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

D6.2v5

EVENTVIDEO RESULTS REPORT

Video Processing and Understanding Lab

Escuela Politécnica Superior

Universidad Autónoma de Madrid

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CHANGE LOG

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0.0	20/06/2012	José M. Martinez	Initial version
1.0	29/06/2012	José M. Martínez	Version 1 (D5.4v1)
2.0	29/12/2012	José M. Martínez	Version 2 (D5.4v2)
3.0	29/06/2013	José M. Martínez	Version 3 (D6.2v3)
4.0	13/12/2013	José M. Martínez	Version 4 (D6.2v4)
5.0	30/06/2014	José M. Martínez	Version 5 (D6.2v5)

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1. Introduction

This *report* recapitulates the results obtained within the EventVideo project. The results are disseminated both at the Web site (http://www-vpu.eps.uam.es/eventvideo) and via the eVi Newsletters.

The EventVideo project started officially January 2012, nevertheless the Video Processing and Understanding Lab (VPULab) has been working during part of 2011 in the research lines proposed in the project. Therefore the project started to produce related results even before the project official start.

1.1. Document structure

This document contains the following chapters:

- Chapter 1: Introduction to this document
- Chapter 2: Publications
- Chapter 3: Content Sets
- Chapter 4: Project Documents
- Chapter 5: Workshops and Seminars

2. Publications

2.1. Journals

1. Juan C. SanMiguel, José M. Martínez, **"Use of feedback strategies in the detection of events for video surveillance"**, IET Computer Vision, 5(5):309-319, Sep. 2011. (DOI 10.1049/iet-cvi.2010.0047)
2. Álvaro García-Martín, José M. Martínez, Jesús Bescós, "**A corpus for benchmarking of people detection algorithms"**, Pattern Recognition Letters, 33(2):152-156, Jan. 2012. (DOI 10.1016/j.patrec.2011.09.038)
3. Juan Carlos San Miguel, Luis Caro, José M. Martínez, "**Pixel-based colour contrast for abandoned and stolen object discrimination in video surveillance"**, IET Electronic Letters, 48(2):86-87, Jan. 2012. (DOI 10.1049/el.2011.3160)
4. Juan Carlos San Miguel, Andrea Cavallaro, José M. Martínez, **"Adaptive on-line performance evaluation of video trackers"**, IEEE Transactions on Image Processing 21(5):2812-2823, May 2012. (DOI 10.1109/TIP.2011.2182520)
5. Álvaro García-Martín, José M. Martínez, **"On collaborative people detection and tracking in complex scenarios"**, Image and Vision Computing, 30(4-5):345-354, May 2012, Elsevier, ISSN 0262-8856. (DOI 10.1016/j.imavis.2012.03.005).
6. Juan Carlos San Miguel, José M. Martínez, **"A semantic-based probabilistic approach for real-time video event recognition"**, Computer Vision and Image Understanding, 116(9):937-952, September 2012, Elsevier, ISSN 1077-3142. (DOI 10.1016/j.cviu.2012.04.005).
7. Álvaro García-Martín, José M. Martínez, "**Enhanced people detection combining appearance and motion information**", IET Electronic Letters, 49(4):256-258, February 2013, IET, ISSN 0013-5194 (DOI 10.1049/el.2012.3817).
8. Juan Carlos San Miguel, José M. Martínez, **"A semantic-guided and self-configurable framework for video analysis**", Machine Vision and Applications, 24(3):493:512, April 2013, Springer, ISSN 0932-8092 (DOI 10.1007/s00138-011-0397-x)
9. Rafael Martín, Jose M. Martinez, "**A semi-supervised system for players detection and tracking in multicamera soccer videos**", Multimedia Tools and Applications, (on line August 2013), Springer, ISSN 1380-7501 (DOI 10.1007/s11042-013-1659-6).
10. Juan Carlos San Miguel, Sergio Suja, "**Skin detection by dual maximization of detectors agreement for video monitoring**", Pattern Recognition Letters, 34(16):2102-2109, December 2013, Elsevier Science Inc., ISSN 0167-8655 (DOI 10.1016/j.patrec.2013.07.016).
11. Fulgencio Navarro, Marcos Escudero-Viñolo, Jesús Bescós, "SP-SIFT: Enhancing SIFT discrimination via super-pixel based foreground-background segregation", IET Electronic Letters, 50(4):272-274, Feb. 2014, IET, ISSN 0013-5194 (Print), 1350-911X (Online) (DOI: 10.1049/el.2013.3949)
12. Rafael Martín, José M. Martínez, "Correlation study of video object trackers evaluation metrics", IET Electronic Letters, 50(5):361-363, Feb. 2014, IET, ISSN 0013-5194 (Print), 1350-911X (Online) (DOI: 10.1049/el.2013.3209)

13. Juan C. SanMiguel y Andrea Cavallaro, □Temporal validation of particle filters for video tracking□, Computer Vision and Image Understanding, (aceptado Julio 2014) Elsevier Science Inc., ISSN 1077-3142.

