



**Arab Academy for Science and Technology and
Maritime Transport**

**FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF COMPUTER ENGINEERING**

**PERSONAL IDENTIFICATION USING EARS BASED ON
STATISTICAL FEATURES**

A thesis submitted to Partial Fulfillment for the degree of Master of
Science in Computer Engineering

By

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ARAB ACADEMY FOR SCIENCE, TECHNOLOGY AND MARITIME TRANSPORT
College of Engineering and Technology

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by

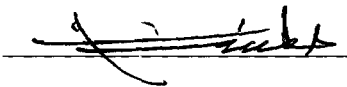
Alaa Tharwat Abd El Monaim

A Thesis

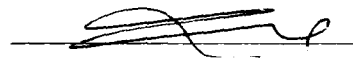
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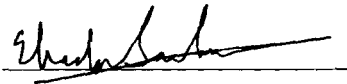
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“Our lord! Give us in this world which is good and in the Hereafter which is good, and save us from the torment of the Fire!” [Al-Baqarah 2:201].

ABSTRACT

Biometrics was used for many years to identify the persons in many systems. Biometrics is the automated methods of recognizing a person based on a physiological or behavioral characteristic. Ear recognition is one of the biometrics' branches that have been interesting in the recent years in the research fields. Ear recognition achieves good result of identification and has many advantages. But, there are many problems that affect the recognition rate of the ear recognition such as the pose of the face, lighting variation, occlusion with hair or clothes.

There are four methods that are used to extract features in this research namely Principal component analysis (PCA), Linear discriminant analysis (LDA), Independent component analysis (ICA), and Discrete cosine transform (DCT). PCA is used in the data reduction problems. While LDA used to discriminate between classes and it depends on maximize the variance between classes and minimize the variance in classes. ICA used in source separation problems. Finally, DCT method is used into many applications such as feature extraction and data compression.

This research includes four models to identify the persons using ears. The first model use single feature extraction method based on single classifier. And the second model based on single feature extraction methods using multi classifiers. The third model includes feature combination techniques (parallel or serial). In this model single classifier is used. But, in the fourth model multi features using multi classifiers are used.

Ear database images that consists of 102 grayscale images (6 images for each of 17 subjects) in PGM format is used in this experiment. And the four models that are mentioned previously are applied on this database using three experiments. The results that are achieved

proved that the identification process using ears gave us a high recognition rate. The results of the four models prove that the most suitable method in the first model is using LDA and neural network classifier. The results were between 64.12% and 100%. But, when combine many classifiers to increase the performance two methods are used namely Bourda count and majority voting. The result of this model was between 94.12% and 96.08%. In the third model, two methods of combining features are used namely serial and parallel. The results of this model prove that the serial (94.12% - 96.08%) combination is suitable than parallel (88.24% - 96.08%) combination. Finally, in the fourth model the results have not been improved because there is diversity between the classifiers so each classifier depend on each other.

Finally, the occlusion problem with hair or scarf is solved using the segmentation technique to neglect the occluded segment. There are many methods that are in the uniform or non uniform segmentation technique. But in this research the uniform segmentation is used for many experiments (horizontal, vertical, and grid). And all the previous models applied on the ear segments to choose the most suitable model that deals with the segmentation problem. And the best model was the fourth model to deal with the segmentation problem.

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ان معامل الارتباط بين المصنفات المستخدمة كان كبيرا مما يدل على وجود اعتماده بين هذه المصنفات على بعض.

لحل مشكلة اخفاء جزء من الاذن بواسطة شعر الرأس او الملابس تم استخدام تقنية التقسيم حتى يتسنى استبعاد الجزء الذى به تغطيه او الذى به تشويه. هناك اكثر من طريقه للتقسيم سواء التقسيم المنتظم او غير المنتظم. ولكن فى هذه الرسالة استخدمنا التقسيم المنتظم وتم عمل اكثر من تجربة (تقسيم صورة الاذن باكثر من طريقه افقيا وراسيا وشبكة). وتم تطبيق الاربعة نماذج السابق ذكرهم على هذه الاجزاء من الصور للوصول الى النموذج الامثل للتعامل مع هذه الاجزاء. وكان افضل نموذج للتعامل مع تقنية التقسيم هو النموذج الرابع.

