READINGS IN ADVANCED INTELLIMEDIA

Role of the new multimedia technologies in VIDEO SURVEILLANCE & MONITORING

INTRODUCTION – 1/3

- Video Surveillance & Monitoring have become a real issue nowadays
- Requires many people to handle it : people have to watch screens all day long
  - Very expensive
  - Risks of human errors
- Big amount of data stored

INTRODUCTION – 2/3

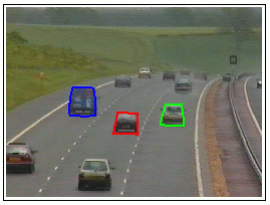
- Man is NOT perfect
  - Many screens to check at the same time (sometimes up to 50)
  - May not see all the events
  - May react badly or late and/or make mistake

→ Problems in case of emergency

  - Building on fire
  - Burglery
  - Health monitoring
- SOLUTIONS :
  - Hire more and more people → costly
  - Improve the existing systems thanks to new multimedia technologies

INTRODUCTION – 3/3

- New efficient multimedia technologies are being developped : how to use them to improve Video Surveillance & Monitoring ?



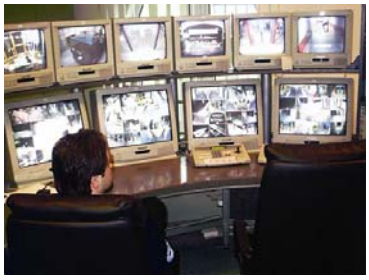
OUTLINE

- Three generations of surveillance systems
- Current technologies for Video Surveillance & Monitoring
- Help of new multimedia technologies
- Example : Tracking and Video Surveillance Activity Analysis
- Example : Fire Detection
- Conclusion

Surveillance systems

- The first generation of surveillance systems (1GSS, 1960-1980)
- The next generation of surveillance systems (2GSS, 1980-2000)
- Third generation of surveillance systems (3GSS, 2000-)

CURRENT TECHNOLOGIES – ½
Video Surveillance



CURRENT TECHNOLOGIES – 2/2
Monitoring

NEW MULTIMEDIA TECHNOLOGIES – 1/2

- Main idea : study the environment to detect if it has evolved
  - Background/Foreground
  - Motion Detection
  - Tracking
- Algorithms are becoming better and better and performances of such systems are improving

JM1

NEW MULTIMEDIA TECHNOLOGIES – 2/2


tracking1.flv


tracking2.flv

Slide 10

JM1 Face Detection, on en a vu assez la semaine passée

Jimmy Mattiuzzo; 2007-10-24

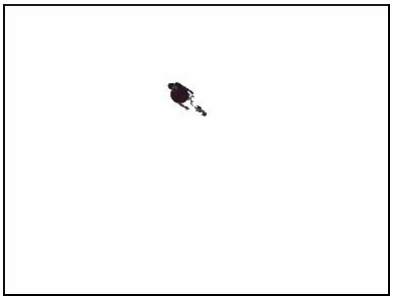
TRACKING AND VIDEO SURVEILLANCE ACTIVITY ANALYSIS – 1/6

- Video acquisition and pixel-level processing
- Object detection and movement tracking
- Action and event recognition

→ aims at comparing the behaviour of the tracked object with a « normal » behaviour

TRACKING AND VIDEO SURVEILLANCE ACTIVITY ANALYSIS – 2/6

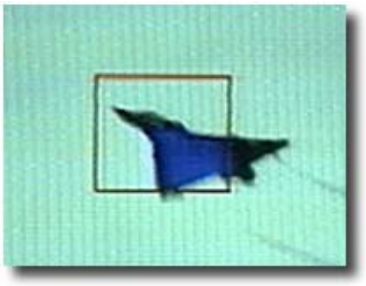
- Pixel-level processing
  - Never perfect (light changes, video noise,



- Use of background models to detect « new » objects

TRACKING AND VIDEO SURVEILLANCE ACTIVITY ANALYSIS – 3/6

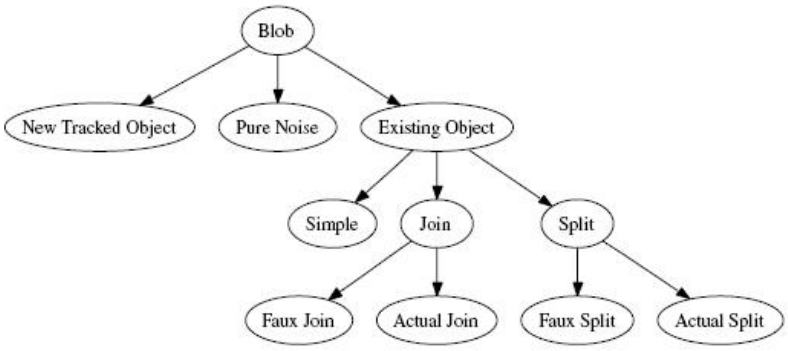
- Use of « blobs »



- Frame by frame tracking is not efficient enough (is it noise or a new object ?)

