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A Review on Automatic Target Recognition and Detection Approaches for SAR Images

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Abstract: ***This paper present a comparative or survey study of object detection or target recognition techniques for synthetic aperture radar images. As know, SAR is an artificial aperture microwave radar or remote sensing equipment which has capability to capture the scene of object by millions of kilometer or where human beings not supposed to reached, generally SAR images known as satellites imaginary. Here in this paper discusses the different techniques and approaches for the target recognition and object detection for SAR imaginary and find the common problem face by the researchers during implementation of such kind of artificial intelligence. Basically ATR i.e. automatic target recognition such as oil spills, missing air-bourn, ships and object identification or recognition at polar surface where human being not supposed to be present or reached has an interested area for the any researchers. In this paper discusses the various techniques such as prescreening method, CFAR, neural networks algorithms, and supervised classifier and many other methods and find the optimal solution or method for fast automatic target recognition and object detection according of their geometry and size. Finally a unique discussion has to be done in this paper and concluded the paper topic.***

Keywords: SAR-ATR, System Oriented Method, CFAR, Prescreening, Feature detection (single and multi), Remote Sensing

I. INTRODUCTION

The synthetic Aperture radar (SAR) is incredibly helpful for providing data concerning earth's surface by using the relative motion between antenna and its target, generally motion in particular swath. Its numerous applications like remote sensing, resource watching, navigation, positioning and military commanding, high-resolution remote sensing for mapping, search and rescue, mine detection, surface surveillance and automatic target recognition. It possesses various benefits over optical satellite imagery like, effective operation is achieved irrespective of the atmospheric condition and might ready to penetrate clouds, forest cover and soil. In spite of these benefits, it's being affected largely by the signal dependent noise referred to as speckle noise that successively affects radiometric resolution.

Synthetic aperture radar (SAR) is a good instrument to get remote sensing data, which is additionally wide used on civil remote sensing and military reconnaissance mission. Maneuvering targets, primarily as well as vehicle, ship and airplane, are attention grabbing targets on civil remote sensing and military reconnaissance mission. At this stage, target detection is one among the hotspots and difficulties on synthetic Aperture radar (SAR) image interpretation that plays a crucial role in civil and military application.

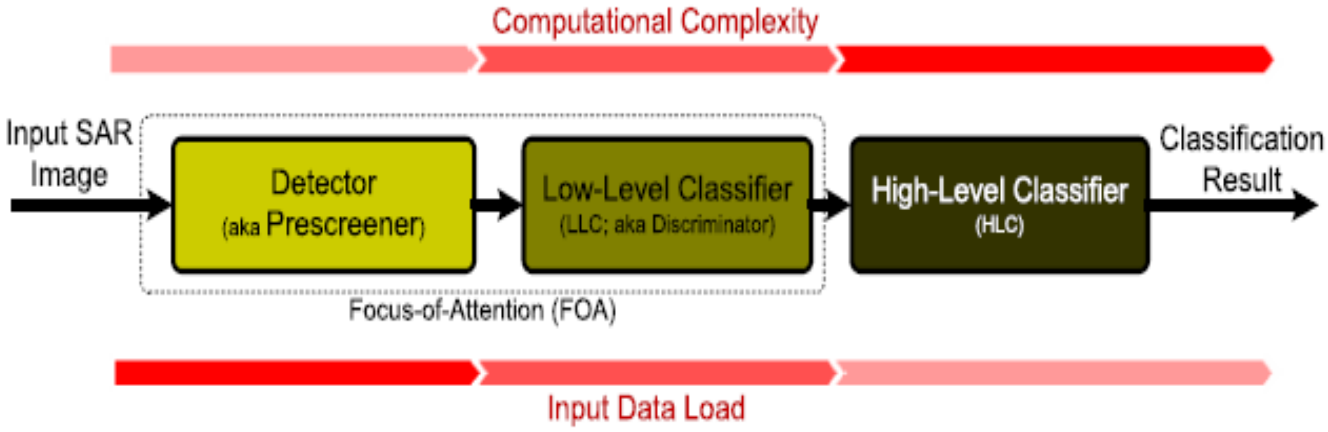

Figure 1: An Essential Architecture of SAR-ATR (End-to-End System)

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As above depicted figure 1 shows the essential architecture of SAR-ATR (End-to-End System) and this architecture consist three distinctive stages i.e. detector or pre-screener, classifier (Low-Level) and classifier (High-Level).
In this section discusses the introductory a part of the subject of the paper, remainder of the discusses, ATR system in section II, in section III discusses the recent implements and their results, problem statement discusses within the section IV, conclusion discusses within the section V.

