Video Summarization and Search: Object Tracking

Problem:
Aerial surveillance demands full attention to video by PED teams
• Manual, error-prone process
• Technical barriers including object detection, and tracking
• Limitations result in poor pattern detection in a surveilled region

Solution
• Work directly with DoD to improve pattern detection in aerial surveillance data patterns
• Work with researchers to address core technology problems of tracking of objects

Impact (FY18–20)
• Improved DoD pattern detection in aerial surveillance data
• Developing unsupervised 3D tracking algorithms to improve on other unsupervised methods and achieve performance similar to supervised methods

3-D Tracking Research: learning correspondence from static 3D points causes 3D object tracking to emerge.

Training
Given 2 viewpoints of the same object:
• a neural 3D mapping for each
• Identify the corresponding voxel pair in the two mappings
• Treat all other mappings as negative correspondences
• Train the features to indicate the correspondences automatically

Given the bounding box for object
• Generate features for the object
• Generate features for search region
• For each voxel of object, compute correlation with search region
• Estimate the total motion with RANSAC
• Update the box automatically

Results: Tracking based on learned correspondence of points

Object Discovery
What if the need is for a system that will discover objects autonomously?
• Extract 3D features for each frame
• Determine voxel-wise median
• Determine the difference from the median for each frame

Early results are promising!
• Work on 3D tracking will continue as part of Adam Harley’s work toward his PhD at Carnegie Mellon University

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