Swarm Intelligence for Detecting Interesting Events in Crowded Environments

Sagar Mane
Dept. of Electronics and Telecommunication Engineering
SLRTCE, Mira Rd
psagarm34@gmail.com

Mrs. Hemangi Satam
Assistant professor
Dept. of Electronics and Telecommunication Engineering
hema.satam@gmail.com

Prof. V. B. Gaikwad
Dept. of Computer Engineering
Terna College of Engineering
vb_2k@rediffmail.com

***Abstract*—**This paper focuses on detecting and localizing abnormal events in videos of crowded scenes, i.e. divergences from a dominant pattern. Both motion and appearance information are thought-about, so as to robustly distinguish utterly totally different types of anomalies, for a wide range of things. A newly introduced thought primarily based on swarm theory, histograms of oriented swarms (HOS), is applied to capture the dynamics of crowded environments. HOS, together with the well-known histograms of gradients, are combined to build a descriptor that effectively characterizes every scene. These appearance and motion options space unit only extracted at intervals spatiotemporal volumes of moving pixels to make sure strength to native noise, increase accuracy in the detection of local, nondominant anomalies, and achieve a lower machine worth.

Key words: *Anomaly,Histogram of Gradients,Histogram Of Oriented swarms.*

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I. INTRODUCTION

The widespread use of surveillance systems in roads, stations, airports or malls has led to a large quantity of data that must be analyzed for safety, retrieval or even commercial reasons. The task of automatically detecting frames with abnormal or fascinating events from long length video sequences has involved the analysis community in the last decade. Event, and especially anomaly detection in crowded scenes is extremely vital, e.g. for security applications, where it is troublesome even for trained personnel to dependably monitor scenes with dense crowds or videos of long length.

The analysis of motions and behaviors in crowded scenes constitutes a challenging task for computer vision methods, as barriers like occlusions, varying crowd densities and the complex random nature of their motions are troublesome to overcome. Computational price is one additional complicating factor, as it must be kept at intervals cheap limits. In many practical things, it is crucial to investigate crowded scenes in real time, or at least as fast as potential, considering the fact that security personnel should act quickly if one thing looks to be "not as was common." Furthermore, the ambiguity of the term "anomaly" sets its own limitations in our effort to spot it, as there is no commonly accepted definition, and it varies significantly relying on the given situation. This means that associate degree "anomaly" pattern in one video sequence could usually be a part of the "normal" pattern of another.

In this work we propose a unique methodology for anomaly detection and localization that incorporates both motion and appearance data. We introduce a descriptor created from Histograms of Oriented Gradients (HOG) to capture appearance, and the newly introduced Histograms of oriented Swarms (HOS), to capture frame dynamics. Swarm intelligence has been used within the past only in the framework of Particle Swarm Optimization. However, in our work, swarms are used in a very different way: the core idea is to construct a prey based on optical flow values over a specific time window and deploy a compact swarm flying over it to acquire accurate and discriminative information of the underlying motion. The agents' motion is determined by forces acting on the swarm which are used to determine the swarm motion and location.[1]

Thus, this work introduces an innovative preparation of swarm intelligence, which, together with the HOG descriptor, forms a new feature capable of successfully deciding a region's "normality" in an SVM framework. In order to capture "anomalies" appearing in a little a part of the frame, our algorithm is applied solely on regions of interest, and temporal information is incorporated to improve accuracy. Even though benchmark datasets of human crowds were mainly used for the algorithm's validation, results on other sorts of videos of crowded scenes, e.g. traffic, reveal that the proposed methodology can be extended and generalized to completely different eventualities.

Swarms are used in an inventive approach, via Histograms of Oriented Swarms (HOS) that square measure introduced to characterize crowd motion for anomaly detection. They lead to credibly filtered flow in videos of crowds, resulting to very few strident flow values. Thus, swarm intelligence captures the motion of crowded scenes in economical way that will be extended to alternative forms of videos. The method are often applied even once the motion in the crowded scene is non-uniform in area and time, and "anomalies" appear domestically in a dynamical context.

II. APPEARANCE MODELLING

In order to extract the ROIs, we apply background subtraction using Gaussian Mixture Mean.

In order to extract the appearance characteristics of a video sequence, the Histograms of Oriented Gradients (HOG) is used [2]. The HOG descriptor is applied in ROI blocks that are tracked over time and are extracted so the final HOG descriptor for each block also incorporates temporal information.The procedure for this computation is as follows: each block k is first divided into 2×2 cells. A weighted histogram of gradients is then created for each cell using 9 bins, corresponding to the gradients' orientation. Once HOGs for each block are calculated for all frames in the temporal window under examination, They are averaged over 3 consecutive frames so as to include richer temporal information and at the same time achieve temporally local noise reduction.[3]

The final appearance descriptor is thus a concatenation of a 3 frame average for each cell c in block k:

HOGkj,j+2(c) = E[HOGkj(c),HOGkj+1(c),HOGkj+2(c)]

III. MOTION MODELLING USING HOS DESCRIPTOR

The core idea is the monitoring of movements in crowded scenes by a swarm of agents "flying" over them, to capture their dynamics in a collective way while also taking motion history into account. Swarms are thus deployed and the agents' positions are extracted from their accelerated motion derived from the forces acting on the swarm. They are then used to form Histograms of Oriented Swarms (HOS), which are used to capture the ROIs' underlying motion and detect anomalous events in them.[4]

Appearance and motion descriptors are combined to form the final descriptor for anomaly detection. In a time window of m frames, average triplets of HOG and HOS are consecutively concatenated, resulting in the feature vector of Eq.

f = {HOG1,3, HOS1,3, . . . , HOGm−2,m, HOSm−2,m}

Here, HOGm−2,m is the average of HOG histograms corresponding to a block for frames m −2 to m and HOSm−2,m is the average of the corresponding HOS histograms taken from Eq.

HOGkj,j+2(c) = E[HOGkj(c),HOGkj+1(c),HOGkj+2(c)]

IV. CONCLUSION

In this work, we propose a novel framework for anomaly detection. Swarm intelligence is exploited for the extraction of robust motion characteristics and along, with appearance options. The proposed rule will be effectively used for difficult crowd videos with many occlusions, native noise and local scale variations. This fact in combination with its low procedure cost and its effectiveness in completely different environments, make our algorithm terribly applicable for a selection of surveillance applications.

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