II. AUTOMATIC TARGET RECOGNITION OR OBJECT DETECTION

Automatic target detection or object detection typically deals with output data from the one or more sensors towards a region of interest for a SAR image, these object such as oil spills, undetermined missing objects at polar end. The typical system depicted in the figure 2 that shows the conceptual data flow in the ATR system.

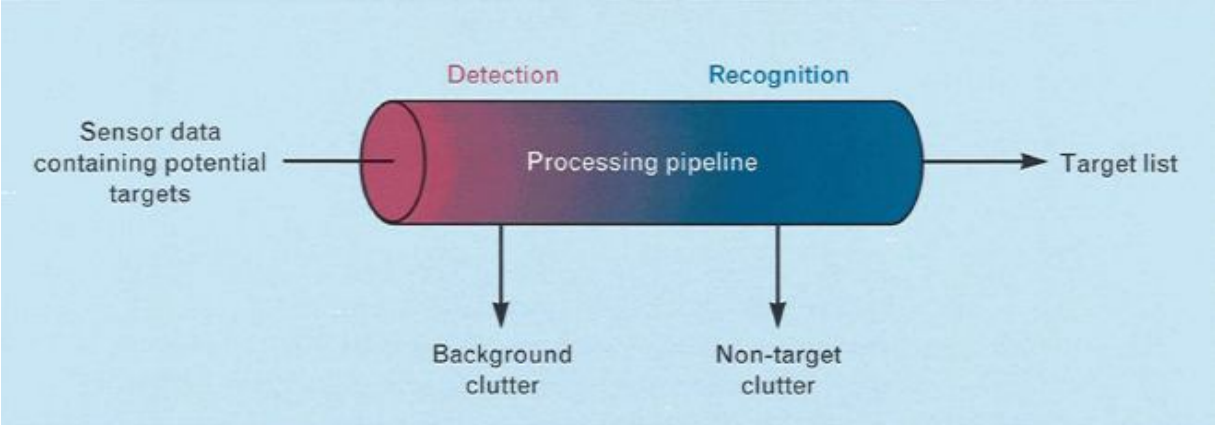

Figure 2: (ATR) systems conceptual data flow in automatic target recognition

III. LITERATURE SURVEY

[1] C. Tang and Z. Cui et al: In this paper, proposed D-ATR for large scene SAR images based on a deep neural network, which can integrate the four steps of traditional SAR ATR as a whole system. The experimental results indicate that it can detect and recognize targets directly in large scene SAR images with a competitive performance with the latest integrated system for SAR ATR, and our system has achieved a faster processing speed.
[2] Z. Cui and S. Wang et al: In this paper, a translational invariant SAR-ATR method evaluated on MSTAR dataset is proposed with inspiration of convolutional neural networks. A model that can accurately locate shifted targets in slices is built, performance of this model in generating accurate predicted boxes and recognition accuracy is evaluated through manually shifted slices. Comparison experiments based on NMF+SVM and PCA+SVM is completed and the results proved that our model is of favorable translational invariance performance. A translational invariant model based on CNN is realized.
[3] J. Pei and Y. Huang et al: They proposed a novel optimization framework for the multi-view SAR ATR, which modeled the multi view SAR ATR as a constrained multi objective optimization problem. While utilize only two functions to construct the objectives of the multi-view SAR ATR optimization frame-work in this paper, it is noted that other constraints, such as squint angle and elevation angle, could also be included when necessary. Based on neural networks ensemble and advanced heuristic algorithm, a series of optimal flight paths and corresponding viewpoints are solved, and the SAR sensor can choose an applicable path and acquire the multi-view SAR images from different tradeoff solutions. The class label of the ground target can be determined by the ensemble classifiers based on the input image sequence. The validity of the approach has been substantiated with simulation results and measured recognition rates. The flight paths from feasible non-dominated solutions representing different tradeoffs are presented. Finally, the recognition performance of the pro- posed multi-view SAR ATR optimization has been evaluated, which shows outstanding recognition accuracy. It also shows that the recognition rates can be enhanced through increasing the amounts of training samples and input views, as well as choosing appropriate starting viewpoints in practice.
[4] J. Guo and B. Lei et al: In this paper they analyzed 20-CNN model by their saliency maps, and proposed the inner feature ratio (IFR) metric to help improve the reliability of the performance evaluation. An experimental results demonstrated that the model with high IFR were more robust against noise and clutters. The accuracy of these model on new testing sets were in better agreement with the accuracy on original testing set.

