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Crowd Behavior Analysis

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Abstract: ***Over the last several years there has been a growing interest in developing computational methodologies for modeling and analyzing movements and behaviors of 'crowds' of people. This interest spans several scientific areas that include Computer vision, Computer Graphics, and pedestrian Evacuation Dynamics. Despite the fact that these different scientific fields are trying to model the same physical entity (i.e. crowd of people), research ideas have evolved independently. As a result each discipline has developed techniques and perspectives that are characteristically it's own. In this chapter we provide a brief overview of major research themes from these different scientific fields, discuss common challenges and point to problem areas that will benefit from common synthesis of perspectives from these fields. In addition we introduce various pieces of work that appear in this vision based analysis***

Keywords: Visual Surveillance, Behavior Analysis

1. Introduction

The steady population growth, along with the worldwide urbanization, has made the crowd phenomenon more frequent. It is not surprising, therefore, that crowd behavior has received attention from technical and social research discipline. Crowd behavior is of great in a large number of applications:
In particular behavior analysis of crowded scenes is of great interest in large number of crowd application [1], such as

- Crowd Management: Crowd analysis can be used for developing crowd management strategies, especially increasingly more frequent and popular events such as sports event large concerts, public demonstration and so on, to avoid crowd related disasters and insure public safety.
- Public Space Design: To provide guidelines for the design of public spaces. e.g. to make the layout of shopping malls more convenient to costumers or to optimize the space uses of an office.
- Virtual Environments: It can be used to validate or increase the performance of the mathematical models used in crowd simulations. Visual Surveillance: It can be used for automatic detection of anomalies and alarms. Furthermore ability to track individuals in a crowd could help the police to catch suspects.
- Intelligent Surveillance: It can be used to take decision on how to split crowd in museum, based on their behavior. For example, in a museum deciding how to divert the crowd based on the pattern of crowd.

Visual perception of objects, activities, and events are among the marvelous capabilities of the human mind that are developed early childhood. The human vision system is capable of performing computationally complicated tasks such as detecting or counting similar objects in a scene, in spite of occlusion and clutter, seemingly

Effortlessly research Scientists in the computer vision community. Research scientists in the computer vision community have been developing mathematical tools to detect objects, recognize objects and actions, and discover behaviors and events in visual scenes comparable to human capabilities. In all these efforts, the understanding of human activities is of a special interest for both application and research purposes. It paves the way for understanding the development of human visual cognition and interaction skills.

For example, the annual Muslim Hajj in Mecca, Saudi Arabia, which is attended by millions of pilgrims, has increasingly suffered from stampedes, even as authorities have constructed new walkways and instituted other traffic controls to prevent them. Similar incidents have reported in India during Hindu religious holidays [10]. Moreover, stampedes may happen in social and political gatherings in case of crowd panic. For example, on 4th of March 2010, crowd panic emerged after hearing someone yelling the word "bomb" and it created a stampede, which ended up in injuring several people [11]. The King's Cross underground fire in London in 1987 gave the field one of its starting shoves. One big danger in an emergency is that people will follow the crowd and all herd towards a single exit. That in turn means that the crowd may jam as too many people try to force their way through a single doorway. [12]

To improve the coordination of the crowds and to facilitate the flow of the people in public spaces, the transportation researchers are increasingly interested in ameliorating urban designs to adapt them to public needs and habits. Very limited research efforts have been made on understanding the coordinated human actions in groups which itself can create a new area of research in human computer interaction. For instance, an automatic system to recognize and evaluate group performances or group sports would help instructors and learners in improving the group executions tremendously.

Figure 1 illustrates the processes involved in crowd analysis. In a crowd scene the attributes of importance are crowd density, location, speed, etc. This information can be extracted either manually or automatically using computer vision techniques. Crowd models can then be built based on the extracted information. Event discovery is achieved using

pre- compiled knowledge of the scene or using the computational model, although both approaches can be combined. In both cases the model is updated with newly extracted information.

