A Statistical Feature Adaptive SVM Model For SAR Image Classification

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Abstract— SAR images are the satellite captured images which are having various associated applications to perform the region classification or the identification of some event or activity on some part of earth. As the images are captured from distances and through satellite, because of this these images are of larger size with high resolution. In this present work, A more dynamic, adaptive and feature specific method is provided for SAR image classification. The presented work is divided in three main stages. In first stage, improvement to features is done in terms of brightness and contrast. In second stage, the feature generation is applied using block specific entropy and Euclidean distance method. In final stage, the SVM classifier is applied to perform the image classification. The classification results shows that the method has provided effective classification accuracy.

Keywords: SAR Images, Classification, SVM, Statistical, Feature Adaptive

I. INTRODUCTION

SAR processing model can be defined as the series of process stages that can be implied to apply the region segmentation, feature detection and applying the classifier over it. The SAR image processing model in standard form is shown here in figure 1.1

![SAR Processing Model Diagram](image-url)

Here figure 1.1 is showing the basic processing architecture to perform the SAR image classification and to separate the images based on the segmented regions and extracted features. According to this standard model, at first the colored SAR image is captured so that processing can be implied over it. Once the image is captured, the filtration methods can be applied over it to transform the image in normalized form. In this stage, the noise reduction and content enhancement can be applied. The color or contrast improvement also included in normalization stage. After this transformation, the next work is to apply the segmentation algorithm to generate the image features or to generate the image regions separately. As the regions are identified, the final stage is to apply the classification algorithm to identify the image type. The image class is identified at this stage. For this, the set training and test data processing implied. The training data is the dataset with known class respective to which the class specific rules are generated.

1.1 SVM CLASSIFIER

SVM classifier is having the signification with specification of quantitative measures so that the effective class identification based on the pattern, component and the image instance processing. The investigation can be applied with specification of different data classes so that the effective identification of the SAR image class will be done. The class specific weight assignment and the mapping to the kernel are the strength properties of this classifier. The process stages of this classifier are listed here under

1.1.1 Prediction

It provides outputs to corresponding input values by predicting. It can be used in different fields such as weather forecasting, stock market etc.

1.1.2 Classification

It provides outputs to corresponding input values by classification. It can be used in different fields such as determining the plane with letter and then classifying the letter.
1.1.3 Data association

It is similar to classification but in addition it also recognizes the data which contains error. For e.g. If in a case scanner is not working properly and we are trying to scan an image then it will inform us that the problem is related to the scanner.

1.1.4 Data Conceptualization

It first completely analyzes the input set provided. After that it will form different groups so that we can infer some relationship between them. For e.g. making groups from a database the category of those which are related to by a particular product.

1.1.5 Data Filtering

It smoothes the input signal provided. E.g. take the noise out of an e.g. signal.

