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Simulation of Face Recognition using Gabor Filter

A Research Submitted in Partial Fulfillment for the Requirements of the Degree of B.Sc. (Honor) In Electronics Engineering

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الاستهـــــــــلال

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قال تعالى:

[لاَ يُكَلِّفُ اللّهُ نَفْساً إِلاَّ وُسْعَهَا لَهَا مَا كَسَبَتْ وَعَلَيْهَا مَا اكْتَسَبَتْ رَبَّنَا لاَ تُؤَاخِذْنَا إِن نَّسِينَا أَوْ أَخْطَأْنَا رَبَّنَا وَلاَ تَحْمِلْ عَلَيْنَا إِصْراً كَمَا حَمَلْتَهُ عَلَى الَّذِينَ مِن قَبْلِنَا رَبَّنَا وَلاَ تُحَمِّلْنَا مَا لاَ طَاقَةَ لَنَا بِهِ وَاعْفُ عَنَّا وَاغْفِرْ لَنَا وَارْحَمْنَا أَنتَ مَوْلاَنَا فَانصُرْنَا عَلَى الْقَوْمِ الْكَافِرِينَ]

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البقـــرة : [286]

To Our parents, teachers, and friends with love…

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There have been many more people involved in this venture, whose names may not have been mentioned above, but their help is undoubtedly acknowledged.

ABSTRACT

Face recognition has been one of the most interesting and important research fields. The reasons come from the need of automatic recognitions and surveillance systems, the interest in human visual system on face recognition, and the design of human-computer interface, etc. Nevertheless, the approaches of the last decades have been determining for face recognition development. Due to the difficulty of the face recognition task, the number of techniques is large and diverse. In addition, the applications involve a huge number of situations.

The purpose of this dissertation is to investigate and implement a neural network for face recognition. the proposed system uses Gabor filters to compute gradient to images and stored it as database images, image inserted to the system firstly, then process it by enhance operation with specified Matlab algorithms, after the processing image been ready to use, the next step gradient is calculated by Gabor filters and finally the recognition done using neural network.

المستخلص

التعرف علي الوجه أصبح من أهم مجالات البحث , وذلك بغرض التعرف الآلي ومراقبة الأنظمة. لهذا كانت المناهج في العقود الأخيرة تسعى لتطوير نظم التعرف على الوجهوبسبب أن مهمة التعرف على الوجه تواجه بعض الصعوبات كانت التقنيات كثيرة ومتنوعة, بالإضافة إلى أن تطبيقات التعرف على الوجه تتطلب مواقع وأوضاع كثيرة جدا

الهدف من هذا البحث هو تطبيق خوارزمية الشبكة العصبية للتعرف على الوجه , النظام المقترح هو استخدام خوارزمية (Gabor filter) لحساب (magnitude) للصور المدخلة وتخزينها كقاعدة بيانات ومقارنة (magnitude) للصورة التي يتم التحقق منها مع (magnitude) لصور قاعدة البيانات .

أولا" تدخل الصورة إلى النظام ومن ثم معالجتها بعمليات تحسين الصورة بواسطة خوارزميات ماتلاب متخصصة لذلك الغرض, بعد معالجتها تصبح جاهزةللاستخدام .

ثانيا" يتم حساب (magnitudes) للصور بواسطة خوارزمية (Gabor filter) .

أخيرا" مرحلة التعرف على الوجه من الصورةباستخدام خوارزمية الشبكةالعصبية لمقارنة الصورة المعالجة مع صور قاعدة البيانات.

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G≡image after processing (Enhancement)

F≡image before processing (Enhancement)

σ_x , σ_y ≡

are the standard deviations of the Gaussian envelope along the x − and y − dimensions.

f≡the central frequency of the sinusoidal plane wave

θ_n ≡The orientation. The rotation of the x-y plane by an angle θ_n

P ≡ The number of orientations

⊗ ≡The convolution operator.

F (x, y) ≡the intensity at the coordinate (x, y) in a gray scale face image,

LIST OF ABBREVIATIONS

ALBPS	Adaptive Local Binary Pattern with Oriented Standard Deviation
ANN	Artificial Neural Network
DLA	Dynamic Link Architecture
EBGM	Elastic Bunch Graph Matching
FRS	Face Recognition System
GPU	Graphic Processing Units
IPT	Image Processing Technique
LBP	Local Binary Pattern
LDA	Linear Discriminate Analysis
LFDA	Local Feature-based Discriminate Analysis
LFW	Labeled Face in Wild
MRF	Markov Random Field
NIR	Near Infrared
ORL	Olivetti-Oracle Research Lab
PC	Personal Computer
PCA	Principal Component Analysis
SVM	Support Vector Machine

VIS	Visible light
WPD	Wavelet Packet Decomposition

Chapter 1

Introduction

Chapter One

Introduction

1.1 Background

Face recognition has been studied for many years and as practical application in areas such as security systems, identification of criminals and assistance with speech recognition.

