

**A Smart Sensor Network
for Object Detection,
Classification and Recognition**

Presented by Yi-Ta Wu

Agenda

- The Surveillance System
- Auto-Alarm Based Surveillance System
- Two Problems of Surveillance System
- Wireless Sensor Based Surveillance System
- Conclusions

The Surveillance System

- The surveillance system is a series of monitoring devices designed to check on environmental conditions.
- It is widely used nowadays to help a guard with consecutive sensing information.



Problem of Current Surveillance System

Exhaustion by long-term observation



Auto-Alarm Based Surveillance System



What is the Proper Resolution ?

Goal: Perform the face recognition

Problem: It is difficult to determine the proper resolution.



What is the Target Object?



First image frame



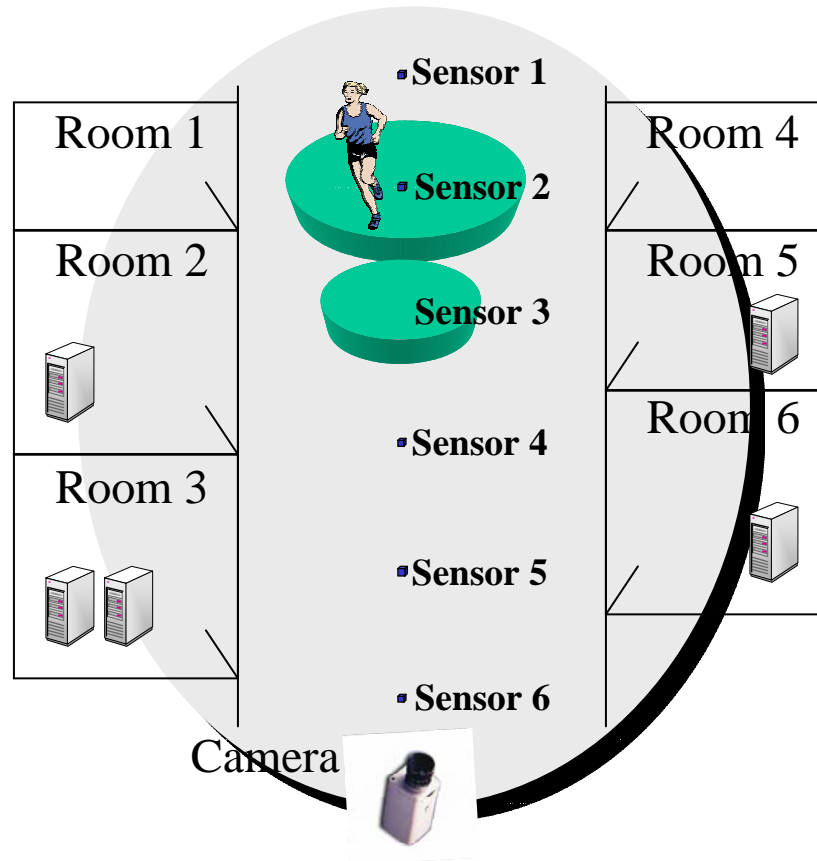
Second image frame



The difference of above two images



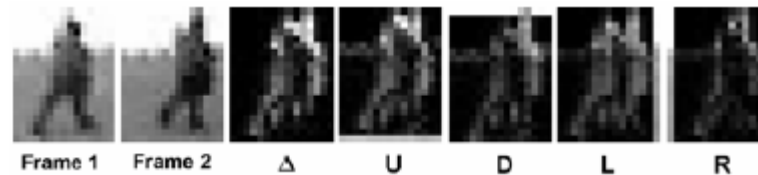
Wireless Sensor Based Surveillance System



$$X = \frac{\sum m_i x_i}{\sum m_i},$$
$$Y = \frac{\sum m_i y_i}{\sum m_i}$$

Object Classification, Human/Non-Human

P. Viola, M. Jones, and D. Snow, “Detecting Pedestrians Using Patterns of Motion and Appearance,” *Computer Vision*, 2003. Proceedings. Ninth IEEE International Conference on, pp. 734-741, Nice, France, Oct. 2003.



$$\Delta = \text{abs}(I_t - I_{t+1})$$

$$U = \text{abs}(I_t - I_{t+1} \uparrow)$$

$$L = \text{abs}(I_t - I_{t+1} \leftarrow)$$

$$R = \text{abs}(I_t - I_{t+1} \rightarrow)$$

$$D = \text{abs}(I_t - I_{t+1} \downarrow)$$

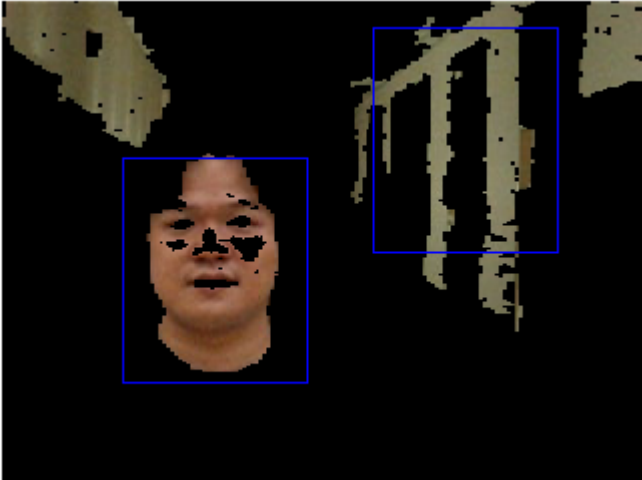
The Method for Efficiently Extracting Candidates



