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Fuzzy Logic Based Spatial Bird Detection with Weather Radar

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Recent efforts in weather radar based bird detection have been focusing on vertical analysis of volume data hence yielding vertical, radar site centered recognition products.

In this study, we have developed a *spatial* bird and insect detection product. The computation is performed independently for each azimuthal scan, producing a probability map in the original geometry and bin resolution.

The algorithm uses single-pol parameters (Z, V) as well as dual-pol parameters (RhoHV, ZDR). In approximating class probabilities, fuzzy logic is applied. In loose terms, birds appear typically as relatively low Z, high local variance of V, relatively low RhoHV and non-zero ZDR. Insects appear similarly, but with lower Z, smooth V fields and larger absolute values of ZDR.

Birds and insects are known to have flight modes that vary seasonally and diurnally. However, we have not aimed at modelling such information but preferred keeping the computation robust and fast.

Practically, the signature distributions of birds and insects are smoothly overlapping and uncertain, hence both classes should be included in a detection scheme even if an end application focused on either class only.

We demonstrate the performance of the proposed scheme with cases consisting of carefully analyzed measurement data.