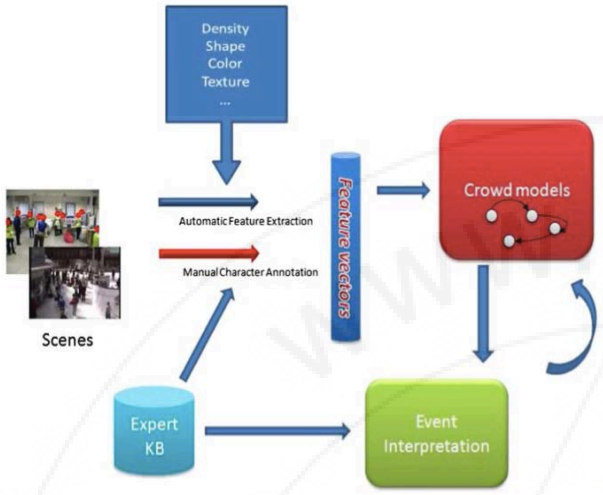

Figure 1: Framework for crowd analysis

2. Crowd Behavior Analysis

Jacques junior et al. [1] crowd behavior analysis classified based on two approaches "object-based approaches" and "Holistic-based approaches".

A. Object-based Approaches

In object-based methods crowd behavior under-standing is performed through some kind of segmentation or detection of individual to analyze group behaviors. For instance, the identification of single person moving against the dominant flow (e.g., one individual trying to enter a sport arena after the match is finished) could be related to potentially dangerous situations. Chen et al. [2] proposed approach based on graph-based modeling. In this analyze individual person or set of occulted person is detected by background subtraction. To construct a graph, Delaunay Triangulation is used to systematically connected vertices and therefor the problem of event detection of human crowd is formulated is measuring the topology variation of consecutive graph in temporal order.

Coppi et al. [9] proposed traced a individual tools and methods (i.e. graph, Laplacians and transductive learning). Their combination with a strong mathematically well-founded update strategy has led to a powerful tool especially for surveillance and forensic applications. In this system represent robust tracing which differ from tracking system. It uses transduce and spectral properties of graph Laplacians proposing a formulation of the people tracing problem as a semi-supervised classification. Its give results in positive and negative samples of target.

Alqaysi et al. [3] proposed approach-automated algorithm for the detection of abnormal behavior in Dynamic Crowded Gathering (DADCG) is reduced the processing speed, sensitivity to noise and improve accuracy. In this analyze individual action recognize and detected crowd.

B. Holistic Approaches

The Holistic approaches looks at the crowd as a global entity. Instead of trying to detect, track and analyze individuals, holistic method focuses on global features.

Calle silos et al. [7] proposed method based on mid-level spatio-temporal features that characteristic motion of typical event in crowd behavior. In this spatio-temporal feature characterize motion of explicit event detection and distance based anomaly detection tasks.

Zhang et al. [5] proposed BoTG (Bag Of trajectory Graph) is presented dense crowd event recognition. In this crowd particles are composed of atomic subgroup to informative behavior patterns, particle trajectories, which simulate motion individual, will be clustered to form at the first step. Result: "graph structure + group attribute" stands for Walking, Running, Formation, demon-standing those behavior pattern are quite related to motion information. Second step connect nodes in each group as a trajectory graph and discover informati-ve features to depict graph. Result "graph structure + group attribute" represent global and local desperation. Third step to analyze method Bag of Trajectory Graphs occurrences of behavior patterns, which provides categorical specific crowd event and detecting abnormality. Result was third attribute less significant compare to graph structure when combining with the motion shown in dark blue bar.

Lee et al. [4] proposed motion influence matrix to analyze crowd behavior. It is generated based on concept of human perception with block-level motion vectors, which describe actual crowd moment. It has main advantages of that does not require to segmentation method to crowd analysis.

Feng et al. [6] approach understanding social grouping of pedestrian behavior as well as unified framework for track - let association based on the temporal snapshots of the introducing snapshots of the introduced evolving tracklet interaction network (ETIN). In this analyze splitting and merging of crowd analyze.

Briassouli et al. [8] proposed method uses both local and global abnormal condition analyze. In this analyze crowd detection technique using statistical sequence changes detection technique and particular CUSUM method. This lead to analyze accurate scene wise, level. Spatiotemporal Localization of the changes in crowd motion is achieved through block-wise application.

3. Conclusion and Future Work

This paper provides a review on current crowd behavior analysis work in computer vision. Perspectives from sociology, psychology and computer graphics are presented, as these research fields also have contributed to an in-depth study on crowd behavior analysis and modeling.

Sociological and psychological studies on the crowd phenomenon make use of human observations. Their studies indicate various ways to represent and model people relationships in isolation and as part of a more or less large group of people. The object based and holistic based is defined to characterize people as individuals or group in part of crowd. The computer vision approach tackles the problem of automatically extracting information sufficient to characterize some special crowd events. we have conclude that our propose system will have crowd behavior analysis in various complex scenario. Its Provide middle level framework and counting, we try to crowd behavior analysis for different scenario splitting, escape, non-escape etc.

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