FEATURES SELECTION TECHNIQUES FOR OFF-LINE HANDWRITTEN ISOLATED ARABIC CHARACTERS

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FEATURES SELECTION TECHNIQUES FOR OFF-LINE HANDWRITTEN ISOLATED ARABIC CHARACTERS

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To my beloved husband, (HADER ABOUD) my biggest supporter;

And to my greatest father (Dr.SHAKIR NAJI) inspiration in my educational life;

my gorgeous mother, for all her efforts to encourage me;

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ABSTRACT

Offline Handwritten isolated Arabic characters' software has become a highly demand application to the machine reading of bank and post offices. In the past few years, several approaches have been used in the development of handwritten recognition applications. However, the recognition of handwritten Arabic characters is a difficult task because of the similar appearance of some different characters.In this study, the moments: contour sequence, geometric and Zernike moments are employed on handwritten characters to select the efficient features. The classification and recognition process are applied using Neural Network technique and the results are analyzed to determine the necessity of thinning and unthinning processes. The database consists of 6885 images of characters: 75% of training and 25% of testing in the network. Matlab tool is implemented to perform the classification and recognition processes. Results obtained have shown that thinning process should be excluded as it deteriorates the recognition accuracy. The experiments resulted 97.58% in Contour Sequence moments with unthinning for classification and 95.25% for recognition process. Thus, Contour Sequence moments with unthinning process exhibited the highest recognition rate as compared to Geometric moments and Zernike moments.

ABSTRAK

Perisian offline tulisan tangan terpencil Arab watak perisian telah menjadi permintaan tinggi aplikasi bagi mesin bacaan bank dan juga pejabat pos. Dalam beberapa tahun kebelakangan ini, beberapa pendekatan telah digunakan dalam pembangunan aplikasi pengiktirafan tulisan tangan. Namun, pengiktirafan tulisan tangan Arab adalah satu tugas yang sukar kerana karekter yang berbeza kelihatan yang agak sama. Dalam kajian ini, teknik pendekatan berasaskan moment digunakan ke atas karekter watak tulisan tangan untuk memilih urutan ciri yang cekap kontur, geometri dan momen Zernike. Pengelasan dan proses pengiktirafan aplikasi menggunakan teknik Rangkaian Neutral dan hasilnya dianalisis untuk menentukan keperluan operasi penipisan dan tak penipisan. Pangkalan data terdiri daripada 6885 arca, bagi semua karekter terdapat 75% latihan dan 25% ujian di dalam rangkaian. Alat Matlab diguna pakai untuk melaksanakan proses klasifikasi dan pengiktirafan. Keputusan yang diperolehi menunjukkan bahawa operasi penipisan harus dikecualikan kerana ia mengurangkan ketepatan pengiktirafan. Eksperimen-eksperimen menghasilkan 97.58% dalam moment kontur susulan dengan tak penipisan untuk klasifikasi dan 95.25% untuk proses pengiktirafan. Dengan itu, momen Kontur susulan tak penipisan mempamerkan kadar pengiktirafan tertinggi berbanding dengan momen geometri dan momen Zernike.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays character recognition is the most valuable and hottest issue in pattern recognition. There are many reasons for the highest importance of character recognition; however the main reason is the rising need of computer-processed documents.

The use of character recognition in different areas of human-machine interaction exhibits its importance; such as the machine reading of bank cheques, the manual processing of tax forms, and the automatic mail sorting of machines for postal code identification in postal offices, reading aid for the blind, forms readers, and other applications in the area of machine vision and office automation. Currently the most challenging issue in the field of pattern, according to many researchers is character recognition. This is because of the reality that logical methods are unable to solve this issue efficiently (Amin, 2003).There are various proposed techniques in the literature to solve the problem of character recognition but their achievement rates are different (Ball et al., 2006). Moreover, no benchmark databases are employed. Therefore, it is hard to compare the results.

A lot of research is carried out in the recognition of Latin, Chinese, Japanese, and Telegu characters since the last four decades. Various commercial systems are initiated in the market for the recognition of Latin characters recognition (Kim and Govidaraju, 1997).

On the other hand, no importance has been given to the recognition of Arabic characters although undoubtedly Arabic characters are used by around one billion people worldwide (Srihari*et al.*, 2005).

1.2 Problem Background

Feature extraction stage is much important in any pattern recognition system because it collects useful information about the desired objects and describes the shape of the character as accurately and distinctively as possible (Srihari*et al.*, 2006).This stage is very important because quality and quantity of extracted features is key factor to determine the accuracy of the system. Different techniques have been proposed for the feature extraction of handwritten characters (Zhang and Srihari, 2003).

