_1	$false$	$true$	...	$false$
⋮	⋮	⋮	...	⋮
c_k	$false$	$false$	...	$true$

,

$$\wedge(a_5, c_{2k+2}, ..., c_{5k-1}) > .$$

Token α go out GN through place a_6 without a new characteristic, while token γ_i ($1 \leq i \leq k$) enters place c_{5k+i} with characteristic

"new expert's score on the basis of the comparison of the expert evaluation and the real status of the situation/object/event".

2 Conclusions

We have shown the possibilities of Generalized Nets as far as description of the decision making processes is concerned.

References

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