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[5] S. Quan and B. Xiong et al: Target prescreening is that the front-end stage within the ATR system for SAR pictures. The performance of the pre-screener directly impacts the next stages within the SAR ATR procedure. This letter has investigated the deficiencies of the wide used CFAR-based algorithms and projected a replacement target prescreening methodology. In thought of the variations of targets and clutters, the projected methodology implements the prescreening by utilizing the thought of amendment detection. By comparisons of the prescreening threshold and also the time required to finish the prescreening of SAR information, the efficacy of the projected methodology has been objectively assessed, and a convictive conclusion may be drawn that the projected methodology may be adaptive and quick prescreen targets.

[6] S. Chen and H. Wang et al: This letter has presented a new "range detector" for ATR of building objects. It detects the building objects from one- aspect SAR image using the common features in the range profiles, and then to connect the detected wall footprint lines to recognize the 2-D building objects. Some experiments with Pi-SAR X-band images demonstrate good performances for non-overlapping/non-obstruction buildings. Compared with the multi-aspect approach, this single-aspect range detector can achieve similar performance as AMAR. Generally, a detection rate of ~80% can be achieved. Adaption of this approach to buildings with complex shapes, e.g., round shape.

[7] J. Won and S. Kim et al: The SAR-IR sensor fusion research has been in progress for effective ground target detection. This is limited by lack of DB of SAR-IR sensor. That is also difficult to obtain or find the DB directly because of cost and environmental issue. This paper generate DB by the synthetic image generation simulator, such as day and night image, and compare the features.

[8] S. Sardar and A. K. Mishra: Automatic target recognition from SAR data using a hybrid framework having FrFT and PCNN is proposed in this paper. Scale, target position and orientation invariant recognition property of the proposed system are demonstrated in the current work. They used the public release of the MSTAR dataset to verify our proposed system and established its superior performance compared to existing approaches. They adopted the naive nearest neighbor classifier in the proposed system.

[9] B. Ding and G. Wen et al: This article proposes an approach for detecting single scattering part in the measured SAR image based on the target part-based electromagnetic scattering model. By employing the position and relative intensity predicted by the model, the matching score are calculated between the model scattering part and the corresponding area in the measured image. The detection results can plays an important role in the following SAR target recognition. The experiments based on simple tank model demonstrated the efficiency of the approach.

[10] X. Liu and Y. Huang et al: In this paper, 2DPCA-based 2DMSDE is introduced for SAR image feature extraction, which preserves the global information and local information of the SAR dataset effectively. Moreover, sample discriminant coefficient is employed to enhance feature discriminative capability during dimensionality reduction. Therefore, the method reduces the dimension of SAR images and improves recognition rate. Experimental results demonstrate the effectiveness of 2DPCA-based 2DMSDE.

IV. PROBLEM STATEMENT

After studying a lot of paper related to fast target detection for high resolution SAR images we conclude that the problem which are generally common in the all literature. In literature part we discussed different mechanism which were using in the past methodology. As we know the SAR images are highly resolved images which also contain heavy noise, speckles, blur and other components. These kind of components have to removal in the early pre-processing process before simulation.

Experiments have been done on these fast target detection for high resolution SAR image schemes to test and show its performance was too complex in previous articles.

Co-relation between reference image and test image was not clearly precise.

The previous system does not detect the multiple object with accuracy.

So the aim of this study is to provide a detailed insight into the characteristics of robust fast target detection for high resolution SAR image techniques by comparing the performance of representative techniques from each category against speckles, and others parameter, using the same source content and visual perceptibility criteria and to propose a hybrid scheme which is robust against common target detection issues.

