Mathematical Framework for Multi-Camera Cooperative Scene Interpretation

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I. INTRODUCTION

Video surveillance is important in various areas of day-to-day life (such as safety at airports, stations, and in the private sector) as well as in many more specialized domains (e.g. traffic monitoring or safety in petrol, etc). Existing surveillance systems are not yet capable of autonomous analysis of complex events in camera networks. Here, millions of video feeds are not analyzed in real time and cannot be used for crime or terrorism prevention, etc. The tremendous amounts of information of existing surveillance systems are, at best, recorded or handled by human operators. Using state of the art techniques [1], there are still many issues which have to be solved regarding real time, robustness and environment changes. We aim to develop novel methodologies for intelligent and robust object tracking in smart camera networks. Finally, the goal is a framework which is capable to detect complex event occurring in a smart camera network.

II. METHODS

A. Occupancy Maps

The fundamental approach of our algorithms is occupancy mapping of a scene which provides top views containing people and objects [2]. The fundamental idea is to project image features (in this case foreground information) onto a common map and use the probabilistic framework to fuse multiple views of a scene. We are currently investigating the robustness and performance of such a system including different features like edges and local binary patterns.

B. Communication between Cameras

Due to the fact that one feature (e.g. foreground information) is not enough to build a reliable and robust system; we are exploring other features and methods as well. We are focusing on the approach of cooperating cameras, i.e. making use of several features (foreground information, edges, local binary pattern, etc) and distribute them in the camera network. The integration of this information in a mathematical framework solves different tasks like tracking of people.

Combining these techniques with state of the art activity analysis makes event detection feasible.

C. Current Research

We are able to localize people in a meeting environment (see Figure 1). A camera network observing a scene was used for this purpose. The strategy of obtaining such a map is based on the Dempster- Shafer theory of evidence using multiple cameras [2].
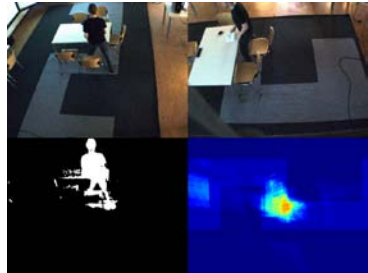

Figure 1. Occupancy map of a meeting environment

III. CONCLUSIONS

During this doctoral research, we are aiming a mathematical framework solves object tracking and complex event detection. The work until now shows occupancy mapping approaches: integrating multiple views of a scene are used to localize people in a meeting environment.

REFERENCES

[1]   Dore, A.; Soto, M. & Regazzoni, C., "Bayesian Tracking for Video Analytics", Signal Processing Magazine, IEEE, 2010, 27, 46 -55

[2]   Morbee, M.; Tessens, L.; Aghajan, H. & Philips, W., "Dempster-Shafer based multi-view occupancy maps", *Electronics Letters,* 2010*, 46*, 341 -343