An inclusive study on the prior proposed techniques can be found in (Alamri*et al.*, 2008). Feature extraction and classification for the problem of handwritten character recognition. In this regard, there are two main types of features: global (i.e. topological or statistical), or local (i.e. usually geometric). Both types have their own characteristics in different fields to get the distinct features of the object.

The competent features for extraction from handwritten characters are: structural features, concavity features and gradient features. Structural features such

as projection histograms, contour profile and zones could confine middle-level geometric characteristics, which count the corners and lines at various directions (Favata*et al*., 1994; Huang*et al*, 2008).

Nevertheless, binary images are used to extract these types of features, but they are the basis of jags on the stroke edges and influence the accuracy of the extracted features (Lorigo and Govindaraju, 2006).

Thus, they have applied more global concavity and gradient features. High-level topological and geometrical features are confined by concavity features which include the direction of bays, the existence of holes, and large vertical and horizontal strokes (Pechwitz*et al*., 2002). Gradient features characterize local characteristics accurately; however they are responsive to the deformation of handwritten characters (Pechwitz and Argner, 2006). The work is about the recognition of handwritten Arabic characters using an enhanced feature extraction technique. Character recognition means to convert the human-readable characters to machine-readable codes so that the human-computer interaction should be efficient. In general Arabic character recognition is a more complicated task than the other languages. The reason is the inherent characteristics of the Arabic characters, especially it is a cursive language, for which the isolated characters of a word is a challenging task.

1.3 Problem Statement

There are different types of features are used for extraction from handwritten isolated Arabic characters: Geometric moment features, Zernike moment featureand Contour Sequence moment feature, which are involved translation, scale and rotation invariants. What is the best feature for Arabic Characters?

1.4 Dissertation Aim

The main aim of this research is to find efficient features and classifiers for off-line handwritten isolated Arabic characters.

1.5 Dissertation Objectives

For achieving the objectives of this study, the following steps will be taken:

1. To study existing feature selection techniques for off-line isolated handwritten Arabic characters.
2. To select the best features extraction among Geometric moment features, Zernike moment featureand Contour Sequence moment feature.
3. To apply Artificial Neural Networks classifier.

1.6 Scope of Study

In order to achieve the objectives of the study, identification of scope is very important, which includes the following aspects:

1. Greyscale images isolated offline handwritten Arabic characters.
2. Research will be focus on feature selection and extraction.
3. Using Matlab tool.

1.7 Data Set

This dataset is obtained from http://hal.inria.fr/inria-00112676/en/, the research presents database for isolated offline handwritten Arabic and characters for use in optical character recognition research .this database consists of 52,380 Greyscale images of handwritten characters, the database is available for academic use, each image was scanned from Iranian school entrance exam forms during the years 2004-2006 at 300 dpi. Figure 1.1 shows the data set for isolated offline handwritten Arabic characters.

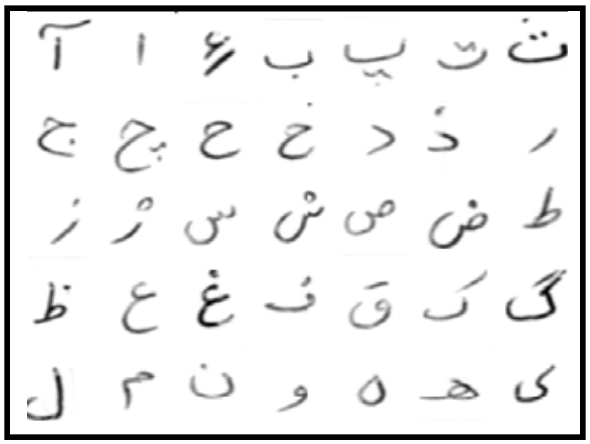

Figure 1.1 The data set for isolated offline handwritten Arabic characters.

1.8 Significance of Study

There are many practical applications of character recognition isolated Arabic characters such as the machine reading of bank cheques, the manual processing of tax forms, and the automatic mail sorting of machines for postal code identification in postal offices, forms readers, and other applications in the area of machine vision and office automation.

1.9 Dissertation Organization

Through this section a brief introductory provided for each chapter in this project which they are five chapters. Chapter 1 includes the introduction of the study, problem background, problem statement, objective, scope and the aim of this project. Chapter two presents the literature review studies of the previous work regarding the written identification. Chapter three shows the methodology and steps that are taken for overall work of this project. Chapter four presents the outputs and results. Finally, chapter five consists of the conclusion and the recommended work for the future improvements.

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