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A Progress Review of Intelligent CCTV Surveillance Systems

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Intelligent CCTV Surveillance Systems

1. Public Attitudes to Surveillance
2. Typical camera installations
3. Historical development of CCTV Surveillance systems
4. Examples of recent research
5. Future prospects

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Public attitudes to CCTV Surveillance systems

two opposing categories

A. concerns over invasion of privacy and fears of authoritarian control of the population.

B. welcoming the increased safety in public spaces and reductions in antisocial behaviour.

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Traditional Viewpoints

(George Orwell's novel '1984' was inspired mainly by the example of the developing Soviet Union system under Communism)

"……There was no way of knowing whether you were being watched at any given moment…"

from the novel *'1984'*, published in 1948.

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From George Orwell's novel '1984', concept of 'Big Brother' always watching everything you do has entered the 'popular culture' in many ways, and forms a conceptual starting point for almost any discussion of Surveillance.

Perhaps idea not so novel, as many of world's major religions include concept that 'God' is continually watching the actions (and reading the 'thoughts' of) every individual.

St. Petersburg, Russia 2005

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Really side–by–side in Barcelona, Spain !
Photo: James Orwell

Examples of typical installations

City University, London (location near urban housing-estate)

Highly visible – functional but also intended as a deterrent

Examples of typical installations

A London Rail Terminus

Examples of typical installations

Alexandra Palace Rail Station, London

Examples of typical installations

CCTV Camera underground in Paris Sewer system

Examples of typical installations

Examples of typical installations

Even in the countryside ! !

(Kingswood, Surrey)

Examples of typical installations

Camera on rail station (Alexandra Palace) ; part of a system to allow the train driver to see the whole platform

Old-technology 'GATSO' speed camera

Captures registration number and speed of vehicle

From website: www.observingsurveillance.org/

OBSERVING SURVEILLANCE

Not-so-obvious CCTV camera equipment

Dome Camera housing

PIR motion detector, with hidden 'spy camera' included

Camera disguised as a Smoke Alarm

www.iviewcameras.co.uk

Not-so-obvious CCTV camera equipment

Easy-to-hide Spy Camera

All you need to pretend to be James Bond, readily available from stores or internet sites

www.iviewcameras.co.uk

The CCTV cameras may see much more than YOU can see !

example from commercial web-site of 'Extreme CCTV' www.extremecctv.com

Surveillance from Space (this one an example from 'Google Earth')

Surveillance from Space (this one an example from 'Google Earth') – closer.

CCTV cameras of Washington DC Police Department

(apparently very few !)

By 2004, claimed that over **four million** CCTV cameras were deployed in the UK

From website: www.observingsurveillance.org/

"More CCTV" = "More Safety"

CCTV surveillance in action

CCTV image released by London Police

shows the four suicide-terrorists setting out from Luton Rail station (at 0721) on the morning of the 7th July 2005 attack

Their bombs were detonated around 0850 (three on trains, one on a bus), killing 56 (including themselves) and injuring over 700.

Crowd Behaviour studies

Early work on behaviour of crowds

(a) to assist architects and town planners in design of urban environments

(b) to assist in the safe management of urban crowds (commuters in rail stations, etc.)

Limited computational resources

⇨ study of 'global properties' using simple image-processing methods

Technology Progress

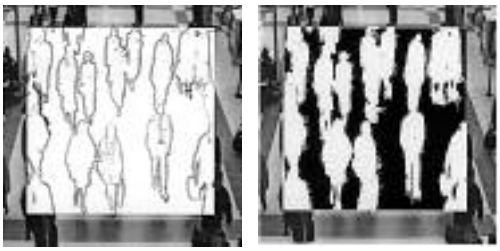
Initially, one camera and one screen and one observer
then
Many cameras, less screens and few observers
then
Video recording added + colour + PTZ cameras

Increased need for and use of automation and image processing methods

Need to retain recordings and make available for search and for use as evidence in legal processes

Huge multi-camera systems capable of on-line expansion and continuous availability **('24/7')**

Estimating Crowd Density



(a) **(b)**

Pedestrian extraction from crowd-scene

(a) 'edges' of pedestrians **(b) area of pedestrians**

Automatic Crowd-density Estimation (in London station)

'dots' indicate density above a set threshold

Estimating Crowd Flow

Polar velocity plot derived from flow estimate

Automatic Crowd-flow Estimation (in London rail-station)

Lines indicate estimated direction of movement

'Incident detection' in public spaces

Now a high priority in many urban environments

e.g.

Overcrowding (dangerous)

Loitering (possible criminal intent)

Busking (unpopular with public if not licensed)

Begging (often unrelated to need and usually unwelcome)

Jumping ticket-barriers (loss of income to transport authority)

Unattended bags (potential terrorist bombs)

Entering forbidden area (danger to individual, or threat to others)

Automatic identification of a 'suspect package'

'Backtracking' video recording to discover how it got there.

Tracking moving objects

Captured objects placed in a bounding box.

Problems with dynamic and static occlusions have to be overcome.

Adaptive background estimation is usually essential

Tracking

Pedestrians marked by bounding rectangles

(approaches marked by ■ and departures by ⊢)

Automatic detection of person standing in 'danger area'
(once having been 'tagged' his subsequent movement can also be tracked)

Galleries of cars and people associated with car-park usage.

Future developments and prospects ?

Increased automation of the capture, storage and retrieval of significant CCTV images

Automation of lip-reading, gesture analysis and recognition – with a telescopic camera, will be possible at long distances.

Integration with other forms of surveillance – audio, thermal, etc. and links to large data bases of personal data

Increased miniaturization leading to easier covert surveillance.

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Future developments and prospects ?

All vehicles and all persons will be able to be tracked and observed at almost all times without their direct knowledge

Who will control the cameras and who will have access to the data?

What might they use the information for?

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Thank you for your attention