Automatic Target Recognition (ATR)

Research Interests

ATR refers to the task of detecting and identifying targets in scenes. What makes this challenging is that the targets to be detected are not only not co-operative, but will go to great extent to camouflage and conceal. Also, sensors of interest in imaging these targets can vary from optical sensors to infrared sensors and radar sensors. In radar images, targets appear very differently from the normal optical images and in fact can be very sensitive to even minor scale and rotation type variations. It is this variability that makes the detection and identification of the targets very difficult.

Over the past twenty years, we have developed several correlation filters to achieve distortion-tolerant automatic target recognition. These include, but are not limited to the following.

- Minimum average correlation energy (MACE) filter that was the first to yield sharp correlation peaks,
- Minimum variance synthetic discriminant function (MVSDF) filter that provides the most noise tolerance,
- Maximum average correlation height (MACH) filter that simplifies filter design by avoiding matrix inversion,
- Optimal tradeoff circular harmonic function (OTCHF) filter that provides specified response to inplane rotation, and
- Distance classifier correlation filter (DCCF) that carries out target recognition by using distances rather than correlation peak values.

References:

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- R. Singh and B.V.K. Vijaya Kumar, "Performance of the extended maximum average correlation height (EMACH) filter and the polynomial distance classifier correlation filter (PDCCF) for multiclass SAR detection and classification," **Proc. Of SPIE**, Vol. 4727, April 2002. pdf

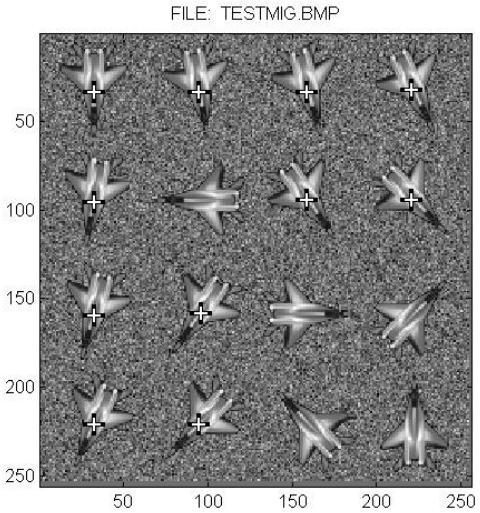

Figure 1. Output from a optimal tradeoff circular harmonic function (OTCHF) filter designed to recognize airplane targets that are between –45 degrees and +45 degrees of horizontal. Crosshairs indicate successful recognition.