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Performance Analysis of Target Recognition in Synthetic Aperture Radar Images

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ABSTRACT: Synthetic aperture radar(SAR) is to emit the microwave electromagnetic radiation to the surface of the target and to captured the broad range of images in accurate format. While capturing this kind of SAR images ,in moving as well as static, this system gives better results without any noise (blur).The large area and sparse population, the surveillance becomes a difificult problem. The technological advances, the armed forces can rely upon different types of image data like infrared and radar data. This paper reports an Automatic target recognition in the battle field. The available images using from the public release of the Moving and Stationary Acquisition and Recognition (MSTAR) program. This work focuses on SAR images for recognizing enemy targets with more accurate by using feature extraction and image matching of multifeature automatic target recognition(ATR) technique. The data will pre-process first. The preprocessing is required to distinguish the target from clutters like building, trees etc., and non target object such as confuse vehicles etc., which is very much required for identifying the targets like Battle tank. Sparse repesentation based Classification(SRC) method is used to find the results more accurately, and experimental results show that the significant improvement for recognition accuracy can be achieved by the comparison of baseline algorithms. The components derived from the monogenic signal at different scales are then applied into a recently developed framework.

KEYWORDS: Synthetic Aperture Radar (SAR), ATR, MSTAR, Principal Component Analysis(PCA)

I. INTRODUCTION

Nowadays, Target recognition in Synthetic aperture radar (SAR) is a high resolution imaging Radar and this imaging system is a coherent microwave remote sensing. rescue,mine detection, and target recognition. It has been widely used for applications ranging from civil to military categories such as disaster surveillance and automatic target recognition. SAR image conveys more information than just target location. Being able to discriminate targets into separate classes of vehicles provides a greater level of battle field awareness to the radar operator. The benefit of being able to accurately discriminate between enemy, friendly, and non military targets is obvious.
The Moving and Stationary Target Acquisition and Recognition (MSTAR) data set is a collection of SAR images taken of soviet made military vehicles. consists of three basic data processing stages (1) detection (2) discrimination and (3) classification.In the detection and discrimination stages,the first stage roughly locates the candidate targets in a SAR image by examining the amplitude of the radar signal in each site of the image. To create a SAR image, successive pulses of radio waves are transmitted to "illuminate" a target scene and the echo of each pulse is received and recorded.

A. Synthetic Aperture Radar (SAR)

Synthetic aperture radar (SAR) image target recognition is a key issue in SAR image interpretation and analysis. Before target recognition detecting targets in images is generally required .When a target is detected and its position is known in the SAR image target recognition is then implemented, i.e. both left-justified and right-justified. Principal component analysis (PCA) is a major part of radar image classification. The automatic target recognition is also based on the location and orientation. The algorithm will help to recognize specific class of the target T-72 tank on the basis of target signature. The target, images were captured at different depression angles sparse representation based classification (SRC) are a new statistical learning technique that can be seen as a new method for training classifiers

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based on polynomial functions.Gaussian models. Performance is measured quantitatively using the Hilbert Space is used for for orientation estimation and the probability of error for recognition. It gives good recognition result for the images of different resolution, and as the resolution of image increases rate of recognition increases.

This results from the fact that a SAR image reflects the fine target structure (point scatter distribution on the target surface) at a certain pose. Parts of the target structure will be occluded when illuminated by the radar from another pose which results in dramatic differences from image to image taken with angular increments of only a few degrees.SAR system employs a linear antenna that is mounted in the direction of the heading of the aircraft. The aircraft heading is called the cross range direction. SAR application in many fields such as geological exploration,ocean research,and disaster monitoring.To fullfill this gap paper reports this work focuses on synthetic aperture radar (SAR) images for recognizing enemy targets with more accuracy.

II.SYSTEM MODEL AND ASSUMPTIONS

To cover the drawback, a family of methods named correlation pattern recognition has been presented. Different from the conventional strategies these methods perform the matching procedure in the frequency domain with a certain metric(e.g., peak-to-side lobe-ratio) rather than in the spatial domain. Despite of achieving shift and distortion invariance it is needed to estimate the pose from which a specific classifier can be selected. However pose estimation from SAR image is very difficult due to the mutability of the scattering phenomenology. In addition, the computational cost is unattractive because of the repetitious convolution with the templates.

