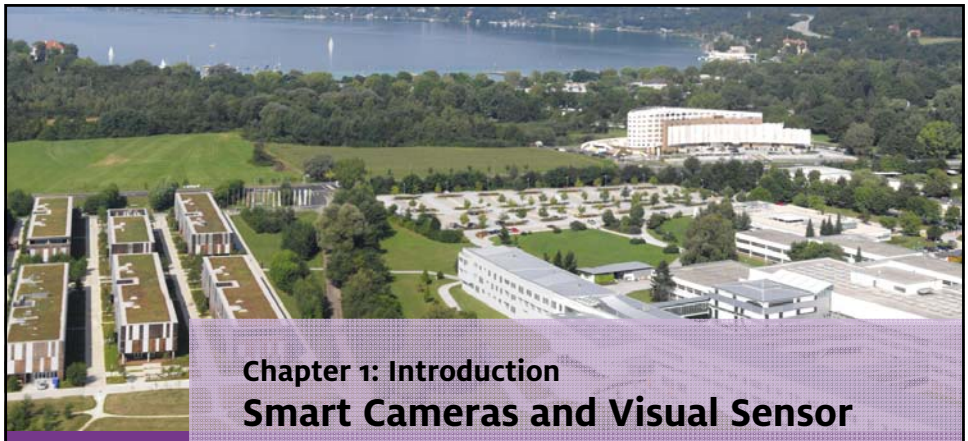

Chapter 1: Introduction

Smart Cameras and Visual Sensor Networks

ALPEN-ADRIA UNIVERSITÄT
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Course Information

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- Tutorial site

  Most recent course material is available at
  http://pervasive.uni-klu.ac.at/SCVSN_tutorial

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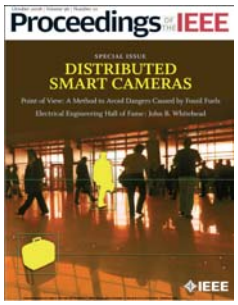
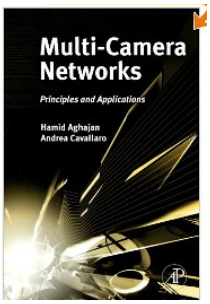
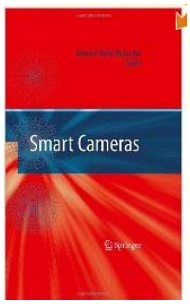
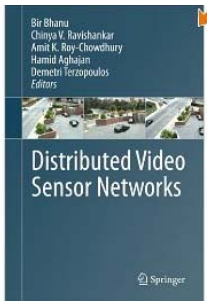
Selected Key Literature









- Check also references in Chapter 5

Dedicated Scientific Events

- ACM/IEEE Int. Conf. Distributed Smart Cameras (ICDSC)
  Aug 23-26, 2011 Ghent/Belgium www.icdsc.org
- IEEE Int. Conf. Information Processing in Sensor Networks (IPSN)
  Apr 12-14, 2011 Chicago www.cpsweek.org
- IEEE Workshop on Embedded Computer Vision (@CVPR)
  June 20, 2011 Colorado Springs www.cvpr2011.org
- IEEE Workshop on Camera Networks & Wide Scene Analysis
  June 20, 2011 Colorado Springs www.cvpr2011.org
- IEEE Conf. Advanced Video and Signal-based Surveillance (AVSS)
  Aug 30 – Sep 2, 2011 Klagenfurt/Austria www.avss2011.org
- …

Revolution in Cameras

- Ongoing technological advances in
  - lenses
  - image sensors
  - onboard processing
  - networking
- transform camera as box delivering images into spatially distributed that generate data and events
- Huge amount of visual information is processed in a network of resource-limited embedded nodes in dynamic environment

Principle of Smart Cameras

- Smart cameras combine
  - sensing,
  - processing and
  - communication

  in a single embedded device

- perform image and video analysis in real-time closely located at the sensor and transfer only the results
- collaborate with other cameras in the network

