Public Abstract

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Title:APPEARANCE MODELING FOR PERSISTENT OBJECT TRACKING IN WIDE-AREA & FULL MOTION VIDEO

Wide-area motion imagery (WAMI) presents a host of challenges for target tracking. Time varying low framerate large imagery poses certain unique difficulties in terms of appearance based track before detect paradigms. Likelihood of Features Tracking (LOFT) system is an appearance based tracker designed specifically for WAMI which follows the track before detect paradigm. The motivation for tracking using dynamics before detecting was so that the large scale data can be handled in an environment where the computational cost can be kept at a bare minimum. Searching for an object everywhere on a large frame is not practical as there are too many similar objects, clutter, high rise structures in case of urban scenes and comes with the additional burden of greatly increased computational cost. LOFT bypasses this difficulty by using filtering and dynamics to constrain the search area to a more realistic region within the large frame and uses multiple features to discern objects of interest. The objects of interest are expected as input in the form of bounding boxes to the algorithm. The main goal of this work is to present an appearance update modeling strategy that fits LOFT's track before detect paradigm and to showcase the accuracy of the overall system as compared with other state of the art tracking algorithms and also with and without the presence of this strategy. The update strategy using various information cues from the Radon Transform was designed with certain performance parameters in mind such as minimal increase in computational cost and a considerable increase in precision and recall rates of the overall system. This has been demonstrated with supporting performance numbers using standard evaluation techniques as in literature. The extensions of LOFT WAMI tracker to include a more detailed appearance model with an update strategy that is well suited for persistent target tracking is novel in the opinion of the author. Key engineering contributions have been made with the help of this work wherein the core of LOFT has been integrated for a wide range of government applications and research programs such as Air Force Research Lab's Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) Enterprise to the Edge (CETE), Army Research Lab's Advanced Video Activity Analytics (AVAA) and a proposed fine grained distributed computing architecture on the cloud for processing at the edge. The system was also tested and entered in the popular Visual Object Tracking Challenge (VOT) which comprises of mainly Full Motion (FMV) and standard videos.