

Sensing with Camera Networks

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The Sensors



Digital
Cameras



Webcams



Low Power
Cameras



Camera-phones
1MP- 8MP



Surveillance Cameras

Cameras are on the network

Goal

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

Increase Resolution

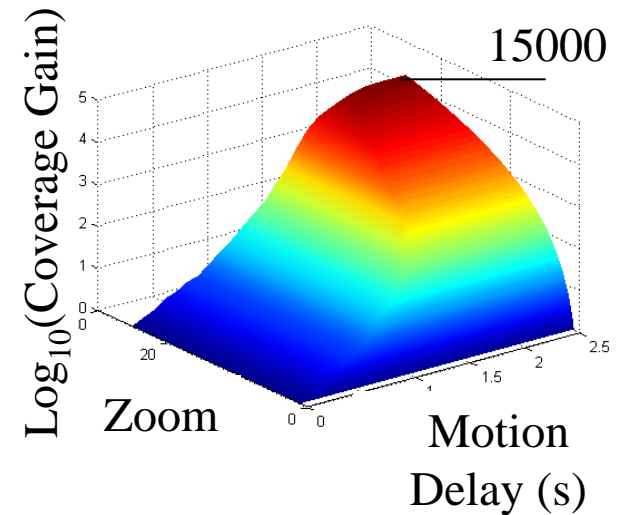
- Use controlled motion to create a virtual hi-res view
- Methods to reduce motion delay



1 MP coverage

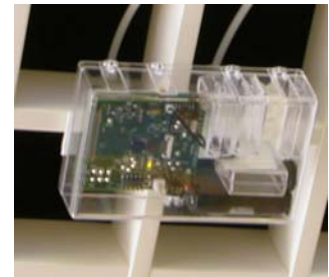


761 MP equivalent



Data Transformation

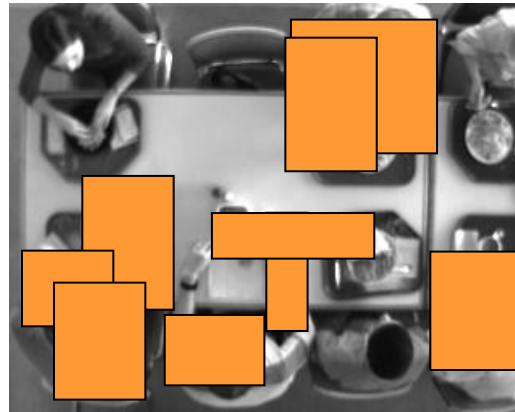
- Pixel values to people count
 - Indoor scene with people seated close together



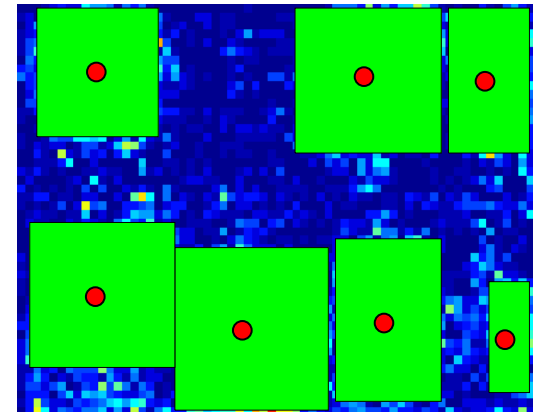
16kP CMOS imager on AVR



Scene: Lunchtime



Background Extraction,
Frame Differencing
and Blobbing



People count and
location

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