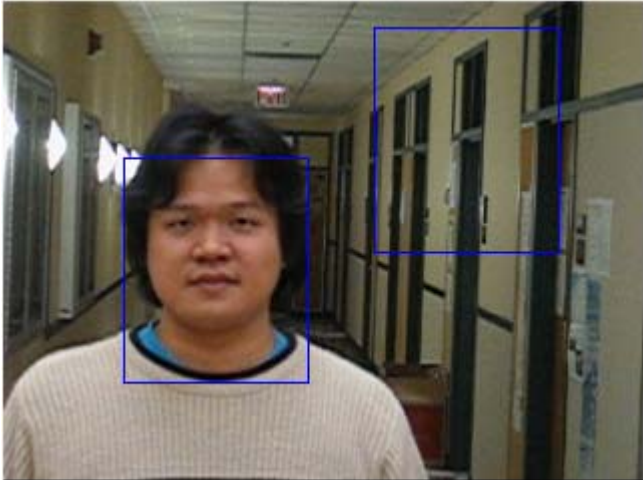
(a)



(b)



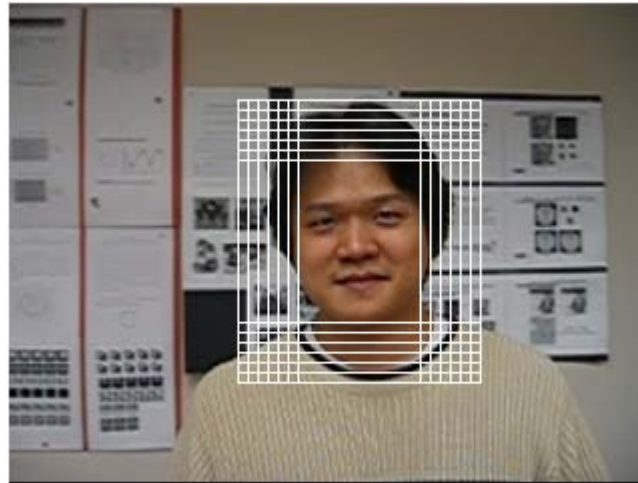
(c)



(d)

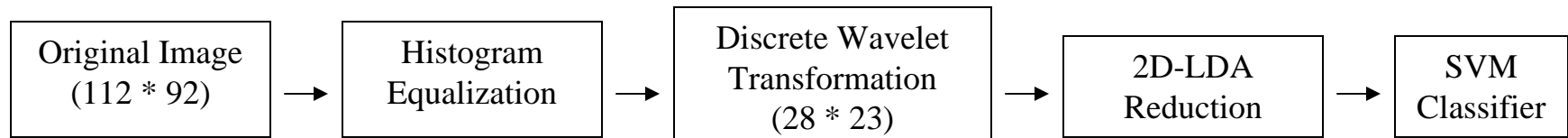
**Program
Demo**

Sets of Candidate for Face Recognition



Sets of Candidate for Face Recognition

The Flowchart of the experimental procedure



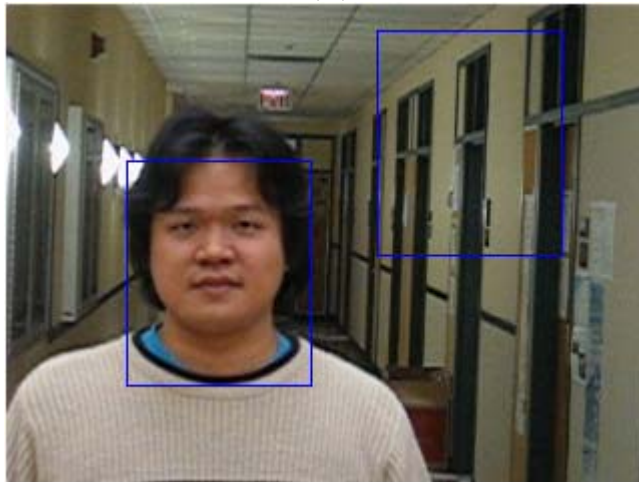
Experimental Results



(a)



(b)



(c)



(d)

Conclusions

- The traditional surveillance systems are performed either **periodically or manually** rotating the cameras, which may have the difficulties of **determining the proper object resolution**, and the **automatically detecting the moving object** when the camera is not fixed.
- Wireless Sensor based surveillance system:
 - ✓ The Wireless Sensors are utilized as the first layer guards to detect the coordinates of the unauthorized invasions
 - ✓ After identify the location of the invasions, the system will arrange cameras to catch the image features for object classification and recognition based on the hierarchical approach.

Question