Differences to traditional Cameras

Traditional Camera

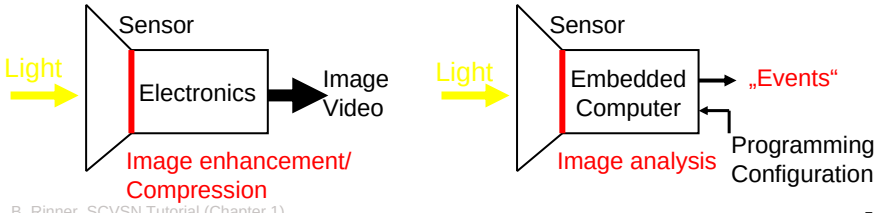
- Optics and sensor
- Electronics
- Interfaces

delivers data in form of (encoded) images and videos, respectively

Smart Camera

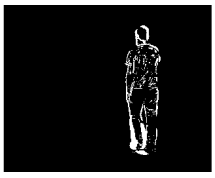
- Optics and sensor
- Onboard computer
- Interfaces

delivers abstracted image data and is configurable and programmable



SmartCams look for important things

- Examples for abstracted image data
  - compressed images and videos
  - features
  - detected events



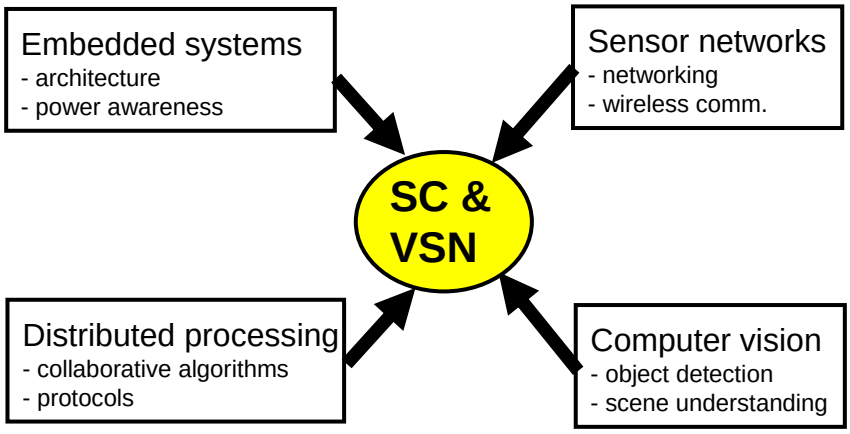
Smart Cameras collaborate

- Connect autonomous cameras in a network
  - exploit smart cameras' capabilities (eg. avoid raw data transfer)
  - relax centralized/hierarchical structure of MC networks
  - introduce dynamic configuration (structure and functionality)
- Distribution of sensing and processing imposes several challenges
  - camera selection and placement
  - calibration & synchronization
  - distribution of data and control
  - (ad-hoc) networking
- Form a visual sensor network

Advantages of Distributed SC

- Scalability
  - No central server as bottleneck
- Real-time capabilities
  - Short round-trip times; "active vision"
- Reliability
  - High degree of redundancy
- Energy and Data distribution
  - Reduced requirements for infrastructure; easier deployment
- Sensor coverage
  - Many (cheap) sensors closer at "target"; improved SNR
- …

Multidisciplinary field



New Applications

- From traditional cameras to pervasive smart visual sensor networks
  - distributed surveillance and security
  - vision-based interpretive applications
  - smart homes / smart buildings
  - ambient intelligence
  - office automation through occupancy sensing
  - human-computer interfaces
  - mobile and robotic networks
  - virtual reality systems
  - …

Differences to traditional WSN

- Sensing & processing directional, multi-dimensional data
  - Larger data volumes
  - More demanding algorithms
- More powerful computing & networking infrastructure
  - Camera nodes and wireless network
- More complex data distribution
  - Streaming as well as eventing
- Network coordination and control
  - Active camera control (eg. PTZ cameras)
  - Real-time operation
  - Sensor selection

Tutorial Agenda