Project title: Detecting Anomalous Actions In Videos Using Spatio-Temporal Compositions

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Project summary:

Video surveillance systems are widely used in many applications such as nursing care institutions, law enforcement and building security. Detecting unusual objects or suspicious behaviours in a scene is the primary objective of an automated surveillance system. We refer to this activity as anomaly detection because the sought-after situations are not observed regularly. In other words, all such systems are based on the implicit assumption that things that occur occasionally are potentially suspicious.

We present a novel approach for detecting suspicious actions in videos by using a few initial training samples of valid behaviours. The proposed method detects suspicious regions in a video and it is fast enough for real-time applications. It codes video as a compact set of spatio-temporal volumes while considering their spatio-temporal arrangements using a probabilistic framework to calculate the likelihood of the regions in the video. This approach can be considered as an extension of the common bag of video-words approaches, which represent a video as an order-less distribution of video volumes. The results are superior when compared to other approaches, while requiring vastly fewer computations. The algorithm is very fast and does not employ background subtraction, motion estimation or tracking. It is robust to spatial and temporal scale changes as well as some deformations.

Results: Detecting abnormalities using the UCSD Anomaly detection dataset [1]

The dataset contains video sequences from two pedestrian walkways where abnormal events occur. The dataset contains different crowd densities, and the anomalous patterns are the presence of non-pedestrians on a walkway (bikers, skaters, small carts, and people in wheelchairs) in the scenes. Using a few numbers frames containing valid actions, the algorithm learns to detect suspicious activities in the videos.
- The first dataset:

A sample video containing valid actions containing walking people:
Abnormalities in the query videos are highlighted in green. The bikers, which are the anomalous patterns, are detected and localized.

Sample 1: **Bicyclists**

![Sample 1 Image]

Sample 2: **Bicyclists**

![Sample 2 Image]
- The second dataset:

Sample video of valid actions

for the two scenes, containing only walking pedestrians.
Abnormalities are detected and localized in the scene and highlighted in green.

Sample1:  Skater and Bicyclist

Sample 2:  Bicyclist

Sample 3:  Bicyclist
Sample 4: Car and Bicyclist


Publications: