Behaviours in video

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Editorial:

Special issue: Behaviours in video

With a significant increment of the number of CCD cameras used for various purposes, there is a demanding call for advanced video analysis techniques that can be used to systematically interpret and understand the semantics of video contents, which have been recorded in security surveillance, intelligent transportation, health care, video retrieving and summarization. Understanding and interpreting human behaviours based on video analysis have observed competitive challenges due to non-rigid human motion, self and mutual occlusions, and changes of lighting conditions. To solve these problems, advanced image and signal processing technologies such as neural network, fuzzy logic, probabilistic estimation theory and statistical learning have been overwhelmingly investigated.

The primary purpose of this special issue is to organise a collection of recently developed video analysis techniques for understanding/interpreting human behaviours, starting from human detection and tracking, segmentation, spatial and temporal features extraction, human body modelling and synthesis, event detection and behaviour learning, including the applications of these techniques. The special issue is intended to become an international forum for researches to report the recent developments in this field in an original research paper style.

This special issue has included nineteen papers which are accepted in the categorization of five themes: human detection and tracking, human behavior analysis, motion segmentation, event recognition and others. Details are followed.

(1) Human detection and tracking

Human detection and tracking has been an active research area over the last decade. However, we are still facing strong challenges in real applications, where human subjects cannot be effectively distinguished from the background due to occlusions, pose or light changes. In this special issue, some authors have addressed these issues. *Mazzon* and *Cavallaro* developed a Multi-Goal Social Force Model (SFM) for multi-camera tracking. The SFM was developed with a goal-driven approach that modeled the desire of people to reach specific interest points (goals) of the site such as exits, shops, seats and meeting points. *Zhang* et al. proposed a tracking method that dealt with the appearance problem based on sparse representation in a particle filter framework. Each target candidate defined by a particle was linearly represented by the target and background templates with an additive representation error. Discriminating the target from its background was achieved by activating the target templates or the background templates in the linear system in a competitive manner. An online algorithm was used to learn the basis functions that sparsely span the representation errors.

Bhaskar et al. introduced a self-adaptive cluster background subtraction scheme for human detection, which was based on a Gaussian Mixture Model (GMM) and foreground matching with rectangular pictorial structures. *Filipov* et al. reported a fast and accurate human head detection

algorithm that was used with range images. Their proposed Pylon Grid algorithm can be used to associate human heads in the scene with local minima in the range images. *Moctezuma* et al. proposed a new method called HoGG for human detection, based on Gabor filters and Histograms of Oriented Gradients. *Cao* et al. proposed a method for pedestrian detection in various scenes based on the transfer learning technique, which included two stages: one is a manifold learning based sample screening algorithm, and the other is the transfer learning based classifier.

(2) Human behavior analysis

Human action recognition continuously attracts the attention of the computer vision community. Current research work is mainly driven towards handling occlusions and pose changes in dynamic environments. In this special issue, *Cristani* et al. reported a new algorithm called Social Signal Processing (SSP) for human behavior classification, which modeled the behaviours using nonverbal cues such as face expressions/gazing and body posture/gesture. *Bao* and *Shibata* introduced a VLSI-hardware-friendly action recognition algorithm using spatio-temporal motion-field patches. This system employed a hierarchical structure so that the robust recognition could be achieved gradually. *Bouziane* et al. presented a unified framework for human behavior recognition, using Markov spatio-temporal random walks on graph.

To effectively classify human behaviours, *Álvarez-Meza* et al. proposed a nonlinear dimensionality reduction algorithm, Laplacian Eigenmaps, was improved using a multiple kernel learning framework. *Boltes* and *Seyfried* performed markerless action detection, based on groups of ellipses approximating isolines of the same distance to an overhead stereo camera. *Wang* et al. proposed to train a pLSA model in a supervised manner for the task of human motion analysis using the bag-of-words representation. Each frame in a video is treated as a word, and all the frames in the training videos are clustered to construct a codebook. The class label information was used to learn the pLSA model in a supervised manner.

Mubashir et al. provided a comprehensive review of different systems for fall detection and the corresponding algorithms, which were divided into three main categories: wearable device based, ambience device based and vision based. *Du* et al. proposed a new concept, Consent Biometrics, which incorporated a consent signature based on human behavioral information. The proposed Consent Biometrics allowed users to register their consent signature. *Taati* et al. presented a novel video analysis technique that performed temporal segmentation of video containing human-product interaction and automatically identifies time segments in which the human has difficulties in operating the product.

(3) Motion segmentation

Motion segmentation is a fundamental element in analyzing image sequences of real scenes. This is a step to associate image pixels with individual motion patterns. The major challenge in this area is the motion randomness and its effects on the motion extraction. In this special issue, *Zhang* et al. introduced a Markov Random Field (MRF) based approach for skeleton extraction from 3D point cloud sequences acquired by the Kinect system. To reduce the large computational

cost of the non-rigid matching, a coarse-to-fine procedure was applied. *Huerta* et al. presented a novel algorithm for mobile-object segmentation from static background scenes. A case analysis of motion segmentation errors was proposed considering the inaccuracy due to different cues, e.g. colour, edge and intensity. The authors then reported a hybrid architecture by fusing the knowledge from the aforementioned three cues and a temporal difference algorithm.

(4) Event recognition

In this special issue, *Zúñiga* et al. reported an event learning approach for videos, based on concept formation models. This approach incrementally learnt on-line a hierarchy of states and event by aggregating the attribute values of tracked objects in the scene. The model could aggregate both numerical and symbolic values.

(5) Others

Finally, this special issue has also witnessed the application of computer vision techniques in different areas. For example, *Hadid* and *Pietikäinen* proposed a novel approach to demographic classification, which encoded and exploited the correlation between two face images using manifold learning. This approach has been applied to the test data for gender and age classification.

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Guest Editors

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