Arabic Characters Recognition using Fuzzy-Neural Network

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Outline

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- **Feature Extraction**
- **Fuzzy-Neural Networks Techniques**
- **Neural Networks (NNs) and Fuzzy-Neural Recognizers Results**
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Overview of ACR-FNNs

- ACR may provide a solution to the data entry problems, a bottleneck for the data processing industry. Four Character Forms (isolated, initial, medial and final (characters=105 it was 28-30)) used

- The research describes a system of ACR by using NNs & FNN recognizers to select the best combination of characters recognized by a fuzzy neural network.

- The computational intelligent approach proposed here permits the recognition of the four types of characters with a segmentation procedure allowing overlapped strokes having FNN-physiological meaning

- **Arabic Character Recognition System Structure**
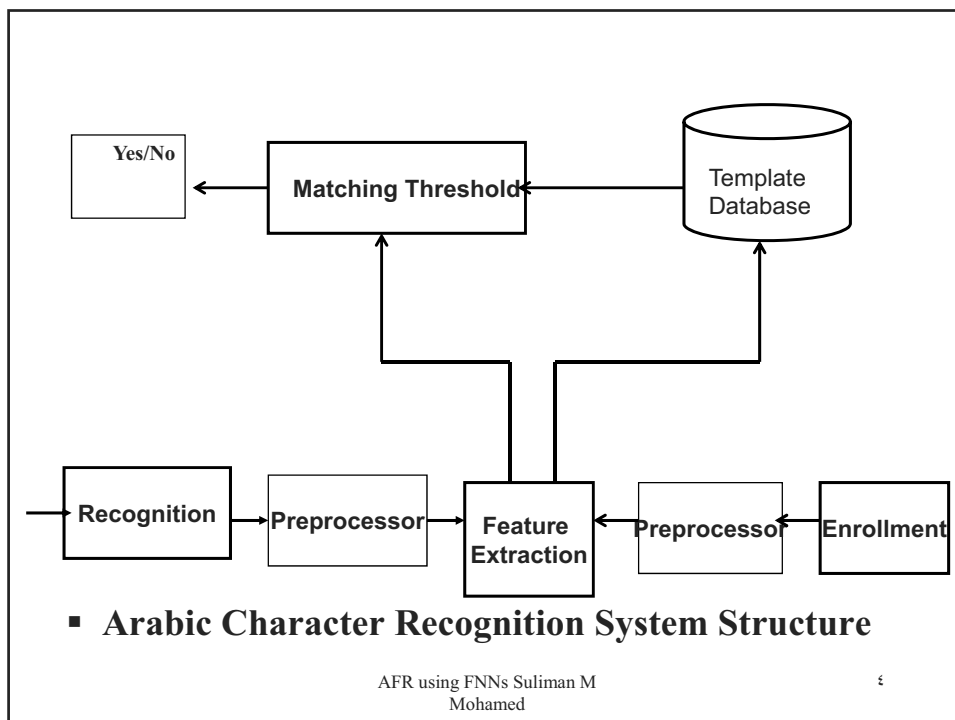
The Four Forms Problem (isolated, initial, medial and final)

Arabic **Isolated** letter forms

ا ب ت ث ج ح خ د ذ ر ز س ش ص ض
ط ظ ع غ ف ق ك ل م ن ه و ي ء ة

Arabic **Initial** letter forms

بـ تـ ثـ جـ حـ خـ سـ شـ صـ ضـ
طـ ظـ عـ غـ فـ قـ كـ لـ مـ نـ هـ يـ

Arabic **Medial** letter forms

ـبـ ـتـ ـثـ ـجـ ـحـ ـخـ ـسـ ـشـ ـصـ ـضـ
ـطـ ـظـ ـعـ ـغـ ـفـ ـقـ ـكـ ـلـ ـمـ ـنـ ـهـ ـيـ ـئـ

Arabic **Final** letter forms

ـا ـب ـت ـث ـج ـح ـخ ـد ـذ ـر ـز
ـس ـش ـص ـض ـط ـظ ـع ـغ ـف
ـق ـك ـل ـم ـن ـه ـو ـي ـئ ـة

Feature Extraction

- Feature Extraction (FE) is a step by step automatic algorithm has been implemented. The methodology developed, is comprised of image pre-processing and FE and then use intelligent system.

- FE implemented in four steps, such as, threshold, directional image computing, character points extraction, and feature vector encoding

- The statistical distribution of feature vectors been analysed using SPSS.

Fuzzy-Neural Networks Techniques

- Fuzzy logic and neural networks are the most computational intelligence techniques which imitate biological (brain) system & human behaviour.

- We investigated the combination of features of NN (with learning ability, self-organizing and high speed parallel structure) and fuzzy systems (with ability to process fuzzy information using fuzzy membership).

- In this system we utilised Neural and Fuzzy-Neural recognizers namely *(MLP, RBF and FNN)*. NNs and FNN all depend on training and testing the feature encoded vector of feature extraction.

Neural Networks (NNs) and Fuzzy-Neural Recognizers Results

- The developed feature vector used in a three recognizers to recognize a given database of character images into well known characters.

- The system has been tested on database of 219 character images. Recognition accuracy of 98.3% for FNN, 96.07% for MLP and 84.54% for RBF was achieved, without any rejection. This achievement is very reliable compared to reviewed existing studies which targeted up to 95% accuracy.

Further Works

- Create a database of Arabic characters for research and official use,

- Image enhancement techniques to deal with poor quality images and different nosey conditions,

- Apply thinning methodologies to enhance feature extraction

- Developing FNNs Techniques that can deal with other Arabic related issues

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•Many Thanks to all of you and Welcome for your questions

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