An "On The Fly" Method for Discriminating Target and Clutter Detections in Synthetic Apperature RADAR Images

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Abstract— **The detection of stationary ground vehicles in Synthetic Appature RADAR (SAR) images is an important signal processing task for many millitary and civillian applications []. Often the dominating feature of the detection process is the mitigation of false alarms caused by ground clutter. In previous algorithms [], this mitigation was done with a quadratic Gaussian statistical classifier trained on a *known* set of targets and a *known* set of clutter detections. This classifer is then used to reject clutter detections when the algorithm is run opporationally, via standard two class discrimination techniques []. Algorithm training has to be performed before a new type of clutter is encountered and/or the space of targets of interest changed. In this paper, we present a method for computing the statistics of the clutter detections for use in the Gaussian classifier that does not require any pre–opperation training. As such, the clutter statistics are determined "on the fly" as SAR images are collected. If target statistics are available, they too can be used, or if not we suggest a modification of the original algorithm that detects targets by means of looking for outliers.**

I. Introduction

In a series of papers [] L. Novak and others at MIT Lincoln Laboratory developed an Automatic Target Recognition (ATR) system for identifying stationary ground vehicles appearing in Synthetic Aperture Array (SAR) RADAR images. It was envisioned that this software would enable very large regions of terrain to be seached automatically. To this end, a signal processing chain was developed by Novak and others which works as follows. A SAR images is collected and passed into the system. A CFAR detection algorithm **??** is used to locate pixels that are significantly bright compared to the surrounding clutter. This CFAR image is thresholded and the resulting binary image is clustered. Each cluster is considered a potential target. For each potential target a few simple features are calculated and "obvious" (mostly based on size) non-targets are discarded. For the potential targets that remain, a set of nine features is calculated. Using a Gaussian quadratic classifier this feature vector is compared against *known* clutter and target statistics to determine the most likly class. Finally, the remainning detections are compared to template targets from an input target image database to find the most likely target. See figure 1 for a highlevel flow chart of the image processing. A nice summary of much of Novak's work in this area is given in the recent book [1].

Manuscript received January 1, 2005; revised December 30, 2005. This work was sponsored by the U.S. Government under Air Force Contract F19628-00-C-0002. Options, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the United States Government.

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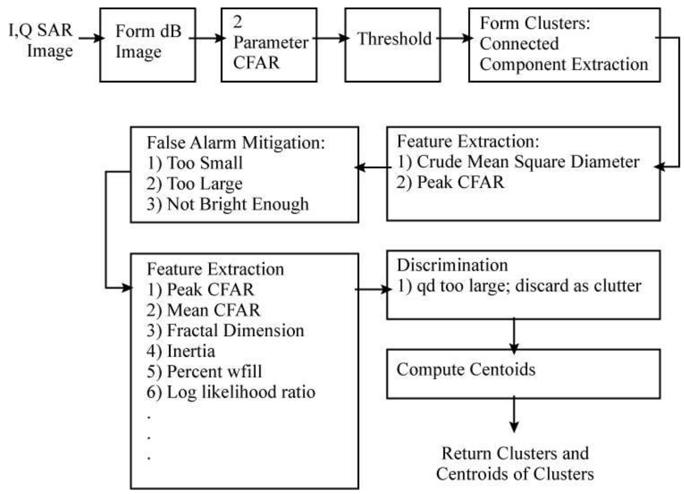

Fig. 1. High level overview of the SAR image processing proposed in []. As papers concern is only with the processing that happens in the box labeled "2 Parameter CFAR", only that calculation will be discussed in any detail. Please see the original articles for more information on the other components.

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II. Conclusion

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Appendix I
Proof of the First Zonklar Equation

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Appendix II

Appendix two text goes here.

ACKNOWLEDGMENT

The authors would like to thank...

REFERENCES

[1] R. J. Sullivan, *Microwave Radar: Imaging and Advanced Processing*. Artech House, 2000.

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