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A Moment Analysis Approach for Region Extraction in Radar Images

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Abstract: To identify different regions over radar images, it is required to perform image classification. The present work will perform image classification for extracting regions over radar images. The present work is the hybrid approach that will use the concept of moment analysis along with histogram analysis to perform the image classification. Histogram based analysis is used to identify the number of possible region by analyzing the peak values. After that the region assessment will be performed by analyzing the average weight over the pixels called moment of image pixels and finally color mask will be implemented to perform the colorization to separate different regions. The presented work will work on high intensity images effectively so that the moment analysis will be performed accurately.

Keywords: classification, histogram, SAR image, hybrid approach, segmentation.

1. Introduction

In the broadest sense, Radar sensing is the measurement or acquisition of information of a phenomenon or object by a recording device that is not in the intimate or physical contact with the object. Basically, radar sensing is the utilization at a distance (as from satellite, spacecraft or ship) for any device for gathering information from the environment. So an aircraft taking photographs, environmental monitoring and weather satellites, monitoring of a pregnancy via ultrasound & space probes all are the examples of radar sensing. In modern usage, the term generally refers to techniques involving the use of the instruments abroad aircraft, spacecraft & is distinct from other imaging-related fields such as medical imaging.[1] Remote sensing is about to perform the analysis and acquire the information of an object under some defined phenomenon relative to the associated device. The main objective of sensing is to identify the existing of some entity, object, region etc. over the image. In the applications that will be focused on my thesis, the radar sensor is usually carried by a satellite or an aircraft & the data set acquired by the sensor is typically expressed as a digital image of the Earth surface. From this viewpoint, each pixel corresponds to a given ground portion where geophysical/geographical information where information being of interest to the end user.[3] The radar sensing technology has been acquiring a growing interest from the viewpoints of the environmental monitoring & management. This type of technology allows to new opportunities for Earth surface information extraction. Radar sensing data allows studying on a regional scale (e.g., desertification studies, weather forecasting and modeling) and on a local scale (e.g., urban areas mapping, crop monitoring). More generally, radar sensing data can provide valuable information for a large variety of applications from vegetation-resource management and ecology (e.g., precision farming, forest mapping and inventory) to urban and land use applications, from meteorological, oceanography and hydrological applications (e.g., ice, snow cover, dro
ght monitoring, water quality assessment) to geological (e.g., stratigraphy studies) and geophysical (e.g., crustal-dynamic monitoring, Earth magnetic fields studies) applications. Additionally radar sensing can also provide a crucial support for handling natural disasters (e.g., forest fires, floods, landslides, earthquakes and seaquakes), both for prevention purposes (e.g., through the generation of risk maps for flooding events) and as a support to crisis management and to post crisis damage assessment (e.g., through the generations of maps of burnt areas after a fire event)[3].

However, an effective exploitation of such potentialities calls for the development of accurate and reliable image analysis procedures. In this thesis, this analysis issue is addressed by operating in the context of pattern recognition methodologies and by proposing innovative processing techniques to solve specific problems of environmental information extraction from radar-sensing images.[14]

2. Literature Review

In Year 2011,Wu Chun performed a work," Speckle Denoising Method for SAR Based on EMD". Author proposed an amalgamation frame based on EMD and PCA algorithm. The frame can effectively filter the speckle noise and enhance the structure character which finally can be seen by people's eyes. Using the proposed method, the speckle noise of SAR image in different scale is filtered. At last, Author obtain the new denoised SAR image[1].

In Year 2011, S.Md.Mansoor Roomi performed a work," Discrete Wavelet Transform Based Despeckling for SAR images". This proposed algorithm uses new improved thresholding and polynomial soft thresholding function to threshold the non-edge component present in the corrupted image. The proposed work has been simulated using Matlab 7.0 and the experimental results demonstrate that the new method shows better result compared with various other despeckling techniques[2]. In Year 2011, Lavika Goel performed a work," Performance Governing Factors of Biogeography Based Land Cover Feature Extraction: An Analytical Study". This paper is an analytical study and a performance based characterization of the most recent nature inspired image classification technique i.e. Biogeography based Optimization (BBO) that has been used for focused land cover feature extraction. The paper explores the behavior of BBO over different terrain features of a multi-spectral satellite image and establishes the fact that the classification efficiency of BBO for a given land cover feature is proportional to the degree of disorder of the Digital number (DN) values of the pixels comprising that land cover feature when viewed in any of the bands of the multispectral satellite image[3]. In Year 2011, Patil Bhushan V. performed a work," SDMS-An image processing application". The principal idea of this system is to automate the inspection process of sheet metal components manufactured by small and medium scale industries. The motive behind developing SDMS is to reduce the time and labor spent by the industries for inspection of components. This paper shall throw light upon various aspects of image processing and will focus mainly on the details of SDMS as an application of digital image processing[4]. In Year 2009, H.B. Kekre performed a work," SAR Image Segmentation using co- occurrence matrix and slope magnitude". Author here proposed a new method as an edge detector for SAR images. It computes actual magnitude of slope in horizontal as well as in vertical direction by using any edge operator and then the resultant of these gradient of slope obtained and image of slope magnitude is constructed. On this image of slope magnitude canny's edge operator is used for getting segmented image[5]. In Year 2010, Dr.P.Subashini performed a work," A combined preprocessing scheme for texture based Ice classification from SAR images". This paper presents a preliminary study of image processing on the ice patterns in synthetic aperture radar (SAR) imagery. Here, analysis is done on the performance of texture features derived from the gray-level co-occurrence matrix based on image enhancement methods. The discrimination ability of the proposed method for texture computation is examined and compared by objective parameters. All experiments are conducted on several SAR images to provide generalizations of the results [6].