2.2. Book chapters

1. Juan Carlos San Miguel, Álvaro García-Martín, José M. Martínez, "Performance evaluation in video-surveillance systems: the EventVideo Project evaluation protocols", cáp. 9, pp. 171-192, Intelligent Multimedia Surveillance: Current Trends and Research, Pradeep K. Atrey, Mohan S. Kankanhalli, Andrea A. Cavallaro (eds.), 2013, Springer (ISBN 978-3-642-41511-1 – Print; 978-3-642-41512-8 - Online)(DOI 10.1007/978-3-642-41512-8_9).

2.3. Conferences

1. Juan Carlos San Miguel, Andrea Cavallaro, José M. Martinez, "**Standalone evaluation of deterministic video tracking**", en Proc. of 2012 IEEE International Conference on Image Processing, ICIP 2012, Orlando, E.E.U.U., 30 September-3 October 2012, pp.1353-1356
2. Álvaro García-Martín, Andrea Cavallaro, José M. Martinez, "**People-background segmentation with unequal error cost**", en Proc. of 2012 IEEE International Conference on Image Processing, ICIP 2012, Orlando, E.E.U.U., 30 September-3 October 2012, pp. 157-160
3. Diego Ortego, Juan Carlos San Miguel, "**Stationary foreground detection for video-surveillance based on foreground segmentation and motion history images**", in Proc. of 2013 IEEE International Conference on Advanced Video and Signal-based Surveillance, AVSS 2013, Kraków, Poland, 27-30 August 2013, pp. 75-80
4. Rafael Martín, Jose M. Martinez, "**An automatic system for sports analytics in multi-camera tennis videos**", in Proc. of Activity Monitoring by Multiple Distributed Sensing (AMMDS) Workshop 2013 in conjunction with 2013 IEEE International Conference on Advanced Video and Signal-based Surveillance, AVSS 2013, Kraków, Poland, 27-30 August 2013, pp. 438-442
5. Fabricio Tiburzi, Jesús Bescós, "**Robust camera motion estimation in presence of large moving objects**", en Proc. of 2013 IEEE International Conference on Image Processing, ICIP 2013, Melbourne, Australia, 15-18 Septiembre 2013, pp. 2509-2513Rafael Martín, José M.Martínez, "Evaluation of Bounding Box Level Fusion of Single Target Video Object Trackers", en Hybrid Artificial Intelligence Systems - HAIS 2014, M.Polycarpou et al. (eds.), Lecture Notes in Computer Science, Vol. 8480, Springer Verlag, 2014, pp. 200-210. (ISBN 978-3-319-07616-4)
6. Fulgencio Navarro, Marcos Escudero, Jesús Bescós, "Enhancing region-based object tracking with the SP-SIFT feature", in Proc. of 2014 Interational Workshop on Content-Based Multimedia Indexing, CBMI 2014, Klagenfurt, Austria, 18-20 Jun. 2014

7. Diego Ortego, Juan Carlos San Miguel, "Multi-feature stationary foreground detection for crowded video-surveillance", in Proc. of 2014 IEEE International

Conference on Image Processing, ICIP 2014, Paris, France, 27-30 Oct. 2014 (in press).

2.4. PhD thesis

1. **Contributions to robust people detection in video-surveillance**, Álvaro García Martín (advisoradvisor: José M. Martínez), Tesis Doctoral (PhD Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Oct. 2013.

2.5. Masther thesis

1. **Evaluación comparativa de algoritmos de seguimiento de objetos (Comparative evaluation of object tracking algorithms)**, Mónica Lozano Cruz (advisoradvisor: Juan C. San Miguel, ponente: José M. Martínez), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Feb. 2012.
2. **Generación de fondo de escena en secuencias de video-seguridad (Background generation in video-surveillance sequences)**, Alberto Muñoz García (advisor: Juan C. San Miguel, ponente: José M. Martínez), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Sep. 2012.
3. **Detección de robo/abandono de objetos en interiores utilizando cámaras de profundidad (Indoor stolen/abandoned object detection using depth cameras)**, Fabricio A. Córdova Lucero (advisor: Juan C. San Miguel, ponente: José M. Martínez), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Dec. 2012.
4. **Análisis de interacciones y actividades en entornos controlados (Analysis of interactions and activities in controlled environments)**, Sergio Suja Garrido (advisor: Juan C. San Miguel, ponente: José M. Martínez), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Dec. 2012.
5. **On the Fusion of Single-Target Video Objects Tracking Algorithms**, Rafael Martín Nieto (advisor: José M. Martínez), Trabajo Fin de Master (Master Thesis), Master Universitario en Investigación e Innovación en TIC (i2TIC), Escuela Politécnica Superior, Universidad Autónoma de Madrid, Sep. 2013.
6. **Detección de objetos estáticos de primer plano en escenarios altamente concurridos de video-seguridad (Detection of foreground static objects in crowded video-surveillance scenarios)**, Diego Ortego Hernández (advisor: Juan C. San Miguel, ponente: José M. Martínez), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Sep. 2013.
7. **Anomaly Detection in Video Sequences**, Luis A. Caro Campos (advisor: Juan Carlos San Miguel), Trabajo Fin de Master (Master Thesis), Master Universitario en Investigación e Innovación en TIC (i2TIC), Escuela Politécnica Superior, Universidad Autónoma de Madrid, Oct. 2013.

