Thu A. Tran

Literature Review 1

This paper is to present to you summaries of a primary technical paper titled “Crowd Motion Segmentation via Streak Flow and Collectiveness” by Gao, Jiang, et al and a secondary paper titled, “Meta-Tracking for Video Scene Understanding” by Jodoin, Benezeth, and Wang. In addition, highlighting the similarities between them and how both papers contributed to the computer graphics community.

There are challenges that exists with analyzing the scenes from surveillance videos and it was clearly mentioned in the “Meta-Tracking for Video Scene Understanding” by Jodoin, Benezeth, and Wang. Eminent issues raised in the computer graphics community are: clutter, structure of flow, and layout. Clutter refers to multiple object moving at random which can lead to difficulty with the analyzing step. Take for example, tracking people in a crowded mall, or religious gatherings. Structure of flow breaks down the scene into structured, well-defined pattern or unstructured, random pattern. Lastly layout of a scene deals with the traffic pattern in a scene, such as linear and non-linear patterns.

Numerous of methods have been developed honing on understanding object tracking. However, object tracking is known for being incapable of analyzing video with a large amount of moving objects, like a gathering consisting of many people. On the opposite spectrum, non-tracking methods have been proposed. An issue with it that it does deal with overlapping motion patterns. There are other work that translated the scene into a topological structure of words, but the challenge here is that it is not fit for unstructured flow.

Realizing that one method is not sufficient at solving the problem of video scene analysis, the authors proposed a 4-step process to address the challenges mentioned previously. The notable distinction with this algorithm is that is factors in a meta-tracking procedure in an effort to connect low-level motion attributes to long-range motion patterns. The first step is to convert the pixels from the scene into a histogram based on their colors. Then the histogram is converted into orientation distribution functions (ODFs). With ODFs, information about magnitude can be extracted. The third step is the meta-tracking generation piece which is an unique procedure "lays a grid of particles and have them adverted in the scene following an iterative algorithm. The fourth and final step is stochastic sampling which begins after the stopping condition for the meta-tracking algorithm have been meet. This entire procedure created motion patterns and then are sorted.

The meta-tracking procedure has been applied on real life video footage of crowded areas such MIT, Mecca, Indian Market, rush hour, and at Hanoi. The results of the analysis yielded very high numbers of true detections and low numbers of false detections. The result supported that the algorithm can work on sparse or crowded scenes, in un/structured areas, with direction magnitude and complex layouts. The authors' algorithm proved to work better than existing object-tracking methods especially with crowded scenes and overlapping motion patterns.

The second paper's work titled "Crowd Motion Segmentation via Streak Flow and Collectiveness" by Gao and Jiang et al is on analyzing crowd motion using streak flow and collectiveness. Detecting and analyzing crowd motion is a prominent issue yet to be solved. The proposed solution to accurately interpret a dynamic segmented scene is using a combination is streak flow to surface dynamic properties of the crowd, but also collectiveness which entails revealing the structural property of the scene.

The community is yet to perfect an approach to that the segmentation accuracy yield. Existing approaches are split into "two categories: 1) appearance-based methods and 2) motion-based methods." The appearance-based approach deals with converting raw images into more expressive representations. There are limitations with these methods that large and condense crowds are not taken into account and tracking individuals objects is a challenging task.
The proposed method has a goal of enhancing the detection and clustering of collective motion. The key aspect of collectiveness is that it will reveal information pertaining to topological

characteristic. The three main part of the algorithm is streak flow, crowd collectiveness, and crowd motion segmentation. A Steak flow is a whole scene composed of streaklines, which is a collection of particles, each particle being a pixel. Streak flow can represent motion information of flow for an entire scene for segmenting crowd movement. Crowd collectiveness groups together similar trajectories with similar topological structure. The crowd segmentation is the output step that in the calculation process that will create region boundaries. Where the crowd with similar trajectories will have similar motion vectors, streamlines, and streak flow.

For the experiment, the researchers have compared their algorithm to well-known crowd motion segmentation methods. The result was their algorithm outperformed the well-known methods by precision, although with the tradeoff of higher performance run time. Their findings show that the algorithm is accurate at finding and clustering motion pattern in crowd scenes.

There were many similarities with both of these two technical papers. The results of the two technical paper showed a very similar approach to classification. In both cases, the presentation of the patterns were similar. For example, color and line magnitude was used to distinguish a certain region or segmentation of the scene from one another. The distinction between the colors and each grouping of colors were used to detect the structural properties of the crowd and the crowd's behavior. The similarities are that they are targeted to analyze scenes composing of different crowds with objects moving in different directions. The Meta-Tracking for Video Scene Understanding paper is more specific towards the application of video scenes, but you can also apply the algorithm proposed in the paper Crowd Motion Segmentation via Streak Flow and Collectiveness on the same data. Another comparison is how the two paper mentions the topological classification, more specifically the Meta-Tracking paper elaborated on converting the data into words then converted to another form to extract data. Both papers mentions that their algorithm can be applied on any types of scenes, regardless of the crowd size, density, magnitude, and other special or temporal differences. The model that was generated can be applied to a variety of datasets to predict crowd behavior, anomaly detection, and recover motion patterns. Both technical papers goals was to contribute valuable methods to address the challenges faced in the computer graphics community.