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Classification of Land and Marine Resources Using SVM Classifier

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***Abstract**: In the last several years, there has been a significant decrease in ecosystem marine and terrestrial resources. Therefore the conservation and management of these natural resources are an essential aspect for the present and for future generation. The main objective of the paper is to build and develop the advanced image processing methods applied to remote sensing images for the marine and land resources conservation. Different image processing techniques have been implemented in preprocessing stage in order to acquire high-resolution satellite imagery. The paper in mainly focused on three ecosystems from the Canary Islands where, after different evaluation and extensive analysis are made. Pansharpening process is used to enhance the image quality, then, different RPC models have been used to perform the orthorectification and finally, advanced techniques have been used for atmospheric correction. The final procedure is to develop the marine and terrestrial product map using advanced classification techniques for the management of marine and natural resources.*

***Keywords:** Remote Sensing, Satellite Imagery, High-Resolution Images, Atmospheric Correction and Orthorectification, Pansharpening.*

I. INTRODUCTION

Ecosystem natural resources provide a wide range of useful marine and terrestrial resources which enhance the human welfare. However, due to the lack automation and computerization, there has been a significant decline in these ecosystem resources [1]. The remote sensing satellites provide the specific, accurate and systematic product information about these marine and terrestrial resources. Thus, it is important to develop advanced image processing techniques to acquire the accurate data from remote sensing satellites to monitor the natural resources. The advanced reliable methods have to be developed for the management, analysis, and conservation of these land and marine resources, in a continuous, automatic and economic way, and at efficient spatial, temporal and spectral resolution for the proposed work is under the study.

The coastal ecosystems are the most complicated and complex productive systems across the world in exists a difficulty in remote sensing areas of water and land meet, which are boundaries of sea, rivers because of the low reflectivity of land covers, These ecosystems are very sensitive to the human and environmental perturbations. Concerning terrestrial resources, which are difficult in the analysis and classification of living organisms such as plant and tree species by remote sensing, due to lack of reliability of the product maps, the high cost, the lack of computerization and automation in remote sensing classification becomes difficult. Finally, the enhanced images of satellites need to be processed to obtain the useful products of the land and marine resources for the appropriate management.

In this context, the main objective is to develop advanced image enhancement techniques which, when these techniques applied to high-resolution remote sensing sat imagery, which serves to obtain accurate needed information for the management of natural resources. Thus different novel techniques are implemented at each level of processing. During initial stages techniques for image fusion, image segmentation and multispectral bands classification will be developed and algorithms for topographic correction will also implement.

Objectives at more specific stages are:

- Obtain the all necessary data for characterization of different ecosystems to be analyzed.

- Apply the feature extraction and other pre-processing algorithms to the selected images to provide high quality spectral and spatial information.
- Implement and develop the specific product for coastal marine resources management.
- Develop essential product tool for the plant and terrestrial resource management.
- Carry out studies on the state of conservation of natural resources.

II. LITERATURE SURVEY

Remote sensing satellite will provide the raw data images, hence, it is a very important step to apply feature enhancement and extraction techniques and applying image processing techniques to obtain high resolution spatial and spectral image information. Most of the optical remote sensors will give a multispectral and panchromatic image of the same scene, which is simultaneously recorded. By image fusion techniques at each pixel level, multispectral image spatial resolution will be improved by combining the information from the panchromatic images.

In the last several years, various algorithms are developed [2, 3], Discrete Wavelet Transform is main algorithm [4, 5] and MTF [Modulation Transfer Function] [6] and other traditional algorithms are developed [7], however the specific algorithms has to be implemented for new high-quality multispectral sensors. In addition, the images acquired from the high-resolution sensors needs to be processed in order to reduce the tilt and topographic relief effects or to increase the illuminated radiance on the slope of the remote sensing areas. Previously used main algorithms for orthorectification [8-10] are not fully accurate and validated, which works efficiently only for medium resolution images. Different techniques and methodologies have been developed for removing the atmospheric absorption such as 6S, DOS, FLASH, and QUAC. Recently, there have been comparative studies about FLASH and QUAC [12, 13]. Simulation and Synthesis of image processing algorithms are dealt in [14, 15].