8. **Entorno de desarrollo de aplicaciones de vídeo-seguridad multicámara (Development environment for multicamera video-surveillance applications)**, Carlos Sánchez Bueno (advisor: José M. Martínez), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Jun. 2014.
9. **Seguimiento de personas en vídeo basado en detección (Detection-based people tracking in video sequences)**, Raúl Porras Martín (advisor: José M. Martínez), Proyecto Fin de Carrera (Master Thesis), Escuela Politécnica Superior, Univ. Autónoma de Madrid, Jun. 2014.

2.6. Graduate thesis

1. **Detección de personas en tiempo real (Real-time people detection), Patricia Marín Belinchón (advisor: Álvaro García), Trabajo Fin de Grado (Graduate Thesis), Grado en Ingeniería y Tecnologías de Telecomunicación, Escuela Politécnica Superior, Universidad Autónoma de Madrid, Jun. 2014.**
2. **Detección de caídas para vídeo-monitorización en entornos domésticos (Fall Detection for Video-monitoring in domestic environemnts), Sara Cerro Pardo (advisor: José M. Martínez), Trabajo Fin de Grado (Graduate Thesis), Grado en Ingeniería y Tecnologías de Telecomunicación, Escuela Politécnica Superior, Universidad Autónoma de Madrid, Jun. 2014.**
3. **Detección de intrusión con cámaras móviles en tiempo real (Real-time Intrusion detection with mobile cameras)**, Alberto Palero Almazán (advisor: Jesús Bescós), Trabajo Fin de Grado (Graduate Thesis), Grado en Ingeniería y Tecnologías de Telecomunicación, Escuela Politécnica Superior, Universidad Autónoma de Madrid, Jun. 2014.

3. Content Sets

1. Abandoned and Stolen Object Discrimination dataset - ASODds (http://www-vpu.eps.uam.es/DS/ASODds/)
2. Event Detection dataset - EDds (http://www-vpu.eps.uam.es/DS/EDds/)
3. Person Detection dataset - PDds (http://www-vpu.eps.uam.es/DS/PDds/)

4. Project Documents

4.1. Deliverables

D1.1v1 – System Infrastructure (public) – June 2012
D1.1v2 – System Infrastructure (public) – June 2013

D1.2v1 – DiVA Documentation (public) – June 2012

D3.1v1 - People detection in dense environments (public) - June 2014

D4.1v1 - Tracking in dense or cluttered environments - (public) June 2014

D4.2v1 - Visual attention driven tracking (public) - June 2014

D5.3v1 – EventVideo Test Sequences, Ground-truth and Evaluation Methodology (public) – June 2012

D5.4v1 – EventVideo Results Report (public) – June 2012
D5.4v2 – EventVideo Results Report (public) – December 2012
D6.2v3 – EventVideo Results Report (public) – June 2013
D6.2v4 – EventVideo Results Report (public) – December 2013
D6.2v5 – EventVideo Results Report (public) – June 2014

4.2. Technical Reports

TR.01 "Evaluation results and future research lines" (restricted) - April 2013

5. Workshops and Seminars

5.1. eVi Workshop 23rd May 2014

The workshop was held during the morning of 23rd May of 2014 with over 30 attendees (not including the presenters). After a presentation of the project and an overview of the workshop program the technical sessions started with a description of the infrastructure used in the project, both material and software development framework. Afterwards four sessions were devoted to the main research areas of the project. Session 2 presented the work done in segmentation, presenting two works: foreground-background segmentation in multimodal environments and Segmentation for PTZ cameras, both including a live demos. Session 3 presented results in people detection, detailing after an overview of all the work done, the results obtained in real-time people detection (demonstrating live several real time people detecotrs) and people-background segmentation. In Session 4, deveoted to object tracking, two works were presented: visual attention based tracking and long-term object tracking, the later showing a live demo with cameras installed in the workshop room and allowing the public to interactively test the system. The last session on Event detection included three presentations on specific topics: people activities and interactions detection, stolen and abandoned objects detection and anomaly detection, including two live demos.