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PROCESSING DIGITAL IMAGES FOR REMOTE SENSING

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Abstract

Particularly those found on satellites, imaging systems , offer a repeating and consistent image of the planet that has been utilised in several remote sensing applications, including mapping land use and cover, monitoring crop growth and deforestation, forecasting the weather, and many others. It is required to establish a specific process to extract information from the image data for each application. Finding an approach based on image processing techniques that is better suited to solving the issue is important in order to design a methodology. Despite the intricacy of the application, image registration, picture fusion, segmentation, and classification are some fundamental techniques that are used in the majority of remote sensing applications. So, the purpose of this study is to provide an overview of the application of image processing techniques to a general remote sensing problem. . A case study on an urban application is given to demonstrate how remote sensing technology may be used to address the issue.

Keywords: satellites, segmentation, Image registration, Image processing.

1 Introduction

The fundamental goal of processing a digital image is to extract information from it and improve its visual quality so that a human analyst or autonomous machine perception can better understand it. Digital images include those taken with digital cameras, by sensors on satellites or aircraft, by medical devices, by industrial quality control tools, etc.

To fully comprehend Earth processes, data from different sensors are being used more and more. To overcome the difficulties of extracting information from remotely sensed data, a variety of image processing systems have been developed [1]–[4]. To create a remote sensing application, a processing method must be created that will transform the data and produce the desired results. The photos must be adjusted geometrically and radiometrically before being examined. Pre-processing is a crucial step in the processing process, especially in applications where images are gathered from several sensors and at various times. After this step, the photos are improved to make information extraction easier. A digital thematic map is created after the photos have been split and categorised. Users must be aware that not

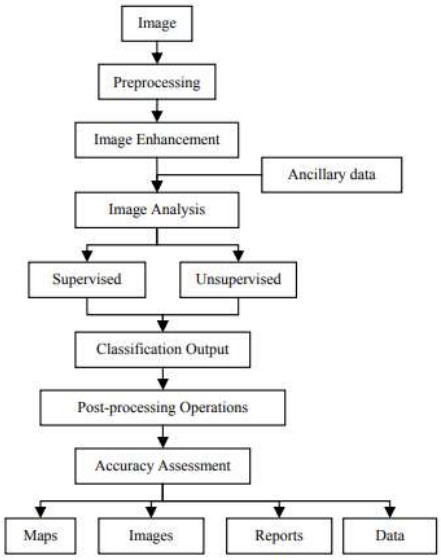
all apps require the same method of processing photos. The researcher needs knowledge of the data characteristics, the area of interest, and the kind of outcome he is interested in in order to construct a remote sensing application. Based on this information, he determines the best image processing methods and creates a strategy to address the application issue. As a result, we will give a broad overview of how image processing techniques might be used in remote sensing applications in this study. In Section II, we outline fundamental remote sensing ideas. In Section III, we then give a succinct overview of picture registration, fusion, segmentation, and classification. In Section IV, we present a research case on urban area analysis to demonstrate the implementation of image processing techniques in a remote sensing application. In Part V, we conclude by giving our findings.

2 Remote Sensing Concepts

Here, the term "remote sensing" refers to the process of measuring item qualities on the surface of the Earth using information from aircraft and satellites [5] [6][7]. The quantity of energy reflected from or emitted by targets on the Earth's surface is measured by sensors on board satellites or aircraft at various wavelength intervals. In order to monitor the earth system and the impact of human activities on the planet, remote sensing technologies, especially those on board satellites, offer a repeating and consistent view of the world [1].

3 Image Processing Techniques

It is necessary to establish a customised processing mechanism for each remote sensing application. The below figure tells about the key stages of digital image processing that specify the basic order of operations used to develop a technique. The processes that prepare data for a subsequent analysis that seeks to repair or make up for systematic flaws are referred to as preprocessing. Typical preprocessing methods include detector calibration, atmospheric correction, noise filtering, geometric correction, and picture registration [1], [3]. The analyst may utilise feature extraction techniques to decrease the dimensionality of the data as well as enhancement strategies to improve the items of interest after preprocessing is finished. Here, we'll refer to this action as improvement.



A. Image Registration

In many image processing applications where it is important to match two or more The registration process is essential for many of these applications, including the integration of data from various sensors, analysis of changes in images collected at various times, object recognition, motion analysis, and weather prediction.

The identification of several control points in the photographs is essentially what the registration operation entails. The control points are located with human aid in the

typical manual method. Automated solutions have been developed since manual control point detection may be time-consuming and laborious. Also, the rise in satellite imagery has increased the demand for automatic image registration techniques.

B. Image Fusion

The growing availability of digital images in various spectral bands, spatial resolutions, and remote sensing applications provides significant incentives to combine images with supplementary data to produce hybrid products of higher quality. It is preferable to spatially improve low-resolution multispectral (MS) data since there is a physical restriction on the trade-off between spatial and spectral resolution in remote sensing imaging. While having strong spectral resolution, multispectral images sometimes have poor spatial resolution that makes them unsuitable for some identification tasks.

C. Image Segmentation

A fundamental task in image analysis is image segmentation. One of the initial phases in the study of remote sensing images is the segmentation process: The image is divided into areas that most accurately depict the necessary scene elements.The data can be further analysed using the extracted region properties. The quality of segmentation has a direct impact on classification quality in object-oriented analysis.

D. Image Classification

The technique of producing thematic maps from remote sensing imagery is known as image categorization. A thematic map shows the elements of the earth's surface (soil, plants, roofs, roads, and buildings), and the way it is made suggests that the themes or categories chosen for the map are recognisable from one another. This task can be made more challenging by a variety of factors, such as geography, shadows, atmospheric effects, similar spectral signatures, and others. A thematic map shows the elements of the earth's surface (soil, plants, roofs, roads, and buildings), and the way it is made suggests that the themes or categories chosen for the map are recognisable from one another. This task can be made more challenging by a variety of factors, such as geography, shadows, atmospheric effects, similar spectral signatures, and others.

E. Classification Result

The attributes chosen during the training phase and the preceding decision trees were used for classification. While other classes are pretty clearly separated, the visual study of the categorization reveals confusion between the classes for Ceramic Roof and Bare Soil.

4 Conclusion

This paper presented a brief review about the general procedure employed to solve a remote sensing application using image processing techniquesTo demonstrate a remote sensing application, a case study based on an urban application is given. With the intention of enabling an interpreter or scientist to perform research on remote sensing applications, attention has been paid to the key image processing techniques.

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