V. CONCLUSION

SAR could also be a measuring system imaging technique provides necessary info concerning earth's surface or subsurface. SAR could be a filled with life, day/night and unrestricted remote sensing system. Throughout this paper has studied varied image method and object detection techniques that square measure useful in ATR and detection of object of SAR image. The steps involved in

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image method and ATR, object detection in SAR image embrace pre-processing, segmentation, feature extraction and classification. Varied detection approach for SAR image square measure presented. for every components, image method and ATR technique with capability to strengthen performance in artificial aperture measuring system systems were explained, and samples of successful or instructive ways that from past got.

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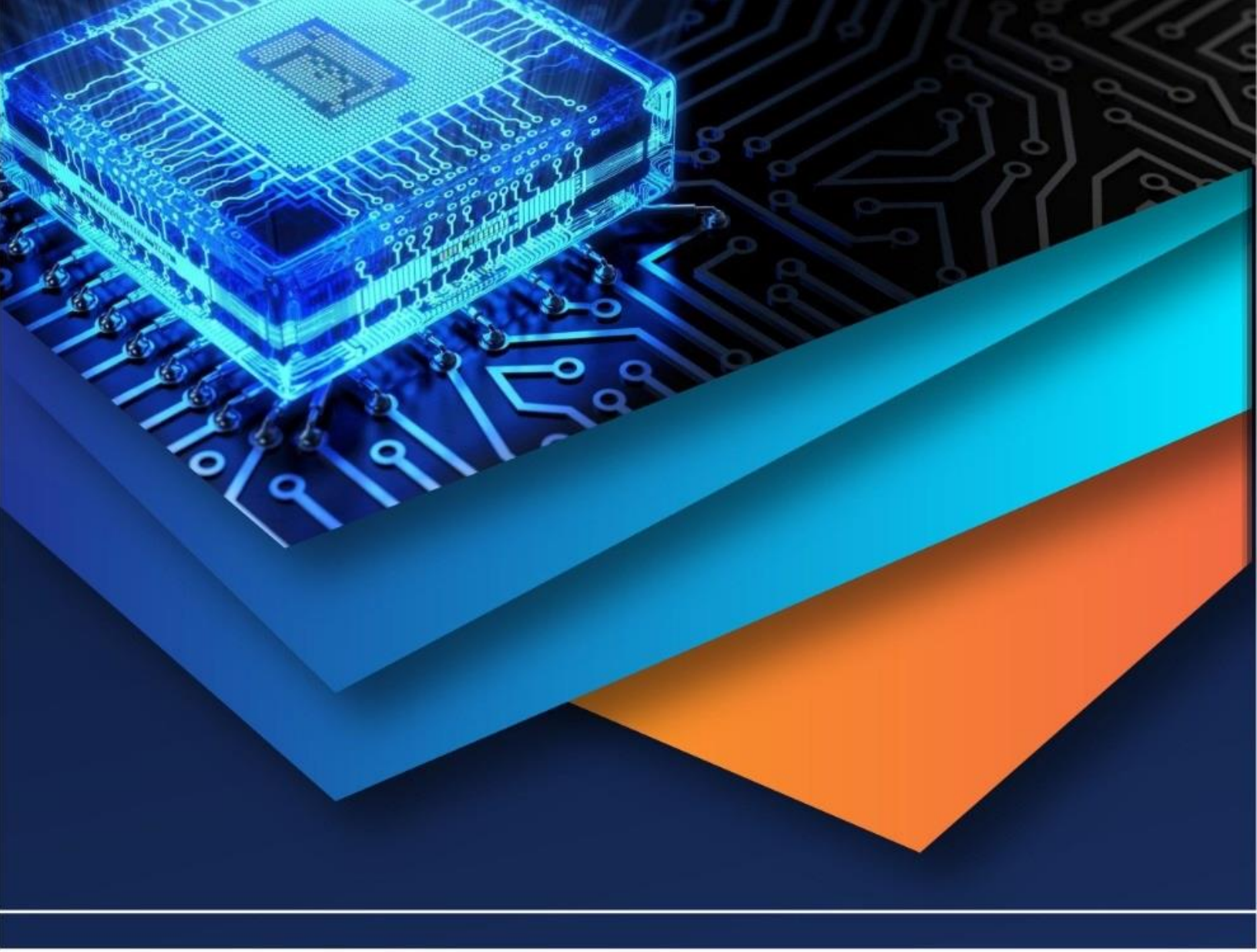

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