

event
video

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TEC2011-25995 EventVideo (2012-2014)

Strategies for Object Segmentation, Detection and Tracking in Complex Environments for Event Detection in Video Surveillance and Monitoring

<http://www-vpu.eps.uam.es/eventvideo/>

Eleventh trimester progress report

The work during the summer trimester has evolved on plan. The project is trying now focusing on closing several deliverables describing the project outcomes and completing several publications of the main scientific results.

Deliverable D2.1 "Segmentation for static cameras" has been published with a small delay. The list of deliverables to be published before the end of the project includes:

- D2.2 "Segmentation for moving cameras"
- D3.2 "Events detection in dense environments"
- D5.1 "Description of demonstrators and applications"
- D5.2 "Quality measures and feedback-driven analysis approaches"
- D5.3 "Description of exploration of the use Kinect's depth data in analysis stages"

Two conference papers describing the work carried out in collaboration with Technische Universität Berlin have been published, and two journal papers, a book chapter and two conference papers have been accepted for publication.

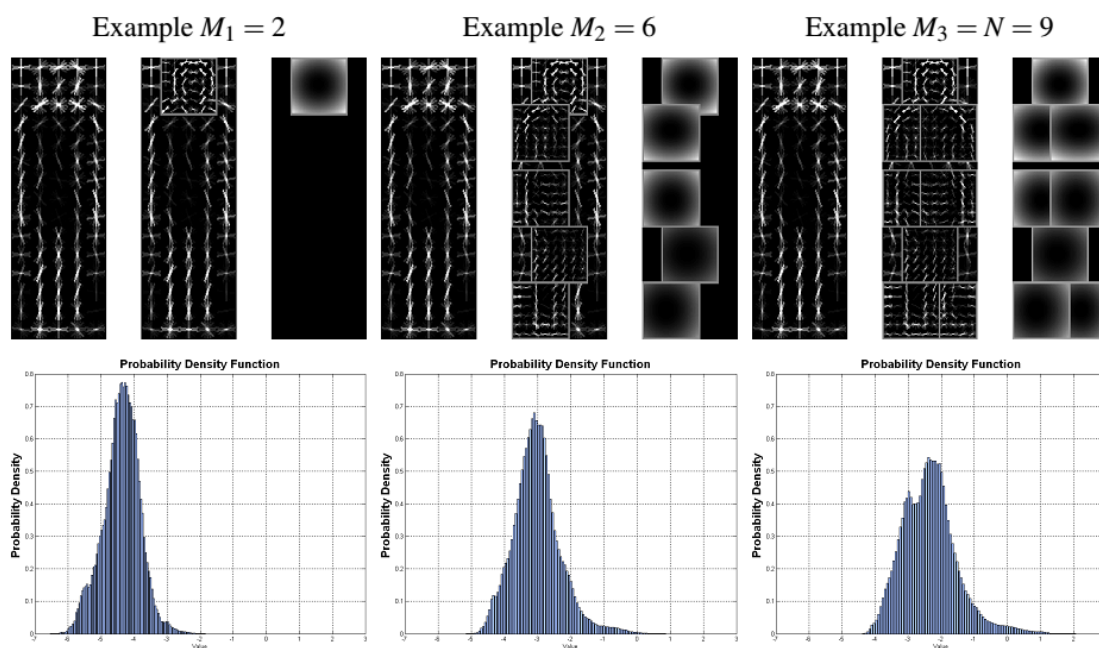
Eleventh trimester results

Publications

Álvaro García-Martin, Ruben Heras Evangelio, Thomas Sikora: "A Multi-configuration Part-based Person Detector", in Proc. of International Conference on Signal Processing and Multimedia Applications, SIGMAP 2014, pp. 321-328, Vienna, Austria, 2-4 Sept. 2014.

Abstract: People detection is a task that has generated a great interest in the computer vision and especially in the surveillance community. One of the main problems of this task in crowded scenarios is the high number of occlusions deriving from persons appearing in groups. In this paper, we address this problem by combining individual

body part detectors in a statistical driven way in order to be able to detect persons even in case of failure of any detection of the body parts, i.e., we propose a generic scheme to deal with partial occlusions. We demonstrate the validity of our approach and compare it with other state of the art approaches on several public datasets. In our experiments we consider sequences with different complexities in terms of occupation and therefore with different number of people present in the scene, in order to highlight the benefits and difficulties of the approaches considered for evaluation. The results show that our approach improves the results provided by state of the art approaches especially in the case of crowded scenes.



Álvaro García-Martín, Rubén Heras Evangelio, Thomas Sikora, “Multi-configurations for Part-based Person Detectors”, Third International Workshop on Parts and Attributes in Conjunction with the European Conference on Computer Vision, ECCV 2014, Zurich, Switzerland, 12 Sept. 2014.