II. RELATED WORK

Feng et. al.(2014) has provided a work on textual and amplitude feature extraction for SAR images using two stage method. Author used the SVM as the classifier for SAR class identification. To generate the effective image features, the morphological profile based encoded features ar generated. The conditional observation on the random field was applied generate the adjacent region graph based on which the fusing classifier and the relative feature score was generated. The amplitude and the feature specific classifier was defined by the author. The feature set generation respective graph cut method has optimized the classification results[1]. Xue et. al. (2015) has used the polarimetric and the spatial features for classification of SAR images. The characterization of neighborhood information and realtime processing for generating the scattered features for denoised image was applied. The textual gray level features were processed to generate the co-occurrence matrix and provided the extrated feature form to generate the effective featured characterization. The combined generate features for generating the radarsat and providing the polarized feature processing. Author used the moment analysis, entropy analysis, homogeneity analysis and non similarity analysis to generate the effective co-occurrence matrix. Finally, these collected features were processed statistically to perform the image classification[2].Zhang et. al. (2015) has generated the contextual SAR image features and processed them in polarimetric manner to improve the classification results. The potential feature of this recognition method is to process the orthogonal features in contextual form and applied the effective classification method to improve the efficiency and accuracy. The classification model is able to classify the SAR images based on CSR based polarimetric method. The multi-band feature extraction method with pseudo color processing also improved the accuracy of recognition. Author identified five different classes called building, forests, crops, road and broad leaf crops [3] Chen et. al.(2007) has provided a work on case based reasoning method to improve the classification accuracy for SAR images. A constraint specific case library was constructed to generate the spatial-temporal features and define the relative cases with confidence value specification. The effective object driven post classification method is also defined to process the region features in meaningful form. The regeneration of GIS data was processed to identify the actual and accurate region so that the classification will be generate more accurately. The featured reasoning method is able to remove the noise and to preserve the edges significantly[4].Guan et. al.(2015) has defined an effective feature descriptor for SAR images to generate the textual property for SAR images. The quantization based statistical features are processed under local binary pattern. The sliding window based feature extraction model was applied to generate the features in descriptive form. These constructed features were later on processed with descriptor specific classifier to generate promising results. A features specific SVM classifier was implied at the final stage to identify the image class. Author work on three main classes called building, water and Farmland[5]. Samanta et. al.(2012) has provided a novel clustering based classification method for SAR image processing. Author generated the accurate recognition by using the histogram adaptive thresholding method. The color space processing along with watershed algorithm generated the merge region so that the effective featured region will be obtained. The histogram itself used as the classification measure to separate the regions for SAR image[6]. Chamundeeswari et. al.(2007) has a potential feature based mapping under intensity and textual feature map. The featured relationship under homogeneous intensity and textual features are group to separate the sea and land regions. Separate spatial informatin is extracted for water, urban the vegetation areas in complex featured form. The exge features, textual regions and land cover processing is here provided for improving the classification accuracy. The block label mapping along with feature vector is processed so that the accurate labeling is applied. The featured analysis has improved the work strength[7].

III. RESEARCH METHODOLOGY

In this present work, a feature adaptive statistical data processing method is provided for SAR image classification. SAR images are the images captured through satellite. These images represents different
geographical information such as land regions, water regions etc. The first stage of the work is to capture the images from external web source. After collecting the SAR images, the first stage of this work model is to generate the features for each image. To generate the features, the preprocessing will be applied to filter the image and generate the orientation information analysis. The filtered method is here applied to generate the feature aspect. Now these normalized and images are divided in smaller segments and for each segment some textural and statistical features will be generated. This stage will represent the complete image in the form of numerical dataset. This transited featured dataset will be processed finally under SVM method to perform the classification. The proposed work model is shown here.

IV. RESULTS

In this present work, Feature improved SVM method is provided for SAR image classification. The provided method is here applied on real time SAR images collected from secondary web source. The images are taken for 3 main categories of SAR images called rivers, desert and forest. The work is applied on different training and testing sets to perform the recognition. The first training dataset taken here is of size 37 and testing set with 10 images. The method has classified about 9 images correctly. The recognition result of this test process is shown here in figure 3.

Here figure 2 is showing the proposed framework to perform the SAR image classification. In this method, the input is taken as the SAR image set on which the classification method is applied. To perform the classification, at first the training image is processed to improve the image features. The image size and the contrast improvement is here defined to improve the image features. Once the image is enhanced, the block segmented feature analysis method is here defined over the image. In this work, the entropy and the cosine method is here defined to generate visibility and statistical features. These features are here presented as the quantized and the graphical curve form. These visualized features on training set are presented as the featureset on which the classifier is applied. Same feature generation process is also applied on test image. As the training and test data is transformed to the visualized curve form. Finally, the SVM classifier is here applied to perform the classification. The distance and the curve point specific mapping is applied to perform the classification.

Figure 3 : Recognition Result for Sample Set 1

Here figure 3 is showing the recognition results obtained from the work. The figure has showed the number of training set images, test set images and the correctly recognized images. From this the qualified results from proposed model is obtained.

Figure 4 : Recognition Result for Sample Set 2
Here figure 3 is showing the recognition results obtained from the work for another sample set. The figure has showed the number of training set images, test set images and the correctly recognized images. From this the qualified results from proposed model is obtained.

V. CONCLUSION

SAR images are the satellite images collected from external web source. The work is defined using feature adaptive SVM model. The model first generated the textural and statistical features and later on applied the SVM classifier to improve the results. The work is applied on two sample sets. The method has provided the accuracy over 85%.

REFERENCES