Another widely used family of approaches to SAR ATR is the statistical model based method. SAR images have wide applications in remote sensing and mapping of the surfaces of both the Earth and other planets. It relies on representing the intensity of SAR image with a parameterized statistical distribution model (e.g., conditionally Gaussian model) and reaching the inference by evaluating which class of parameters could maximize a posterior probability. However it easily fails when strong statistical relationship does not exist between the training and the query due to the problem of parameter estimation under limited statistical samples. Furthermore the feature based methods have also been popularly studied. Since the target chip image usually composes of three different kinds of scattering phenomena (target, shadow, and background clutter) it is typically nonstationary. Thus it is needed to separate the target and shadow beforehand and hence enslaved to the accuracy of image segmentation.

The development of compressed sensing theory, a great resurgence of sparse signal representation over a redundant dictionary has been witnessed. In the recognition problem is cast as one of classifying among multiple linear regression models, and addressed by the sparse signal representation. By sparsity constraint the unique representation can be generated. The decision is made by evaluating which class of samples could recover the query as accurately as possible. Since SAR images of a given class lie in a manifold whose dimension is much lower than the actual one the training images can be assumed to be the samples drawn from the manifold. Then the classification of SAR image is equivalent to finding the manifold that is closest to the query image.

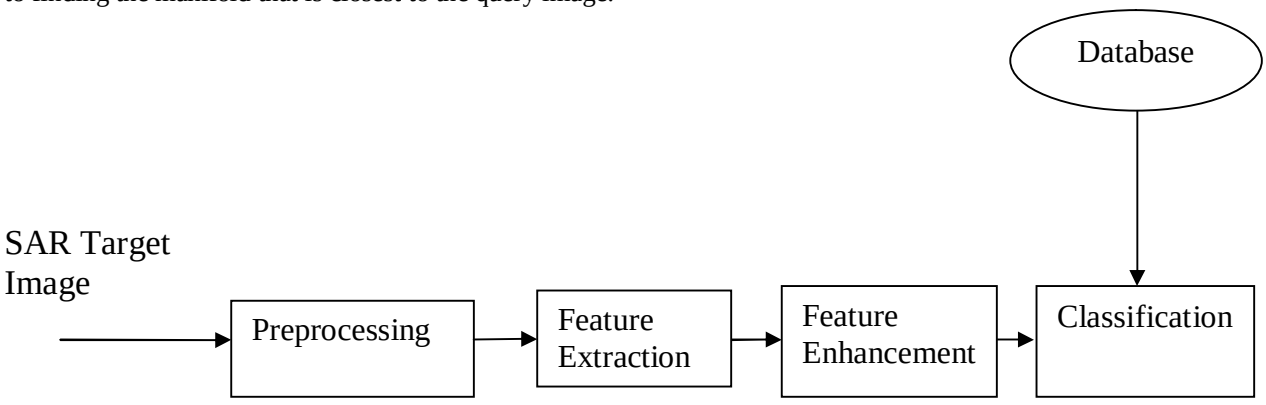

Fig 1 Block diagram of SAR target Recognition

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The SAR image is usually affected by a multiplicative noise known as speckle mainly due to the interference constructively or destructively of radar waves. These interferences produce light and dark pixels in SAR image. This noise provides a poor quality of SAR image and consequently the interpretation of image and shape detection becomes difficult. Increasing the image quality and reducing speckle effect becomes a crucial process in the recognition system
In signal processing several different methods are used to eliminate speckle noise based upon different mathematical models of the phenomenon. One method for example employs multiple look processing (a.k.a. multi-look processing) averaging out the speckle noise by taking several "looks" at a target in a single radar sweep.

$$g(m,n)=f(m,n)*u(m,n)+s(m,n)$$

Non adaptive filtering is simpler to implement and requires less computational power. There are two forms of non adaptive speckle filtering, one based on the mean and one based upon the median (within a given rectangular area of pixels in the image). The latter is better at preserving edges whilst eliminating noise spikes than the former is there are many forms of adaptive speckle filtering it is often desirable to be able to perform some kind of noise reduction on an image or signal. Median filtering is one kind of smoothing technique as is linear Gaussian filtering. All smoothing techniques are effective at removing noise in smooth patches or smooth regions of a signal but adversely affect edges. Often though at the same time as reducing the noise in a signal it is important to preserve the edges. Edges are of critical importance to the visual appearance of images. For small to moderate levels of (Gaussian) noise the median filter is demonstrably better than Gaussian blur at removing noise whilst preserving edges for a given fixed window size. However, its performance is not that much better than Gaussian blur for high levels of noise for speckle noise and salt and pepper noise (impulsive noise) it is particularly effective.
Feature extraction is a method to find an appropriate subspace. The extracted features are expected to contain the relevant information from the input data so that the desired task can be performed by using this reduced representation instead of the complete initial data. Feature extraction involves reducing the amount of resources required to describe a large set of data.

