Ain Shams University
Faculty of Engineering
Computer and Systems Engineering Department

Remote Sensing to Recognize Static objects

A Thesis
Submitted in Partial Fulfillment of the
Requirements of the Degree of
Master of Science in Electrical Engineering
(Computer & Systems)

Submitted By
Samer Mahmoud Hessin

B. Sc., Electrical Engineering
(Electronic Computers)
Military Technical College, 1989

Supervised By

Prof. Dr. Abd El-Moneim Wahdan **Prof. Dr. Mohamed Zaki Abd El-Magyd**

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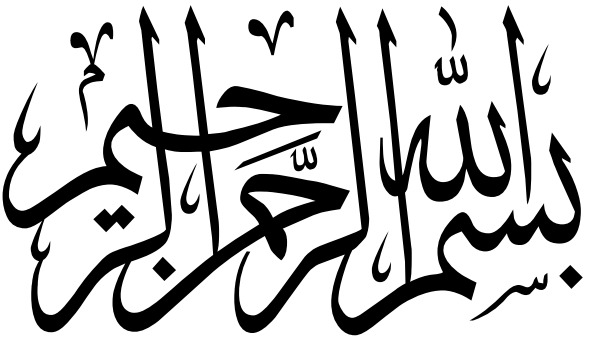
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EXAMNERS COMMITTEE

Name : Samer Mahmoud Hussin
Thesis : Remote Sensing of Static objects
Degree : Master of Science in Electrical Engineering
(Computer & Systems)

Name, Title and Affiliation	Signature
Prof. Dr.	.....
Prof. Dr.	.....
Prof. Dr. Abd El-Moneim Wahdan Department of computer Science The American University in Cairo	.....
Prof. Dr. Mohamed Zaki Department of computer Science The American University in Cairo	.....

Date : / /2004

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ABSTRACT

Samer Mahmoud Hessin

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In pattern recognition of static objects, the objective is to extract basic features for each object and to rely upon these features to distinguish between various kinds of objects. It has been found that there is a need to represent the original objects data in effective ways to overcome the limited digital number representation (0 - 255) for the panchromatic satellite images and the digital number interference of the multi-spectral images. For feature extraction of panchromatic satellite images a frequency analysis using Fourier transform is implemented. However, for the multi-spectral analysis principal components transform has been exploited, since the image elements generated by digital data from various bands often appear similar and convey essentially the same information.

This thesis presents a model-based design that can be used to distinguish between various kinds of objects in image files. This model could be carried out using three applied methods capable of detailed analysis for satellite images. With different features and / or object parameters, users can apply this model in other cases on different objects.

Three approaches have been adopted to extract the features that would enable differentiation between the objects. They are as follows:

First : Fourier Transform, which transforms the image into a frequency domain.

Second: Principal Components, which analyzes the image into its basic orthogonal components.

Third : Region Basde, an approach, which is based on the matching process between the same kinds of features to ensure each object's type.

The model presented in this thesis has successfully led to detecting the features in order to recognize the objects.

Moreover, the model has helped extracting various features for each object for the purpose of future automatic classification.

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APPENDIX A : Software aspects and specification:

Software definition:

The software used while, planning, designing, developing and testing of the model is **ERDAS IMAGINE V8.3.**

System requirements:

Requirements with Windows NT 4.0

System	Intel Pentium (Pentium II or higher recommended).
Operating system	Windows NT 4.0.
Service Pack	Service Pack 4 (or better).
Memory	64 MB .
Hard Disk Space	660 MB.
Display	Super VGA 800 x 600 x 256 colors (1024x768x64k colors recommended).
Install Media	Microsoft window compatible CD-ROM drive.
Mouse	Microsoft window compatible mouse(Microsoft Intellimouse recommended).
Parallel Port	Centronics Parallel port.

Requirements with windows 98

System	Intel Pentium (Pentium II or higher recommended).
Operating system	Windows 98
Memory	64 MB (128 MB highly recommended).
Hard Disk Space	660 MB.
Display	Super VGA 800 x 600 x 256 colors (1024x768x64k colors recommended).
Install Media	Microsoft window compatible CD-ROM drive.
Mouse	Microsoft window compatible mouse(Microsoft Intellimouse recommended).
Parallel Port	Centronics Parallel port.

APPENDIX B : Software Features:

1) A map-based graphical tool for indexing, viewing, managing and archiving data .
2) The ability to natively display and process a wide variety of raster formats without having to first import them .
3) Unequaled power and ease in displaying, combining, analyzing and presenting all types of geographic data.
4) Interactively pan, zoom, rotate and enhance data .
5) Geographically link or overlay multiple data sets and re-project on-the-fly .
6) Quickly and accurately register imagery to the reference system, with over 225 map projections and datum's.
7) Visual interpretation, heads-up digitizing and image categorization tools.
8) Batch wizard processing to automate production process.
9) Fully automated processes speed the creation of single image-map or complete-map series.

APPENDIX C IKONOS SATELLITE IMAGES FEATURE

1- SPATIAL RESOLUTION: 1-meter panchromatic, 4-meter multispectral.

2- Panchromatic : 0.45-0.90 mm.

3- Multispectral : 0.45-0.53 mm (band 1-blue).
: 0.52-0.61 mm (band 2-green).
: 0.64-0.72 mm (band 3-red).
: 0.77-0.88 mm (band 4-near infrared).

4- scene size : 11 X 11 km.

LANDSAT SATELLITE IMAGES FEATURE

1- SPATIAL RESOLUTION: 15-meter panchromatic, 30-meter multispectral.

2- Panchromatic : 0.52-0.90 mm.

3- Multispectral : 0.45-0.52 mm (band 1-blue).
: 0.53-0.61 mm (band 2-green).
: 0.63-0.69 mm (band 3-red).
: 0.78-0.90 mm (band 4-near infrared).
: 1.55-1.75 mm (band 5-near infrared).
: 10.4-12.5 mm (band 6-thermal).
: 2.09-2.35 mm (band 7-middle infrared).

4- scene size : 185 X 185 km.

1. Introduction

1.1 Historical Review

Recognition, of a pattern, could be of a variety of types, ranging from a template of the pattern, to a set of features or measurements that characterize the pattern, or a structural description based on such features [1]. Various images including satellite, medical image contain significant amount of texture information. Efficient ways of extracting this information using statistical [2] and structural approach [3], [4] to describe the texture pattern have been investigated.

Test results show that the texture features which can effectively define directional and spatial and frequency characteristics of the patterns may lead to good texture analysis and classification results.

Since the introduction of the Fast Fourier Transform, the spectral analysis to extract features has become one of the most frequently used tools in signal and image processing.

Principal component analysis has proven to be of significant value in the analysis of remotely sensed digital data [4]. Principal component transformation is a technique designed to remove or reduce redundancy in multispectral data, this transformation may be applied either as an enhancement operation prior to visual interpretation of the data, or as a preprocessing procedure prior to automated classification of the data.