ملخص الرسالة

إن العديد من الأنظمة تتطلب التعرف على الأشخاص قبل اعطائهم الصلاحية للدخول او الاطلاع على مقتنيات منظمة ما. يستخدم علم التحليل الاحصائي للظواهر الحيوية منذ فترة طويلة لهذه الغاية. وعلم التحليل الاحصائي للظواهر الحيوية هو التعرف على الأشخاص من خلال خصائصهم الفيزيائية او السلوكية. ويعتبر التعرف على الأشخاص باستخدام الاذن هو احد فروع هذا العلم والذي نال الكثير من الاهتمام في الفترة الاخيره في المجالات البحثية والتي اثبتت ان التعرف على الأشخاص بواسطة الاذن له كفاءة عالية ومميزات جيدة. لكن هناك الكثير من العوائق التي قد تؤثر على كفاءة التعرف على الأشخاص باستخدام الاذن مثل تغير زاوية الوجه، شدة الاضاءة، أو تغطية الاذن بواسطة شعر الرأس أو الملابس.

استخدم في هذا البحث أربعة طرق من طرق استخراج الملامح هي تحليل المركبات المتعامده، تحليل التمييز الخطي، تحليل المركبات المستقلة، والتحويلات المتقطعة بدوال جتا. تستخدم طريقة تحليل المركبات المتعامده عادة لتقليل عدد المركبات او الاحداثيات في حين تستخدم طريقة تحليل التمييز الخطي للتمييز بين الفصائل وتعتمد على تعظيم التباين بين الفصائل وتقليل التباين داخل الفصائل. و يستخدم تحليل المركبات المستقلة في مشكلة فصل المصادر. اخيرا تستخدم التحويلات المتقطعة بدوال جتا في تطبيقات كثيرة منها استخراج الملامح و ضغط البيانات.

هذه الرسالة تحتوي على اربعة نماذج للتعرف على الأشخاص بواسطة الاذن. النموذج الاول يعتمد على نوع واحد من طرق استخراج الملامح باستخدام نوع واحد من المصنفات. اما النموذج الثاني فيعتمد على نوع واحد من طرق استخراج الملامح لكن مع العديد من المصنفات المندمجه مع بعضها البعض. في النموذج الثالث يتم دمج اكثر من نوع من طرق استخراج الملامح سواء كان هذا الدمج مسلسل او متوازي. وفي هذا النموذج نستخدم نوع واحد منت المصنفات. اخيرا في النموذج الرابع يتم دمج اكثر من نوع من طرق استخراج الملامح مع اكثر من نوع من المصنفات المندمجه مع بعضها البعض.

في هذه الرسالة تم استخدام قاعدة بيانات صور للاذن تحتوي على ١٠٢ صورة (١٧شخص، كل شخص ٦ صور). وتم اختبار النماذج السابق ذكرها على قاعدة البيانات هذه باستخدام ثلاث تجارب للتعرف على الأشخاص باستخدام الاذن. واثبتت النتائج ان افضل طريقه مستخدمه لاستخراج الملامح في النموذج الاول هي تحليل التمييز الخطي باستخدام الشبكات العصبية كمصنف. وتراوحت النتائج عند استخدام ثلاثة صور لتدريب النظام من ٦٤,٧١ % إلى ١٠٠%. لكن عند دمج المصنفات مع بعضها البعض لتحسين النتائج استخدمنا طريقتين(عدد بوردا و التصويت). وتراوحت النتائج بين ٩٤,١٢%- ٩٦,٠٨%. في النموذج الثالث تم دمج طريقتين لاستخراج الملامح لتحسين اداء النظام هما الدمج المتوازي والدمج المتسلسل. واثبتت النتائج ان الدمج المتسلسل افضل من الدمج المتوازي حتى تراوحت نتائج الدمج المسلسل ٩٤,١٦%- ٩٦,٠٨% في حين تراوحت نتائج الدمج المتوازي ٨٨,٢٤%- ٩٦,٠٨%. أخيرا لم يحدث تحسن عند استخدام النموذج الرابع حيث



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التعرف على الأشخاص باستخدام صورة الأذن بالإعتماد على الملامح
الإحصائية

رسالة مقدمة كجزء متمم للحصول على درجة الماجستير في هندسة الحاسب

مقدمة من

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