In Year 2010, Triloki Pant performed a work "Application of Fractal Parameters for Unsupervised Classification of SAR images: A Simulation based Study ". In this paper a contextual classification has been performed in an unsupervised way for SAR image. For this purpose, fractal parameters viz. fractal dimension and lacunarity is used. In order to apply the methodology, first of all a set of simulated SAR images has been generated and tested for classification and then the proposed methodology is applied on satellite SAR images[7].

In Year 2003, Noureddine Abbadeni performed a work," Content Representation and Similarity Matching for Texture based Image Retrieval". This paper addresses the fundamental issues of visual content representation and similarity matching in content-based image retrieval and image databases in general. In this paper, a new similarity model is introduced based on the Gower coefficient of similarity. This similarity model is exible and can be declined in several versions: non-weighted, weighted and hierarchical versions. This model was applied to a sample of homogeneous textured images considering two representation models: the autoregressive model, a purely statistical model, and an empirical perceptual model based on perceptual features such as coarseness and directionality[8].

In Year 2010, V Turkar performed a work," Polarimetric SAR Image Classification by Using Artificial Neural Network". The proposed classifier is based on the artificial neural network which is developed in Matlab and it makes use of backscattering values. It is a supervised classification technique which is applied on the ALOS PALASR and SIR-C data. The classification accuracy after applying different speckle filters is compared with the classification accuracy obtained without applying filter[9].

In Year 2007, Michael R. Peterson performed a work," A Satellite Image Set for the Evolution of Image Transforms for Defense Applications". Author present a set of fifty satellite images used to evolve image transforms appropriate for satellite and unmanned aerial vehicle (UAV) reconnaissance applications. Author identify the best training and test images[10].

In Year 2003, Kentaro Toyama performed a work," Geographic Location Tags on Digital Images". Author describe an end-to-end system that capitalizes on geographic location tags for digital photographs. This paper brings all of these issues together, explores different options, and offers novel solutions where necessary. Topics include acquisition of location tags for image media, data structures for location tags on photos, database optimization for location-tagged image media, and an intuitive UI for browsing a massive location-tagged image database[11]. In Year 2010, Dr.P.Subashini performed a work," Quantitative performance evaluation on segmentation methods for SAR ship images". The work proposed in this paper explores the strength and weaknesses of the methods and are analyzed for practical purposes. The progress towards the work is validated with SAR image database in which objective and subjective quantitative performance is clearly identified. The comparison is based on the potential performance measures. The methods show special strength in providing designers with an adequate degree of freedom in choosing the proper objects of the SAR image for their application purposes[12]. In Year 2009, Xiuli Ma performed a work," Spectral Clustering Ensemble for Image Segmentation". To make full use of information included in a dataset, a multiway spectral clustering algorithm with joint model is applied to image segmentation. To overcome the sensitivity of the joint model based multiway spectral clustering to kernel parameter and to produce the robust

and stable segmentation results, spectral clustering ensemble algorithm is proposed in this paper, which can make full use of the built-in randomness of spectral clustering and the inaccuracy of Nystrom approximation to produce diversity[13].

In Year 2011, Debabrata Samanta performed a work," Classification of Synthetic Aperture Radar Images Using Moment". In this paper a novel methodology has been carried out to classify SAR images using the Moments. This paper also provides the overview of most commonly used of moments and then present a moment based approached for classification of SAR images[14].

