A CLUSTERING APPROACH FOR DETECTING MOVING OBJECTS CAPTURED BY A MOVING AERIAL CAMERA

Joseph DeGol
Department of Computer Science
University of Illinois Urbana-Champaign
Urbana, IL, 61801 USA

Myra Nam
Intelligence and Decision Technologies
MIT Lincoln Laboratory
Lexington, MA 02420 USA

Problem
Given a scene captured by a moving aerial camera

We want to detect the moving objects.

Challenges
Fast Camera Motion, Slow Object Motion
Blurred Frames

Method
Given a sequence of frames

Partition frames into windows

For each window

Generate a graph from KLT Points

Nodes = KLT, Edges = DT

Estimated Camera Motion

RANSAC

KL T Feature Point Trajectories

Delaunay Triangulation

Prune edges to differentiate moving objects

Sum the cumulative sum of distance between KLT and Camera Trajectories

Assign edge weights

Find Threshold

Pruning Threshold chosen by minimum standard deviation

Prune edges

Merge graphs by majority vote

Label Moving Objects if clusters size < N

Done

Results

Scene A
100 Frames

Scene B
350 Frames

Scene C
300 Frames

Baseline - No Overlapping Windows

Full Method - Overlapping Windows

Precision / Recall (%)

68.1 / 29.6
88.9 / 59.7
100 / 48.7
98.5 / 94.2
51.6 / 54.2
64.4 / 98.7

Acknowledgements
This work is sponsored by the Department of the Air Force under Air Force Contract #FA8721-05-C-0002. Opinions, interpretations, conclusions, and recommendations are those of the authors and are not necessarily endorsed by the United States Government.