Once all the correction techniques are applied, advanced image processing is needed in order to obtain the land and marine high-level product maps. The main algorithms are focused on obtaining the multispectral parameters for classification, segmentation to generate a thematic map which h provides the clear parameter under the study.

III. PROPOSED WORK

The first stage of the work is to gather all the necessary information (images and data) required in each study area to proper training of the system for the appropriate characterization of each ecosystem to compare the products which are generated by images of remote sensing satellite.

Proposed study is mainly focused on the ecosystems found in different regions since it is considered both biodiversity and geologic hotspot. Thus three areas in the Canary Islands are chosen as image samples for the availability of obtaining the field data as shown in the figure. 1.

Fig. 2 shows the Worldviw-2 image of the ecosystem of the proposed study. It provides very high spectral and spatial resolution data. To measure the resources such as quality of water, sea and land cover reflectivity and terrain elevation maps were provided and collected by the captured image of these areas

Fig. 3 shows the architecture with every step required in order to obtain ecosystem products. After applying pansharpening techniques, that could achieve good performance with Wv-2 images and gives the better-fused images for appropriate classification of natural resources. However, a number of statistical and other performance evaluation measures are carried out to measure the quality of the fused image. Next step is to carry out the orthorectification using an RPC model to remove the tilt and relief effects in the single scene image.

Once images have been enhanced and corrected, thematic product map is generated for the coastal marine and land terrestrial resource management is carried out.

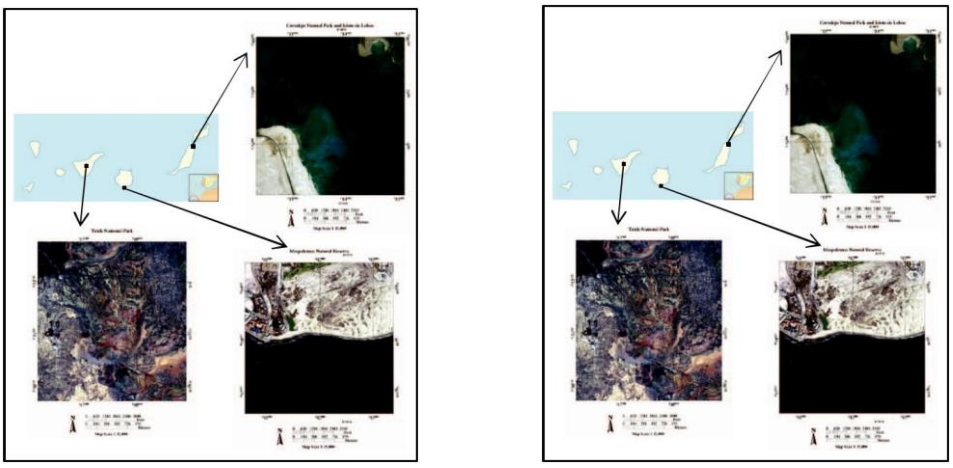


Figure.1: Study area map of the three chosen areas from the Canary Islands.