3. Experimental Approach:

The presented work is the hybrid approach of two major pixel intensity based analysis schemes. These approaches are histogram based analysis and the moment based analysis. The first method will identify the number of different regions over the image based on peak value analysis and the second approach will perform the region identification and the colorization of the work. The stages of the work are given as under:

1. Collection of Data From Some Secondary source : The images required here should be high resolution images so that classification can be done effectively. These kind of images can retrived from the references mentioned in earlier papers.
2. Preprocessing : The preprocessing stage is about the conversion of an image to a normalize image form. Here the normalization includes the adjustment of size, intensity, color model of the image.
3. Find the Number of Regions: To estimate the number of regions over the image, the histogram based analysis will be performed. This kind of analysis is based on the peak value analysis of the regions in histogram. Number of peak mountains in the histogram will represents the number of regions over the image. The region identification will improve the efficiency of the approach.
4. Classify the Image :- Once the number of regions are identified, a moment based analysis will be performed over the image to identify and classify the different regions over the image.
5. Colorization : The color mask will be implemented to perform the colorization to separate these regions.

4. Results and Discussion:

In this work radar images has been considered and region extraction has been performed using moment analysis approach. Figure 1 shows a radar image,

Fig 1.1 :RADAR image

After using our methodology we obtain the following results

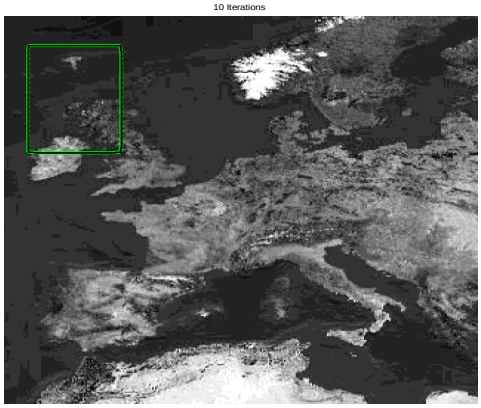

Fig 1.2(a) represents target area and also the image segmentation after 10 iterations.

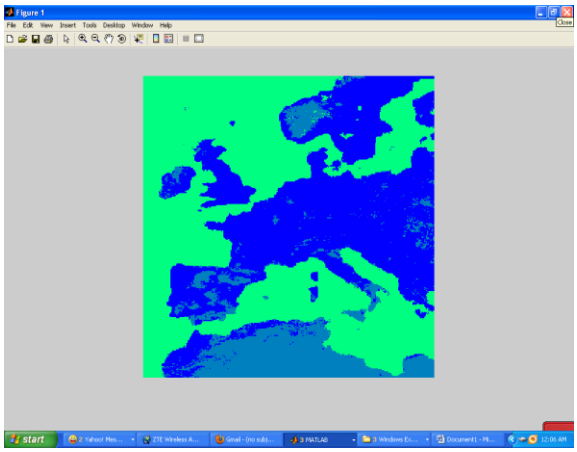

Fig 1.2(b) represents image after various segmentation levels

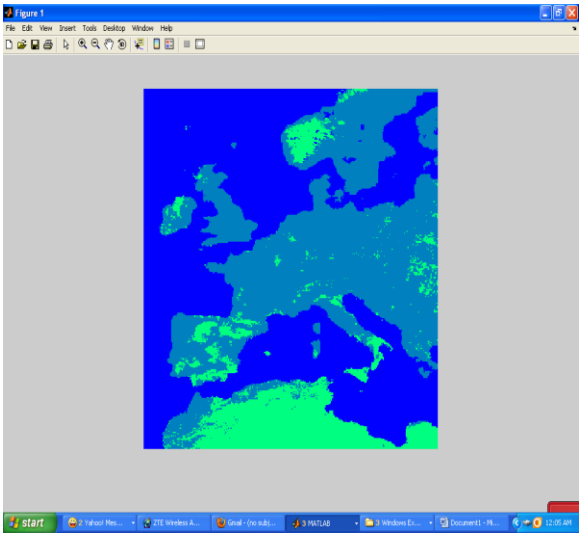

Fig 1.2(c) shows obtained results with effective segmentation and shows different areas over image.

Fig 1.2 (a), 1.2 (b) shows image at different levels of segmentation and fig. 1.2(c) shows final image obtained after segmentation and represents different regions over image in different colours.

5. Conclusion

The presented work is about to perform the region segmentation on radar images. Here, the classification process is performed to separate the image regions. In this work, a hybrid model is presented by using the moment based analysis along with histogram analysis over the radar images. In this model, initially the analysis is performed to identify the number of segments over the image. Later on the region assessment is been performed to identify the average weights over the pixels. Obtained results from the system shows different regions effectively and also shows overlapping regions.

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