Engineering started to show interest in face recognition in the 1960's. One of the first researches on this subject was Woodrow W. Bledsoe. In1960.

The first mention to Eigen faces in image processing, a technique that would become the dominant approach in following years, was made by L.Sirovich and M. Kirby in 1986 .Their methods were based on the Principal Component Analysis. Their goal was to represent an image in a Lower dimension without losing much information, and then reconstructing it [1].

Face Recognition is important to human because the face plays a major role in social intercourse, conveying emotions and feelings. Humans are adept at recognizing faces and can do so with ease even under a range of difficult physical conditions. However, developing artificial systems to simulator the human ability has proven to be a very difficult and computationally complex task. There have been numerous studies exploiting various concepts and problems in the face recognition process and many steps in designing human face recognition system.

Some of the systems have employed artificial neural networks while the others have a variety of approaches such as template matching of ISO-density lines of subject faces. Comparison of sizes/relative distances of facial features (nose, eyes, mouth) of subjects of facial images. Face recognition, although a trivial task for the human brain has proved to be extremely difficult to replicate artificially. It is commonly used in applications such as human-machine interfaces and automatic access control systems. Face recognition involves comparing an image with a database of stored faces in order to identify the individual in that input image. The related task of face detection has direct relevance to face recognition because images must be analyzed and faces identified, before they can be recognized. Detecting faces in an image can also help to focus the computational resources of the face recognition system, optimizing the systems speed and performance.[2] Face recognition involves separating image windows into two classes; one containing faces(targets), and one containing the background(clutter).It is difficult because although commonalities exist between faces, they can vary considerably in terms of age, skin color and facial expression The problem is further complicated by different lighting conditions, image qualities and geometries, as well as the possibility of partial occlusion and disguise an ideal face detector would therefore be able to detect the presence of any face under any set of lighting conditions, upon any background. For basic pattern recognition systems, some of these effects can be avoided by assuming and ensuring a uniform background and fixed uniform lighting conditions. This assumption is acceptable for some applications, where lighting conditions can be controlled, and the image background will be uniform. For many applications however, this is unsuitable, and systems must be designed to accurately classify images subject to a variety of random conditions.[3]

Face recognition is used for two primary tasks:

- Verification (one-to-one matching): When presented with a face image of an unknown individual along with a claim of identity, determining whether the individual is who he/she claims to be.

-Identification (one-to-many matching): Given an image of an unknown individual, determining that person's identity by comparing (possibly after encoding) that image with a database of (possibly encoded) images of known individuals.

There are numerous application areas in which face recognition can be exploited for these two purposes, a few of which are outlined below.

-Security (access control to buildings, airports/seaports, ATM machines and border checkpoints network security; email authentication on multimedia workstations).

- Surveillance (a large number of CCTVs can be monitored to look for known criminals, drug offenders, etc.

- General identity verification (electoral registration, banking, electronic commerce, identifying newborns, national IDs, passports, drivers' licenses, employee IDs).

- Criminal justice systems (mug-shot/booking systems, post-event analysis, forensics).

- Image database investigations (searching image databases of licensed drivers, benefit recipients, missing children, immigrants and police bookings).

- “Smart Card” applications (in lieu of maintaining a database of facial images, the face-print can be stored in a smart card, bar code or magnetic stripe, authentication of which is performed by matching the live image and the stored template) .

- Multi-media environments with adaptive human computer interfaces (part of ubiquitous or context aware systems, behavior monitoring at childcare or old people’s centers, recognizing a customer and assessing his needs.

- Video indexing (labeling faces in video)

1.2 Problem Statement

How to find method to detect or recognize the face from a person’s image. Detection or recognition is not accurate

1.3 Proposed Solution:

In this research the face is detected from images using Gabor filter algorithm recognized using neural network radial basis function (RBF)

1.4 Objectives:

The objective of this work is to simulate face Recognition by enhance the specific image and filter it with Gabor filter and compare it with date base images and recognize it with neural network

1.5 Methodology

Face recognition process can be decomposed into two major tasks.

- Finding a face in an image by using Gabor filter algorithm

The control one has lighting and background conditions. If the background lighting can be controlled then it might be possible to extract the feature of face very simply.

-Recognizing or identification of that face with neural network (RBF).

1.6 Expected Result

Laboratory tests were conductedusing 8photos have beendefinedon the neural networkwereidentifiedaccuratelymeasurethe performance ofthe system has been proved effectiveandexcellent.

1.7 Research Outlines

This research contains five chapters is divided as follows:

Chapter2: present the previous studiesonfacial recognition using neural network algorithms.

Chapter3: gives background information about the algorithm used Gabor filters.And theconstructand modus operand in determiningthe faceof the image and information about neural network function used (RBF).

Chapter4:This chapterexplainsthe practical applicationof thealgorithmand how it face recognition can be cast as a standard pattern classification or machine.recognizes the faces compared withthe database.

Chapter5: discuss the Ongoing Challenges in face recognition,alsocontainsrecommendations on the research infacial recognition inallconditions of the picture andthose constant ambient conditions.