Abstract: People detection is a task that has generated a great interest in the computer vision and specially in the surveillance community. The ability to detect people in video and in particular detecting people in crowded scenarios is the key to a number of multiple applications including video surveillance, group behavior modeling, crowd disaster prevention, etc. Due to the rise in popularity of these applications over the last years, people detection has gradually experienced a great development. Currently, many different systems exist which try to solve the problem posed by the task of detecting people. The state of the art includes several successful solutions working in specific and constrained scenarios. However, the detection of people in real world scenarios such as airports, malls, etc, is still a highly challenging task due to the multiple appearances that different persons may have, heavy occlusions, especially in crowded scenarios, view variations and background variability. The ongoing work is focused on the improvement of people detection in

crowded scenarios. To that aim, we use a part-based person model and propose a statistical driven way of combining the individual body part detectors in order to detect persons even in the case of failure on the detection of any of the body parts. The objective is to be able to detect people with nearly the same reliability whether if they are completely visible (people in front of the group) or only partially visible (people behind).

Master Thesis

Evaluación comparativa de algoritmos de detección de personas en secuencias de vídeo (Comparative evaluation of people detection algorithms in video sequences), Borja Alcedo Moreno (advisor: Álvaro García-Martín), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Jul. 2014.

Abstract: The volume of daily collected data continues to increase and it is estimated that by 2020, the annual amount of data collected will grow to 40 times the existing amount. 80% of all new data will be unstructured and multimedia data, which makes up 70% of this information¹, allows us to understand the importance of information analysis more easily. Therefore, this makes it increasingly important to have the tools that process the data more efficiently to provide the desired results, without having to personally analyze them. There are more and more researchers developing techniques and algorithms for processing multimedia data and specifically more video based multimedia. One of the most useful and complex tasks is detecting people's applicability from day to day in a simultaneous manner. One of the main areas of research in video analysis (in the area of safety driving assistance) is abstracting and indexing video. As a result, there are many people detection algorithms being evaluated on their dataset and their different metrics. This PFC's main objective is to target different algorithms for state of the art People Detection technology to a common dataset. As a result, accurately evaluating the most reliable algorithms in a specific environment and varying them so that they can perform a reliable assessment. In optimizing the settings of each of the parameters and therefore changing each algorithms will give additional results. Furthermore, a study will be made of the current state of the art technology regarding the detection of people and critical phases will be analyzed. The most representative algorithms of different options will be chosen in critical phase and studied individually, and run with initial parameters, set by the author. After that, the parameters of each algorithm will be examined and those that may have an influence on their performance to a "neutral" dataset, will be searched. A selected time is given for each individual algorithm and then together with their best average result for the whole dataset and after that, the configurations are compared. For this, an assessment of each of the proposed algorithm with different configurations dataset is performed. First with the default settings of the author (to compare the original results) and after that we run each algorithm with all configurations of parameters chosen. Secondly a setting of optimal parameters between each video elected is performed. Finally, the result which gives the best average for the entire dataset in general for each

algorithm.

Estimación de fiabilidad del seguimiento de objetos en video (Reliability estimation of object tracking in video), Álvaro Calvo Tapia (advisor: Juan Carlos San Miguel), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Jul. 2014.

Abstract: In this master thesis we propose an approach to estimate the reliability of video tracking algorithms. This estimation consists on determining during online analysis and in the absence of ground truth data (manual annotations of the ideal tracking results) the instants in which the algorithm successfully tracks the desired object. First a study of related work is done in which the existing techniques are analyzed. Then the work is focused on the description of the proposed approach whose main aim is to detect the frames of change in which the tracker loses or recovers the target. For this purpose a set of features related to shape, motion and appearance of the tracked object is used. When these features have sudden variations the existence of a frame of change is considered. To identify these atypical values of the features we propose an anomaly detection strategy. Then a state machine is used to decide in each frame whether tracking is correct or wrong (reliability estimated). Finally the proposed approach is tested with six different video trackers and compared against the most relevant techniques of the state-of-the-art. For such evaluation task we have selected a dataset that includes the most common problems in video tracking.

Detección jerárquica de grupos de personas (Hierarchical detection of groups of people), Ricardo Sánchez Matilla (advisor: Álvaro García-Martín), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Jul. 2014.

Abstract: The massive establishment of video cameras in society makes impossible the control and analysis of the enormous amount of videos files captured. For this reason, the algorithm referred to video analyses has lately gained enormous importance. Nowadays, the algorithms used for person detection under control environments, have achieved an optimum performance, although in crowded sceneries, in which a great number of occlusions among themselves occurred, the performance of the actual algorithms are not acceptable. The main objective of this project is to develop an algorithm for people detection whose main difference would be the hierarchical detection, and thus, improve the actual algorithms in high density of people settings. The key point of the project would be that the detection should not be only focused in the information of individuals, but it should also take into consideration the information from the detection of multiple people, and subsequently, improve the results obtained in this type of sceneries. At the same time, the algorithm would use the person appearance, which could be defined as a whole, or by choosing certain parts such as head, shoulder, trunk, etc. The suggested

algorithm has been tested in video sequences of reference, and the results obtained demonstrate that the detection performance has improved due to the upgrades implemented.

