A signal detection framework for searching for needles in haystacks and similar problems

Abstract

Decades of previous research on violence risk assessment has demonstrated limitations in how accurately future violent behavior can be predicted from individual characteristics and past behavior. Terrorism is a greater challenge due to the presence of low base rates, the lack of diagnostic indicators, and the ability of an adaptive adversary to attenuate their predicted threat level. I formulate this generic problem in a Signal Detection framework, and conduct sensitivity analysis to determine conditions in which such threat assessments are useful. Results depend on the prior probability that a randomly selected individual is a terrorist, the likelihood function associated with the predicted threat level, and the relative cost of false-positives and false negatives. Further sensitivity analysis explores the impact of attenuated diagnosticity resulting from an adaptive adversary capable of learning the characteristics required for a “low-risk profile” and either acquiring a low-risk profile, or recruiting a “low-risk” accomplice.