Sensing with Camera Networks

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The Sensors

Digital Cameras

Webcams

Camera-phones
1MP- 8MP

Low Power Cameras

Surveillance Cameras

Cameras are on the network
Goal

Understand image and video data from camera networks to generate application specific metrics
Increase Resolution

- Use controlled motion to create a virtual hi-res view
- Methods to reduce motion delay

1 MP coverage 761 MP equivalent

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Motion Delay (s)  Log10(Coverage Gain)
Zoom  Motion Delay (s)

15000
```
Data Transformation

- Pixel values to people count
  - Indoor scene with people seated close together

Scene: Lunchtime

Background Extraction, Frame Differencing and Blobbing

People count and location

16kP CMOS imager on AVR
Research Challenges I

• Extracting semantics from camera data

  – **Hard Problems**: object identification, event detection, face recognition

  – **Moderately hard**: key feature point extraction, counting people, quality assessment, key frame extraction

  – **Tractable**: motion detection, change detection
Research Challenges II

• Aggregating across multiple sensors on the network
  – Content acquisition
    • All data is not live: cell-phone cameras, digital cameras
    • Communication and storage scaling
  – Combining transformed outputs from multiple cameras
    • Distributed calibration
  – Sensing Uncertainty
    • Application: Can I use data from this camera?
  – Privacy sensitive sharing
Discussion