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Scoring practices for remote sensing

In applications involving remote sensing and computer vision, scoring practices are of crucial interest for measuring detection performance. In this scenario, a sensor (camera, radar, etc.) collects data over a region, and outputs a confidence map of where targets are likely to exist. This confidence map must be turned into a discrete set of locations and confidences in order to alert the operator. During sensor and algorithm development a set of alarms is compared against the ground truth, and a performance metric such as a receiver operating characteristic (ROC) curve is computed.

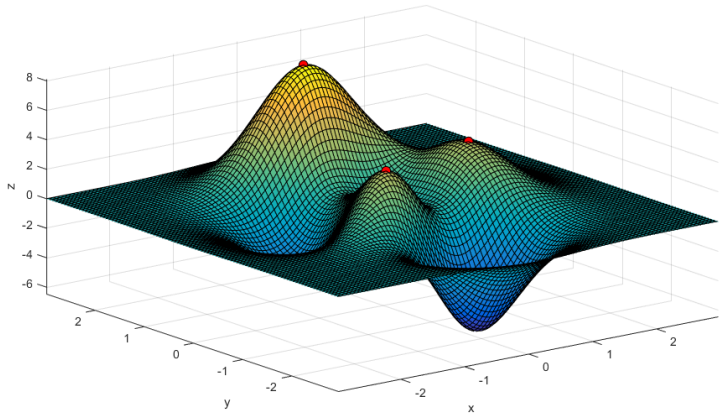

Figure 1: A prototypical example of a smooth confidence map, with red dots indicating alarm locations

Scoring confidence maps and sets of alarms generates many sub-problems of interest. Some open questions: For a given scoring procedure, what is the expected performance of a random sensor? Are there ways to 'game' the scoring based on the size and shape of the region under investigation, and some knowledge about target sizes? Are there similarly optimal ways to decide how to place alarms given a confidence map? Are there other ways of comparing confidence maps directly rather than discretizing them into alarm sets?

Answering these questions is critical for making decisions about which sensors and detection methods to employ, and how best to detect objects from pedestrians and street signs in traffic, to IEDs on the battlefield. Example scenarios in this project will draw from remote sensing of IEDs from a variety of sensors and regions.