Autonomous Multi-Camera Monitoring Systems

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This project is about developing a new methodology for managing intelligent systems of distributed synchronous cameras. Multi-camera systems are increasingly used to identify emerging risks in large buildings and areas where many people walk and interact through successions of corridors and open spaces.[1,2] Their applications range from monitoring patient well-being in hospitals to tracking antisocial behaviour in retail centres and detecting terrorist activity at airports. Systems of pan-zoom-tilt cameras used in such applications are very complex and notoriously tedious and error-prone to monitor and continually adjust by human security agents. We propose a PhD project that will develop a methodology to automate the evaluation of the activity of individuals and groups using complex autonomous multi-camera monitoring systems. The PhD candidate will develop:

1. Distributed algorithms for monitoring individual and group activities and event detection from multi-camera video sequences. This part of the project will extend existing algorithms for the identification of human activity[3] from single-camera video sequences devised in a previous project led by AB. Multi-camera systems will enable better capabilities such as those provided by 3D modelling of group activities[4] and the tracking of unfolding events through complex networks of cameras. Dynamic modelling on graphs will be used to model changing patterns in movement.

2. Model-driven engineering techniques for the dynamic reconfiguration of camera parameters such as pan-tilt angles and zooming, to improve the scene observation and to track complex events involving multiple individuals. Building on recent research led by RC,[5,6] this project component will use runtime stochastic modelling and verification to continually assess the risk situation and adjust the camera configurations accordingly. This will allow multi-camera systems to follow unfolding events and to react to adverse changes such as a camera being damaged accidentally or maliciously.

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[5] R. Calinescu et al. Self-Adaptive Software with Decentralised Control Loops. *FASE*:235-251, 2015.
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