Graduate Thesis

Detección de anomalías en tiempo real (Real-time anomaly detection), Ana Huélamo Vallejo (advisor: Luis Caro), Trabajo Fin de Grado (Graduate Thesis), Grado en Ingeniería y Tecnologías de Telecomunicación, Escuela Politécnica Superior, Universidad Autónoma de Madrid, Jul. 2014.

Abstract: This work aims at integrating an anomaly detection algorithm real time on a platform designed to work with video-surveillance applications called DiVA. With this integration it intends to modify the functionality of the algorithm so that it can process images received from video in real time without compromising the rest of its operations. On the other hand it want to develop a GUI to make easier the management of this algorithm, both skilled user in handling video processing algorithms, and user without knowledge of the subject matter. The GUI shall adjust to the own needs of both the algorithm and the future users. To carry out this work, it's been necessary to obtain knowledge of several fields, before to start developing each of its parts. First of all, the algorithm has been studied and all of its parts for the integration. Same way, it's been studied all the different platforms and tools needed for the development of the set. Once all the main objectives were completed it proceeded to study and evaluation of the results through a set of test performed in appropriate environments. This report is intended to be reflect of the work carried out during the duration months in same way it tries to help the reader in understanding of each ones of the elements of the work.

Detección de intrusión en exteriores en tiempo real (Real-time outdoor intrusion detection), Alejandro Blanco Carrasco (advisor: Marcos Escudero), Trabajo Fin de Grado (Graduate Thesis), Grado en Ingeniería y Tecnologías de Telecomunicación, Escuela Politécnica Superior, Universidad Autónoma de Madrid, Jul. 2014.

Abstract: This Project presents an outdoor intrusion detection system in real time using a background subtraction technique based on a pixel-driven analysis. The objectives are based on an analysis of the current state of the art to later provide a flexible combination of such methods to integrate several functionalities in a scalable scheme that allows the substitution of some of the modules without changing the philosophy of the algorithm. The use of a non-parametric scheme that stores samples of the background and foreground using a multilayer approach is used for the models. The proposed initialization scheme relies in a pixel classification stage to provide local updating mechanisms under a selective spirit. For the updating process, the system uses a process that is guided by the confidence matrix or frequency of occurrence of the modes, which control a selective updating process by using pixel's classes. The models are temporarily adapted using a parametric selective updating

process that controls the evolution of the models. In the stage of comparison against the models, we propose a method of comparison with the pixel spatial environment or pixel's neighborhood. Such method provides robustness to noise due to the vibrations of the capturing system. The system also integrates a comparative process that gives robustness to shadows and moderate reflections. The system has been evaluated using a public database which allows a reliable comparative with the current state of the art. The results have not undergone any post-processing technique that improves the statistical classification. The system has been developed and implemented using the object-oriented programming language C++ and the video analysis library OpenCV. Finally, it is enhanced by a user interface implemented using Qt Designer that allows instantaneous interaction with the system, altering its parameters if necessary. The algorithm is integrated into a common processing environment that allows its use with the direct output of a camera.

Seguimientos de objetos en tiempo real (Real-time object tracking), Jorge Sanjuán García (advisor: Rafael Martín), Trabajo Fin de Grado (Graduate Thesis), Grado en Ingeniería y Tecnologías de Telecomunicación, Escuela Politécnica Superior, Universidad Autónoma de Madrid, Jul. 2014.

Abstract: The main goal of this work is to define a general method for integration of several video object tracking algorithms into the Distributed Video Analysis platform DiVA, allowing the algorithms to process video sequences online and interactivity between the user and the algorithm during the execution. Thanks to this, by using as a reference the algorithms integrated in this work, future integrations of new algorithms can be developed in the same way with much less effort, taking advantage of the developed work. After preparing the algorithms, demonstrators for each integrated algorithm have been developed in order to ease verification of the results and interactivity between the user and the algorithm through the graphic user interface (GUI) created. Furthermore, improvements have been developed to the algorithms treated in this work. To carry out this investigation task, a comprehensive study on the implementation and theoretical basis has been made to each algorithm. Specifically, most of the efforts have been focalized in the second integrated algorithm, PKLTF. After the implementation of the improvements, both the results and processing time have been studied objectively using the previously defined evaluation framework, verifying that, with the improvements, the algorithm offers better results.

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