

# Video Event Detection Techniques

Filip Nálepa, Michal Batko

# Outline

- Motivation
- IBM Smart Surveillance System
  - Background subtraction
  - Appearance-based tracking
- Our approach
  - Optical flow
- Comparison

# Motivation

- Automatic surveillance video analysis
- Real-time alarms for suspicious behaviour
- Situation awareness



# IBM Smart Surveillance System

- Real-time alerts
- Indexed event search
- Approach
  - Object detection – background subtraction
  - Object tracking – appearance-based
  - Object classification
  - Event detection

# Background Subtraction

- Moving objects detection
- Separation of foreground and background
- Background model
  - Adaptive
  - Multimodal

# Appearance-based Tracking

- Associating objects in successive frames
- Based on distance and areas
- Appearance model for each object – resolving splits and merges

# Object Classification

- Person or vehicle
- Object size
- Velocity direction
- Object location



# Our approach

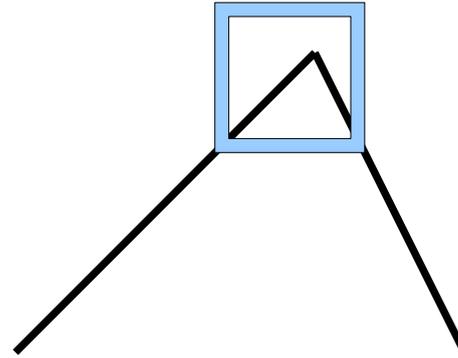
- Real-time event detection
- Approach
  - Object detection – face detector
  - Object tracking – optical flow
  - Event detection

# Optical Flow

- Motion vectors
- Assumptions
  - Brightness constancy
  - Small movements
- More assumptions needed
- Dense and sparse techniques

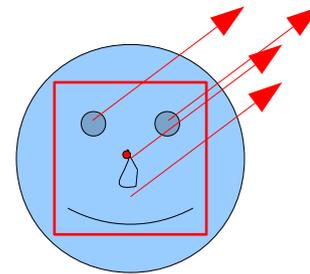
# Good Features to Track

- Corners
- Harris
- Shi and Tomasi



# Lucas-Kanade

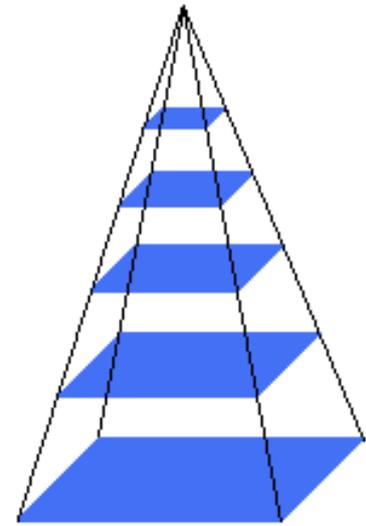
- Sparse optical flow technique
- Windows matching
- Assumptions
  - Brightness constancy
  - Small movements
  - Spatial coherence
- Works for corners



Spatial coherence

# Pyramidal Lucas-Kanade

- Large movements tracking
- Resolution levels
- Small and coherent motion violations mitigated



# Object Detection Comparison

- Face detector
  - Face detection only
  - No adaptation problems
  - 1 frame needed
  - No further classification
- Background subtraction
  - Any moving object detected
  - Adaptation problems
  - More frames needed
  - Object classification needed

# Object Tracking Comparison

- Optical flow
  - Motion vectors computation
  - Tracked points
  - Points loss → object loss
  - Works on camera motion
- Background subtraction and appearance-based tracking
  - Objects associating
  - Entire image
  - Occlusion handling
  - Just static camera

# Object Classification Comparison

- Face detector
  - Face detection only
  - No configuration
- SSS approach
  - Multiple object types
  - Configuration needed

# Possible Combination

- Object detection – background subtraction
- Tracking – optical flow (+ appearance-based)
- Object classification – face detector and other object features

# Summary

- IBM Smart Surveillance System
  - Background subtraction
  - Appearance-based tracking
- Our approach
  - Face detector
  - Optical flow

**Thank you for your attention.**