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GENERALIZED NET MODEL OF FACE RECODNITION

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1 Introduction

Face recognition is the science of programming a computer to recognize a human face. A face is a three-dimensional object and face recognition is a visual pattern recognition problem. There are four important modules in a face recognition system –
• detection (normalization) – segment the face from the background,
• alignment (localization) – more accurate localization of the face and scale of each detected face,
• feature extraction – to provide effective information that is useful for distinguishing between faces of different persons,
• matching – the extracted feature vector of the input face is matched against with the enrolled face in the database.

In [6], an algorithm has been developed for enhancing the quality of an image using operators on Intuitionistic Fuzzy Sets (IFSs, see [2]). In this paper, a Generalized Net (GN, see [1, 3]) model has been constructed for this system on the basis of [7].

2 Generalized net model

Here we shall construct a GN model of the above described process following [7]. The model contains 9 transitions and 3 types of tokens. Two of them – tokens β, γ stay permanently in places l_{13} and l_{15} with initial and current characteristics

"DB with relations between segments"

and

"DB with faces",

respectively.

Each one of tokens α (for simplicity, we will not use indeces of α showing the current number of the respective α-token) enters the GN through place l_1 with initial characteristic

"digital image of the face".

$$Z_1 =< \{l_1\}, \{l_2, l_3, l_4\}, \begin{array}{c|ccc} & l_2 & l_3 & l_4 \\ \hline l_1 & true & true & true \end{array} > .$$

Token α splits to three tokens – token α_1 entering place l_2 with characteristic

"noise reduction is required",

token α_2 entering place l_3 with characteristic

"contrast enhancement is required",

and token α_3 entering place l_4 with characteristic

"edge detection is required".

$$Z_2 =< \{l_2, l_3\}, \{l_5\}, \begin{array}{c|c} & l_5 \\ \hline l_2 & true \\ l_3 & true \end{array} > .$$

Tokens α_1 and α_2 unite in token α in place l_5 with characteristic

"enhanced image".

$$Z_3 =< \{l_4, l_5\}, \{l_6\}, \begin{array}{c|c} & l_6 \\ \hline l_4 & true \\ l_5 & true \end{array} > .$$

Tokens α and α_3 unite in token α in place l_6 with characteristic

"first processing step done".

$$Z_4 =< \{l_6\}, \{l_7\}, \begin{array}{c|c} & l_7 \\ \hline l_6 & true \end{array} > .$$

In place l_7 token α obtains a characteristic

"object separated from the background".

$$Z_5 =< \{l_7\}, \{l_8, l_9\}, \begin{array}{c|cc} & l_8 & l_9 \\ \hline l_7 & true & true \end{array} > .$$

Token α splits to two tokens – token α_4 entering place l_8 with characteristic

"results of shape segmentation",

and token α_5 entering place l_9 with characteristic

"results of colour or grey level segmentation".

$$Z_6 =< \{l_8, l_9, l_{11}\}, \{l_{10}, l_{11}\}, \begin{array}{c|cc} & l_{10} & l_{11} \\ \hline l_8 & false & true \\ l_9 & false & true \\ l_{11} & true & false \end{array} > .$$

Tokens α_4 and α_5 unite in token α in place l_{11} with characteristic

"results of the measurement of segment geometric and colour parameters".

$$Z_7 =< \{l_{10}, l_{13}\}, \{l_{12}, l_{13}\}, \begin{array}{c|cc} & l_{12} & l_{13} \\ \hline l_{10} & true & false \\ l_{13} & false & true \end{array} > .$$

Token α enters place l_{12} with characteristic

"detection of the face based on the relationship between segments",

while token β stays in place l_{13} with the above mentioned characteristic.

$$Z_8 =< \{l_{12}, l_{15}\}, \{l_{14}, l_{15}\}, \begin{array}{c|cc} & l_{14} & l_{15} \\ \hline l_{12} & true & false \\ l_{15} & false & true \end{array} > .$$

Token α enters place l_{14} with characteristic

"degree of similarity to the DB elements",

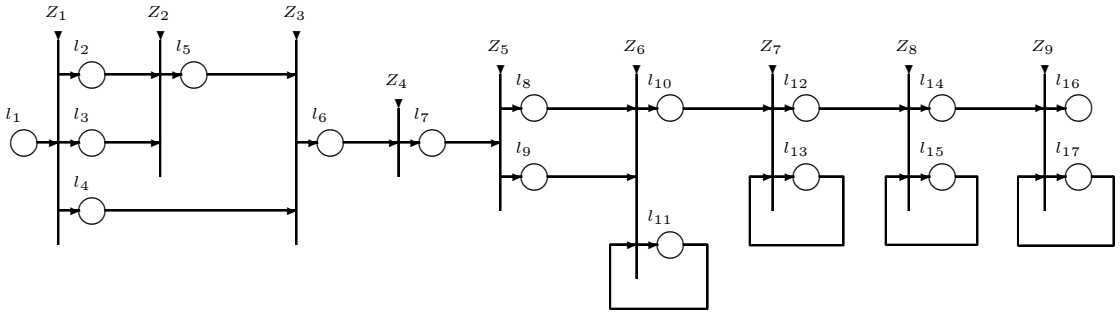
while token γ stays in place l_{15} with the above mentioned characteristic.

$$Z_9 =< \{l_{14}, l_{17}\}, \{l_{16}, l_{17}\}, \begin{array}{c|cc} & l_{16} & l_{17} \\ \hline l_{14} & false & true \\ l_{17} & true & false \end{array} > .$$

Token α enters place l_{16} with characteristic

"the smalest distance",

while all α-tokens entering place l_{17} unite in one α-token that does not obtain any characteristic.



3 Conclusion

The present GN is a new model continuating the researches published in [4, 5]. In continuation of this paper, the authors propose further to develop an algorithm based on this GN model for face recognition.

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