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Satellite Image Processing

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ABSTRACT: Satellite image processing plays a pivotal role in the modern era, enabling us to extract valuable information and insights from remote sensing data captured by satellites orbiting the Earth. This abstract provides a concise overview of the key aspects and importance of processing images from satellites. A vast array of methods and procedures are used in satellite image processing to analyze, improve, and interpret images obtained from different Earth-observing satellites.

It serves as a critical tool in fields such as environmental monitoring, agriculture, urban planning, disaster management, and scientific research. One of the primary applications of satellite image processing is in land cover classification and change detection. The accuracy and efficiency of land cover classification have been transformed by machine learning techniques, especially convolutional neural networks, which automatically identify and classify land features from satellite imagery, including forests, cities, and bodies of water.

KEYWORDS: Machine Learning, Convolutional Neural Networks, Image Classification.

I. INTRODUCTION

Satellite image processing is a field of remote sensing that involves the manipulation, analysis, and interpretation of images acquired from Earth-observing satellites. These images provide valuable information about the Earth's surface, atmosphere, and other features. Applications such as agriculture, scientific research, urban planning, environmental monitoring, and disaster management all heavily depend on satellite image processing. Environmental monitoring and conservation heavily rely on satellite image processing. Satellite imagery helps in precision agriculture by providing insights into crop health, and pest infestations. The ability to process satellite images quickly is essential in disaster management. Processing satellite images supports the management of natural resources, such as water bodies, forests, and minerals.

II. LITERATURE SURVEY

1. In Ibrahim's paper, Investigations were conducted into the impact of transfer learning on classification accuracy as well as the usefulness of the Convolutional Neural Network (CNN) models created by transfer learning to identify land use from satellite photos. In the context of this work, the transfer learning approach has been assessed utilizing various publicly available datasets comprising satellite photos for scholarly research. The accuracy of the CNN models for classifying satellite pictures was evaluated between those that were completely trained and those that were learned by transfer learning. For every dataset included in the study, it has been noted that CNNs trained by transfer learning produced results that were more accurate.

2. Jicheng explain that One of the hottest topics in optical remote sensing image scene classification research right now is the transfer of CNN models that have already been pre-trained on a sizable visual dataset. It is challenging to manually determine the optimal hyper-parameter fine-tuning during the transfer of a pre-trained CNN model. This study proposes CNN automatic fine-tuning based on reinforcement learning to automatically search for the optimal fine-tuning hyper-parameters in order to address this issue. In particular, the CNN fine-tuning hyper-parameters are optimized layer by layer using the Double Q-learning approach, leading to the final production of a convergent fine-tuning hyper-parameters sample. In the experiment, two ORSISC datasets—UC-Merced and AID—are used to fine-tune the pre-trained CNN model of AlexNet.

3. Skakun paper informed Two machine learning techniques, random forest and multilayer perceptron, were utilized to classify all of the Sentinel-1 photos that were accessible and covered the study area. The findings indicate that SAR data can be applied to LULC mapping, including classes for water, sandbanks/outcrops, rainforests, and savannas. However, it is unable to accurately divide all groups, particularly those with geometrically similar structures

like buritizais, perennial crops, and regeneration regions. The objective of this research is to map Land Use and Land Cover (LULC) using time-series Sentinel-1 Synthetic Aperture Radar (SAR) data in the Roraima, Brazil region.

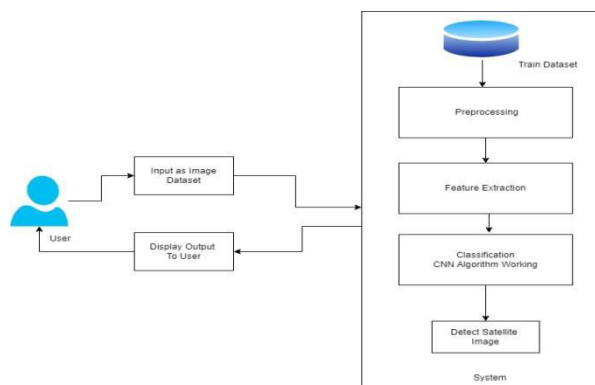
4. Apurva Saksena informed that An urban area is defined as a patchwork of densely populated areas. Within a city, land-use refers to the prudent and logical distribution of available land resources among various uses (e.g., managed woods, arable fields, pastures, and settlements). It is a method of making use of the land, covering resource allocation, planning, and management. A piece of land's physical characteristics and how it is used are related. Nevertheless, despite the abundance of geographical data, there is a dearth of study demonstrating this relationship.

5. Ruikun informed Enhancing the ability to extract information about land cover can be done effectively through the fusion of data from remote sensing. This work investigated the potential in land classification using optical remote sensing images of GF-1 and SAR images of GF-3. The study location was chosen to provide a variety of land cover types. The object-oriented method for classifying land cover included the spectral, texture, and vegetation indices that were retrieved from panchromatic, multispectral, and SAR pictures. When compared to the outcome obtained with simply optical images, the classification accuracy decreased due to the noises produced by the SAR information on roads, buildings, and bare ground.

6. Center for Biosphere Studies In this article, a research site in southwest France, close to Toulouse, is monitored for land cover and use using satellite pictures for a period of 11 years. Spot and Landsat are used to collect time series of optical data, providing high spatial resolution multispectral images. Each year, a variety of land cover and usage types are identified. It is based on a random forest algorithm and national reference geographic data.

7. Patrick Helber Several uses for earth observation are made possible by the resulting classification system. We show how this classification scheme can be applied to enhance geographical maps and to identify changes in land use and land cover. This research presents a patch-based approach to classify land cover and land use using Sentinel-2 satellite pictures.

III. PROPOSED SYSTEM



System Architecture

IV. METHODOLOGY

- Ensure that the image data is calibrated to remove variations in sensor sensitivity. Apply various image enhancement techniques like contrast stretching, histogram equalization, and filtering to improve image quality and visual interpretation.
- Choose appropriate methodologies based on the specific problem at hand. Not all problems require the same approach, and selecting the right methodology is crucial for efficiency.
- Streamline and automate data preprocessing to reduce manual labor and save time. Automated radiometric and geometric corrections, as well as atmospheric correction, can significantly improve efficiency.

- Process smaller subsets of large image datasets to manage data volume and reduce processing time.
- Implement quality control procedures to catch errors early and minimize the need for reprocessing.

V. CONCLUSIONS

Satellite image processing plays a pivotal role in our ability to monitor and understand our planet. It enables us to gather information about the Earth's surface, track changes over time, and make informed decisions in various domains, from climate change studies to disaster response. We can anticipate satellite image processing to become progressively more complex and widely available as technology develops, providing insights that help us make better decisions and get a deeper understanding of the world around us.

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