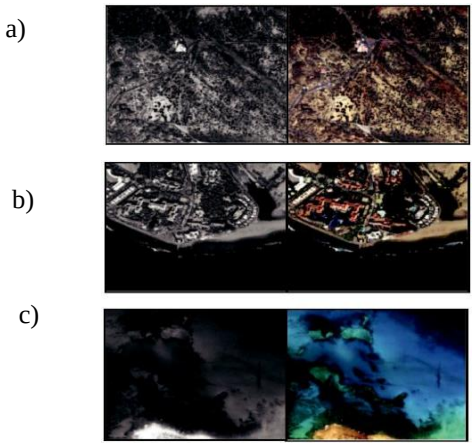
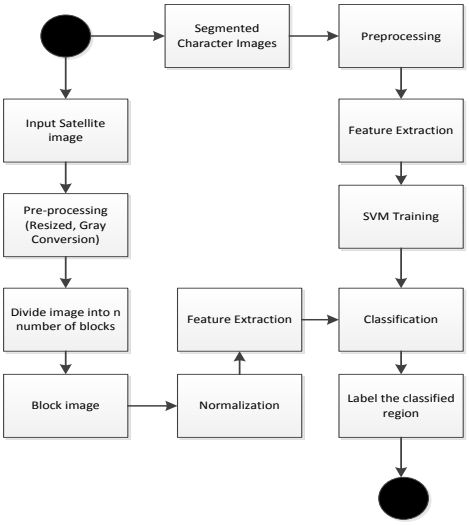


Fig. 2 Wv-2 scenes from Canary Island

Regarding marine resources, evaluation of water surface quality is fundamental and essential for the management of these resources. Estimating the parameters of water quality and the surface is a complex process thus, it is important to develop the operational algorithms to validate such parameters. On the other side, generation of bathymetry maps in an innovation field. Finally, the multiband algorithms for the advanced classification are applied to generate the costal and terrestrial thematic using maps by combining object based technique and support vector machine algorithm using all the necessary spatial and spectral information.



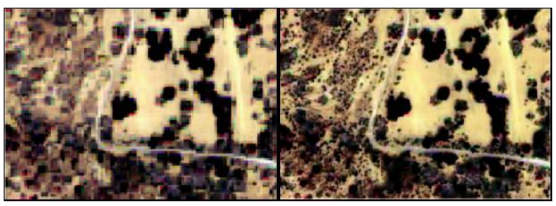


Fig. 3: Proposed system architecture

An effective tool, which allows to the product map generated by sensors for the conservation of coastal and terrestrial resources will be implemented. To finish, the availability of the valid data of the products, which is associated with marine and land resources, researchers will carry out the detailed report on the status of the conservation of each resource analysis

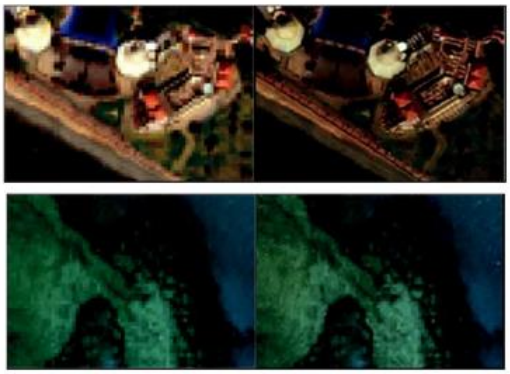


Fig. 4: Original and final fused images.

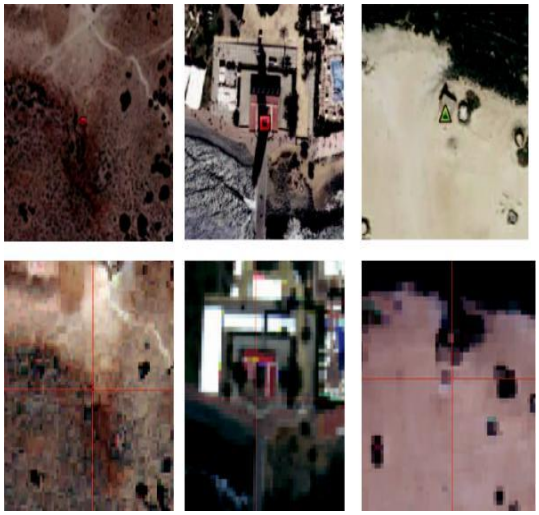


Fig. 5: Orthorectified images (down) and comparative images (up)

CONCLUSION

The best fusion techniques for each study area is implemented and orthorectification is performed, which enhance the image quality for the analysis of natural resources, SVM algorithm is the most suitable algorithm for the classification of the resource products.

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