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Content aware ranking of video segments

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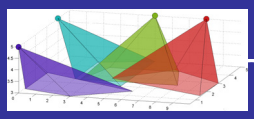
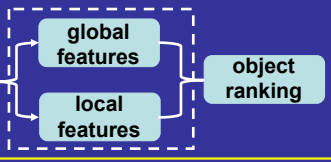
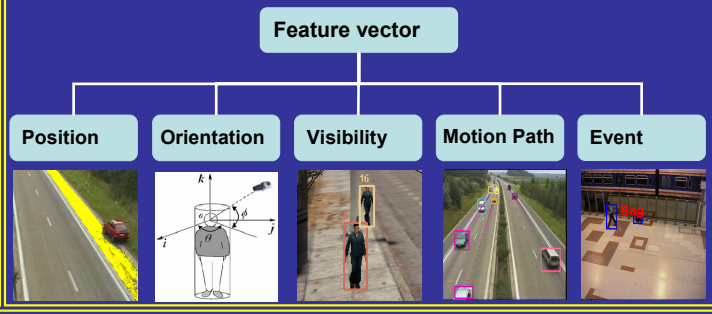
1. Introduction

- Video ranking aims to identify
  - What to show
  - When to show
- Object ranking to capture representative instances in video streams and across cameras

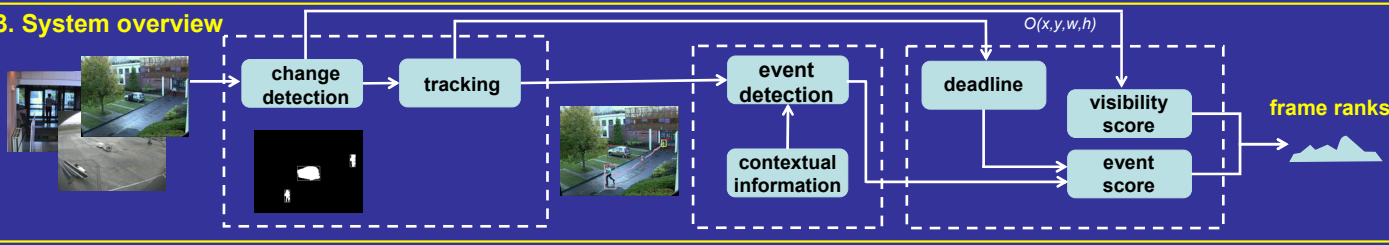




2. Feature selection



3. System overview



4. Proposed approach

- Aim is to find a rank for each object in each frame [1]

Object detection & tracking

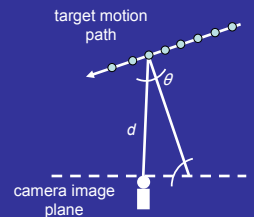
- Object detection using statistical colour change detector [2]
- Association using multi-frame graph matching [3]

Event detection

- Hidden Semi-Markov Model with duration distribution using Viterbi decoding [4]

Object ranking

- Size (s)
- Pose (ϕ)
- Event score (v_ω) for event (ω)
- Event span (κ_ω)
- Deadline(λ)



Pose estimation of a target using the angle between the normal of its motion path and the normal of the image plane

5. Combination of features

- Visibility score (r^1) $r^1(t) = \phi(t).s(t)$
- Content score (r^2) $r^2(t) = \beta_1 v_\omega + \beta_2(t_o - \kappa_\omega) + \beta_3 \lambda(t)$

where t_o is the elapsed time for the event

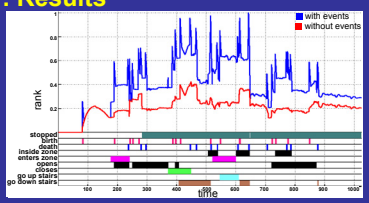
- Object ranking score (ε) $\varepsilon(t) = \alpha r^1(t) + (1-\alpha) r^2(t)$
- Frame rank (ρ) $\rho(t) = \sum_{j=1}^{J} \varepsilon_j(t)$

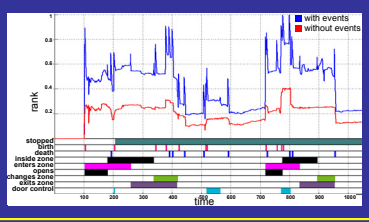
where J is the total number of targets in the scene

6. Multi-camera environment

- Conflict between cameras viewing the same target resolved using visibility score (r^1)
- Deadlines (λ) calculated using ground plane trajectories for the monitored site
- Local event information gathered from individual cameras

7. Results



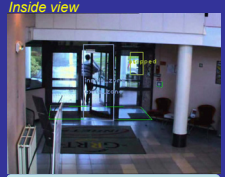


Outside view

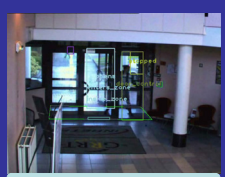
Birth Event

Stopped Event

Inside view



Zone events

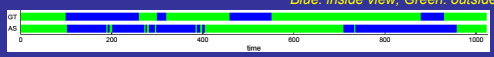


Door control

http://www.silogic.fr/etiseo/index.html

Camera selection

Blue: inside view; Green: outside view



Ranking for a target across multiple cameras

Data generated with VirtualObject tool using halflife-2 (Taylor et al. "OVVV: Using virtual worlds to design and evaluate surveillance systems," CVPR '07. IEEE Conference on, pp. 1–8, 17-22 June 2007

8. Conclusions

- Ranking algorithm based on several target features
- Event detection for video ranking facilitates the ranking procedure

9. Future work

- Integration of saliency models to better estimate video ranking
- Use of active cameras for view planning and camera scheduling

10. References

[1] F. Daniyal, M. Taj and A. Cavallaro, "Content aware ranking of video segments," in Proc. of ACM / IEEE Int. Conf. on *ICDSC, Vieanna, CA, USA* 7-11 Sep 2008

[2] A. Cavallaro and T. Ebrahimi, "Interaction between high-level and low-level image analysis for semantic video object extraction," EURASIP Journal on Applied Signal Processing, vol. 6, pp. 786–797, Jun 2004.

[3] M. Taj, E. Maggio, and A. Cavallaro, "Multi-feature graph-based object tracking," in CLEAR, Springer LNCS 4122, Southampton, UK, Apr 2006, pp. 190–199

[4] M. Taj and A. Cavallaro, "Object and scene-centric activity detection using state occupancy duration modeling," in Proc. of IEEE Int. Conf. on AVSS, Santa Fe, NM, USA, 1-3 Sep 2008

Additional information http://www.elec.qmul.ac.uk/staffinfo/andrea