Title:

Last-Mile Multisource Data Fusion with Bayesian Networks for Robust and Interpretable Object and Intent Classification of Airborne Targets

Abstract:

Despite advances in sensing technology, the challenge of tracking, identifying, and classifying intent of airborne targets increases in difficulty as we face a myriad of air threats ranging from legacy aircraft to next-generation coordinated unmanned systems and emerging hypersonic threats. Coupled with improvements of deception technology, shortcomings of existing sensors, and resulting inconsistencies between sensor readings, the question remains: how do we reconcile sensor readings produce the most accurate understanding of the battlespace? Previous work in this space has sought to improve efficacy of individual sensors or to perform data fusion at the lowest data level possible between sensors, but neglect to address higher level interfaces between distinct sensors and tracking algorithms initially designed to operate as self-contained systems. In this work we take a holistic approach to target tracking and identification, leveraging all possible information of the battlespace – especially human level knowledge regarding strengths and weaknesses of sensors, seeking to relieve dependency on individual sensor units. We present a novel Bayesian network architecture template capable of producing high fidelity target and intent classifications conditioned by the observed conditions of the battlespace and prior knowledge of sensor reliability. We find that Bayesian networks are favorable tools to perform last-mile reasoning over any number of non-explainable black-box type approaches, producing more reliable, trustable, and interpretable results than any individual sensor.

Keywords:

multisource data fusion, object recognition, intent classification, behavior analysis, Bayesian networks, explainable AI