IV. RESULT AND DISCUSSION

1.T-72 tank is used in the original image.Here any image size is used.By reducing the image size, time is avoid.The original image has the faded unwanted signalling. SAR uses the motion of the radar antenna over a targeted region to provide finer spatial resolution than is possible with conventional beam-scanning.

2.In Synthetic Aperture Radar easily find the region.In the military application enemy target is detected and a particular target region is seperated from the other obstucles and confused vehicles.

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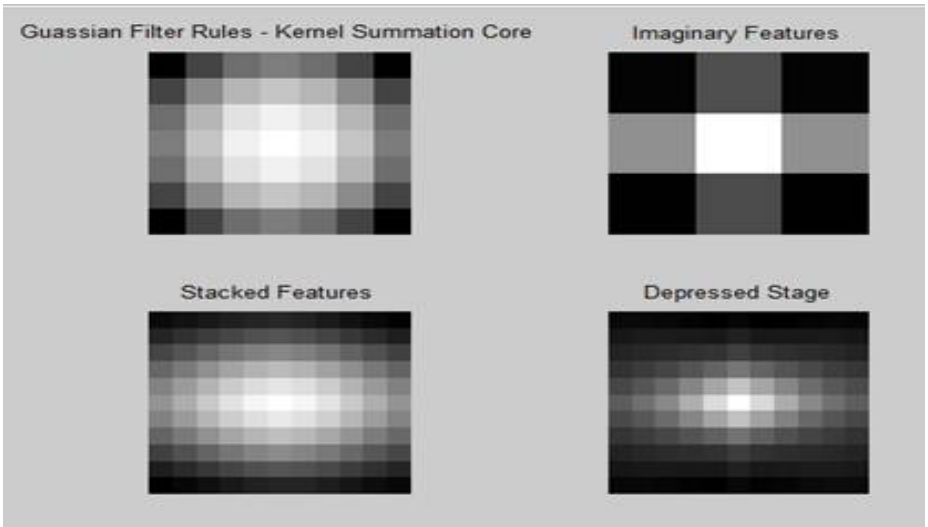

FIG **MONOGENIC SIGNAL REPRESENTATION**

V.CONCLUSION

The armed forces use a variety of sensor information to locate and target enemy forces. The data will be pre-process first the pre-processing is required to distinguish the target from clutters like building, trees etc., and non-target objects such as confuse vehicles etc., which is very much required for identifying the targets like Battle tank or armoured personnel carrier effectively. The larger the aperture is the higher the image resolution. SAR is typically mounted on a moving platform such as an aircraft or spacecraft, and has its origins in an advanced form of side looking airborne radar (SLAR). This work focuses on synthetic aperture radar (SAR) images for recognizing enemy targets with more accurate. To create a SAR image, successive pulses of radio waves are transmitted to "illuminate" a target scene, and the echo of each pulse is received and recorded. The basic design of a synthetic aperture radar system can be enhanced to collect more information. Most of these methods use the same basic principle of combining many pulses to form a synthetic aperture, but may involve additional antennas or significant additional processing.Resolution in the range dimension of the image is accomplished by creating pulses which define very short time intervals, either by emitting short pulses consisting of a carrier frequency and the necessary sidebands, all within a certain bandwidth.Effective.The pulses are transmitted and the echoes received using a single beam forming antenna. SAR requires that echo captures be taken at multiple antenna positions. The ATR systems have been demonstrated to produce classification is used for experimentation and training the SRC.The SRC is used for the classification. Target recognition is based on the location and orientation. The application of automatic target recognition (ATR) technology is a critical element of electronic warfare (EW), advanced avionics, smart weapons, and intelligence, surveillance, reconnaissance. Image matching is the future work of this project. Binary image matching is determined by their various range of estimating the clear target view.

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