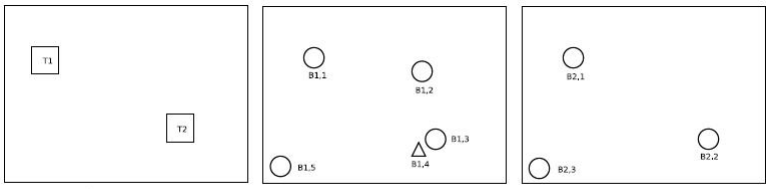
TRACKING AND VIDEO SURVEILLANCE ACTIVITY ANALYSIS – 4/6

- Blob classification types



TRACKING AND VIDEO SURVEILLANCE ACTIVITY ANALYSIS – 5/6

- Frame analysis



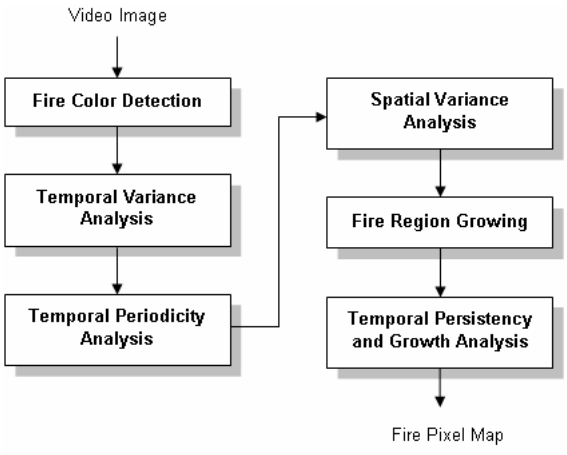
Previous Frame | Current Frame | Future Frame

TRACKING AND VIDEO SURVEILLANCE ACTIVITY ANALYSIS – 5/6

- Comparison with « normal behaviour » of the tracked object with a database of « known » behaviours
  - Behaviour of the already known objects (way to the exit door, for instance)
  - Behaviour of the new tracked object
- Main issue → The system must be trained to « understand » the different behaviours…

FIRE DETECTION – 1/6

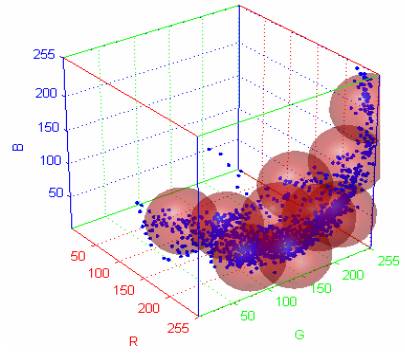
- fire detection scheme consists of six steps



FIRE DETECTION – 2/6

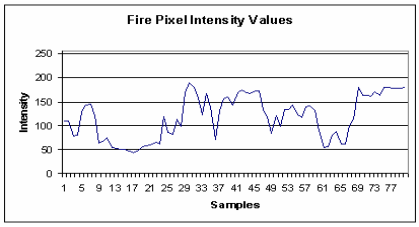
- Color Detection
  - Generally fire regions in video images have similar colors

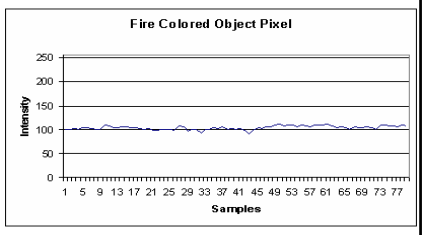
Sample fire color cloud in RGB space and Gaussian distribution spheres



FIRE DETECTION – 3/6

- Temporal Variance Analysis
  - Color alone is not sufficient to categorize a pixel as part of fire
  - The the flicker of fire causes the pixel intensity values in fire region to fluctuate in time





FIRE DETECTION – 4/6

- Temporal Periodicity Analysis
  - If the background scene is fire colored, and an object moves in front of it, this could fail
  - Some of the pixels will be classified as fire for short periods of time
  - We look at the oscillatory behavior of a pixel over a small window of time
  - We calculate the frequency of oscillation
  - For true fire pixels frequency is greater than k3 Hz, where k3 is an experimentally determined constant

FIRE DETECTION – 5/6

- Spatial Variance Analysis
  - Another characteristic of fire regions is that they exhibit larger spatial variance compared to fire colored ordinary objects

A true fire region
Variance = 1598

A fire colored object region
Variance = 397

FIRE DETECTION – 6/6

- Fire Region Growing
  - For a pixel detected as fire, we check its neighboring pixels' values with a smaller threshold and for pixels that pass this check, we set the corresponding entry in the pixel map as fire
- Temporal Persistency and Growth Checks
  - Some false fire regions can be detected for short periods of time due to the pixel level checks applied

CONCLUSION

- Promising technologies for Video Surveillance and Monitoring
- Improving « everyday »
- Much work is remaining…

REFERENCES

- Tracking and Video Surveillance activity analysis

  Michael Cheng – Binh Pham – Dian Tjondronegoro – Queensland University of Technology – Australia
- MOVING OBJECT DETECTION, TRACKING AND CLASSIFICATION FOR SMART VIDEO SURVEILLANCE

  Yi˘githan Dedeo˘glu August, 2004
- Flame Recognition in Video

Walter Phillips III Mubarak Shah Niels da Vitoria Lobo
- Any questions ?