





Australian Centre for Visual Technologies

Large-Scale Intelligent Video Surveillance


Anton van den Hengel

The Australian Centre for Visual Technologies
School of Computer Science
University of Adelaide





School of Computer Science, University of Adelaide

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The information




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The video surveillance crisis

- Camera surveillance is ubiquitous
 - London citizens viewed >300 times per day
 - >1M cameras in London
- Cameras monitor streets, shops, airports, etc
- What happens to the video?
 - Most video is never seen
 - Little observed in real time
 - Forensic search




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The need for smarter systems

- Live human monitoring needs to focus on key events
 - Need systems need to detect such events
 - Scalable solutions
 - Allows more effective responses
- Forensic analysis needs to be faster and smarter
 - Need semi-automated data mining



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Challenge

- Make possible wide area video surveillance
 - Protection of people and property
 - Various scales of threat, eg assault to catastrophe
 - Perimeter defence/monitoring
 - Increased detection of theft, reduced false alarms
 - More effective use of police and private security resources
 - Road traffic analysis
 - Public liability
 - Archived footage provides defence against spurious claims

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Large-scale surveillance – Forensic analysis

- “Inverse Hollywood” problem
- “Find all instances of a blue car that were parked over there”
- How to find an escaped vehicle’s path through a network of video repositories?



The technologies

1. Networked Camera Surveillance Platform
2. Network topology analysis
3. Inter-camera network tracking system
4. Multi-camera behaviour analysis

Network topology analysis

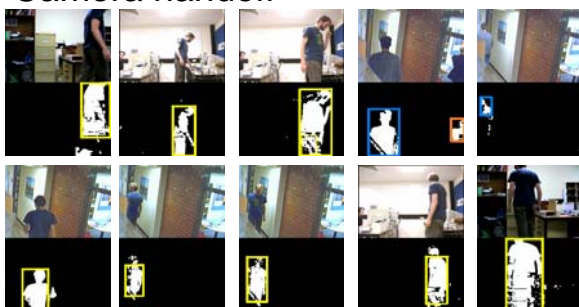
- Characterise movement of targets between video fields of view



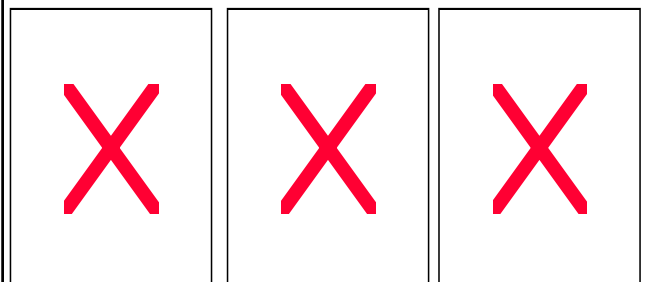
Network topology analysis

- Existing prototype based on Constraint Propagation and Hidden Markov Model
- Each state in the HMM corresponds to the presence of a target in a particular location
- Each link between states in the HMM records the probability that a target moves from one location to another

Camera handoff

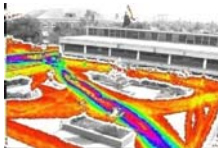


Camera handoff (cont)



Behaviour analysis

- Recent research has looked at single-view behaviour analysis:
 - Detecting violence, theft, suicidal intent, usage patterns, trespass, rendezvous
- Little research done at the network level



Behaviour analysis

- If we can track through the network, we can analyse the tracks:
 - Is the motion non standard? Haphazard?
 - Are standard sequences being followed (e.g. in airport check-in)
 - Has a person been hidden for too long?
 - Are various locked doors being tried?

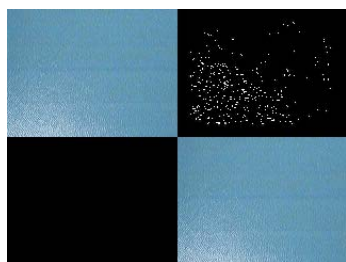
Intelligent Network Video Surveillance

- Abstract over individual cameras
- Present only the most important information at any time
- Effective exploitation of automatic and human analysis

Within-camera tracking



Unmanned Aerial Video



Analysis of crime-scene/accident video



3D models from video



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