

**Distributed Vision Processing
in Smart Camera Networks**

CVPR-07

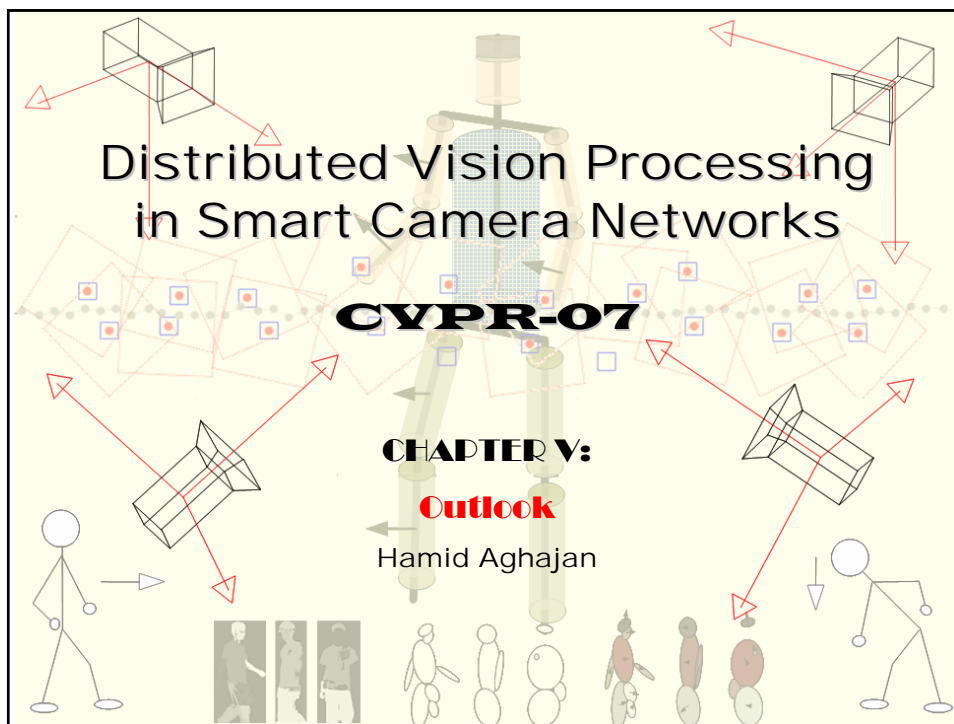
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Course Website – <http://wsn1.stanford.edu/cvpr07/index.php>

Outline

- I. Introduction
- II. Smart Camera Architectures
 1. Wireless Smart Camera
 2. Smart Camera for Active Vision
- III. Distributed Vision Algorithms
 1. Fusion Mechanisms
 2. Vision Network Algorithms
- IV. Requirements and Case Studies
- V. **Outlook**



Summary

❖ Smart camera networks:

- Enable novel user-centric applications:
 - Interpretive
 - Context aware
 - User centric
- Processing at source allows:
 - Image transfer avoidance
 - Scalable networks
 - Descriptive reports
- Privacy issues:
 - Awareness of user choices
 - In-node processing and image transfer avoidance
 - Model-based or silhouetted images

Summary

❖ Smart camera networks:

- Algorithm design is key in efficient use of computing resources
 - In-node feature extraction and opportunistic fusion
 - Use of key features in the data exchange mechanism
 - Model-based approach provides feedback / initial points for in-node processing

- Balance between in-node and collaborative processing
 - Communication cost
 - Latency
 - Processing complexities
 - Levels of data fusion

Towards Active Vision

- Active vision in feature extraction:
 - Use of key features instead of generic features (edges, motion, etc.)
 - Detection of prominent color / texture attributes
 - Use of spatiotemporal fusion results to learn key features

- Active vision in modules with processing load:
 - Instead of avoiding methods with high processing cost / latency:
 - Define what they should look for
 - Perform initialization to restrict searches

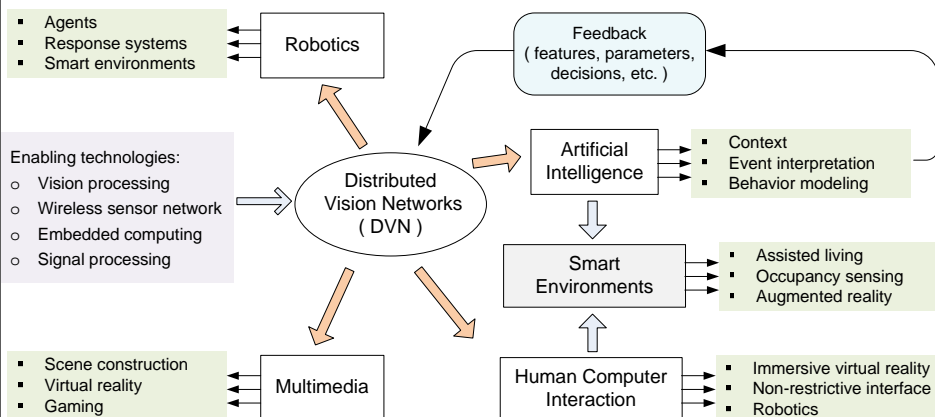
- Active vision in gesture analysis:
 - Use history of subject and semantic meanings of gestures to feedback what is important to detect

Opportunity Outlook

➤ Applications:

- Select best view of person of interest in real-time tracking
- Adjust presentation based on speaker's gestures
- Manipulate virtual world with free hand / finger gestures
- Detect accidental falls at home / elderly care
- Reconstruct face model from a few snapshots
- Build 3D models of objects
- Place people and their actions in virtual world

Opportunity Outlook



A Few Links

- Academic links:

- Distributed Vision Networks – Stanford Wireless Sensor Networks Lab (<http://WSNL.Stanford.Edu/>)
- Embedded System Group – Princeton (<http://www.princeton.edu/~wolf/embedded-group/smart-camera.htm>)
- SmartCam Group – Graz University of Technology (<http://www.iti.tugraz.at/smartcam>)
- Pervasive Computing Group – Klagenfurt University (<http://pervasive.uni-klu.ac.at>)
- SeeMos – LASMEA- CNRS Université Blaise Pascal (<http://www.lasmea.univ-bpclermont.fr/Personnel/Francois.Berry/seemos.htm>)

- Industrial links:

<http://www.vision-components.com/>
<http://www.visualinspections.it/>
<http://www.matrix-vision.com/>
<http://www.isense.com/>
<http://www.smartcamera.it/links.htm>

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**First ACM / IEEE International Conference on
Distributed Smart Cameras (ICDSC-07)**

**September 25-28, 2007
Vienna, Austria**

www.ICDSC.org

- Smart camera architectures
- Image sensing techniques for smart cameras
- Embedded vision programming
- Fusion of vision and other sensors
- Distributed vision processing algorithms
- Distributed appearance modeling
- Collaborative feature extraction, data and decision fusion
- Architectures and protocols for camera networks
- Wireless and mobile image sensor networks
- Position discovery and middleware applications
- Vision-based smart environments
- Surveillance and tracking applications
- Multi-view vision for human-computer interaction
- 3D scene analysis
- Distributed multimedia and gaming applications

Tutorials:

- [Tsuhan Chen](#), CMU, USA:
"Smart Camera Arrays"
- [Andrea Cavallaro](#), Queen Mary
University of London, UK:
"Smart Cameras: Algorithms,
Evaluation and Applications"
- [Bjoern Gottfried](#), University of
Bremen, Germany:
"Ambient Intelligence and the
Role of Spatial Reasoning:
Smart Environments with Smart
Cameras"
- More TBA