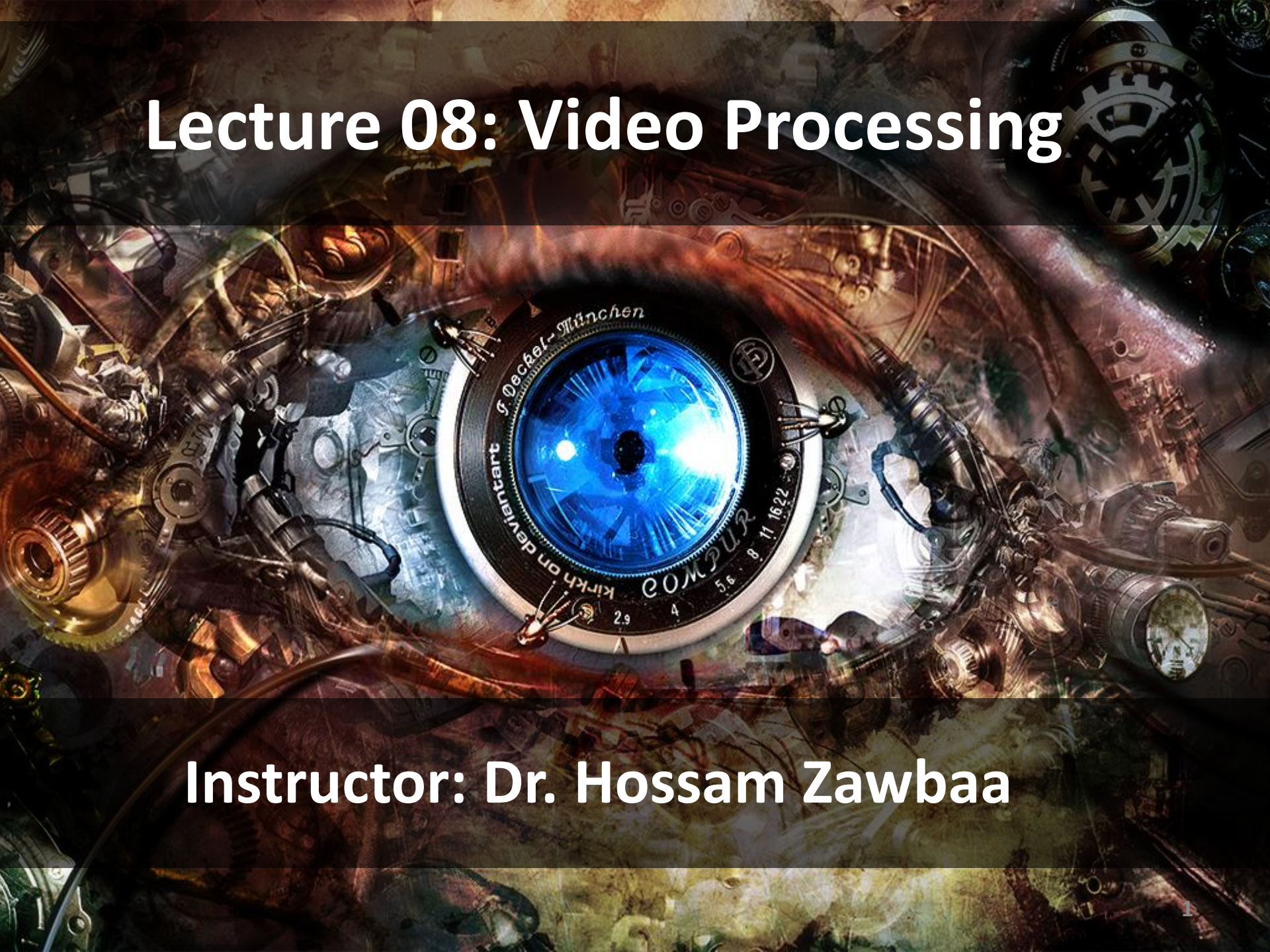
Lecture 08: Video Processing



Instructor: Dr. Hossam Zawbaa

Introduction

- ➔ *Thousands of motion pictures are produced around the world every year.*
- ➔ *3,000 television stations broadcasting for twenty-four hours a day produce eight million hours of video per year.*

Problems:

- Searching the video
- Retrieving the relevant information

Solution:

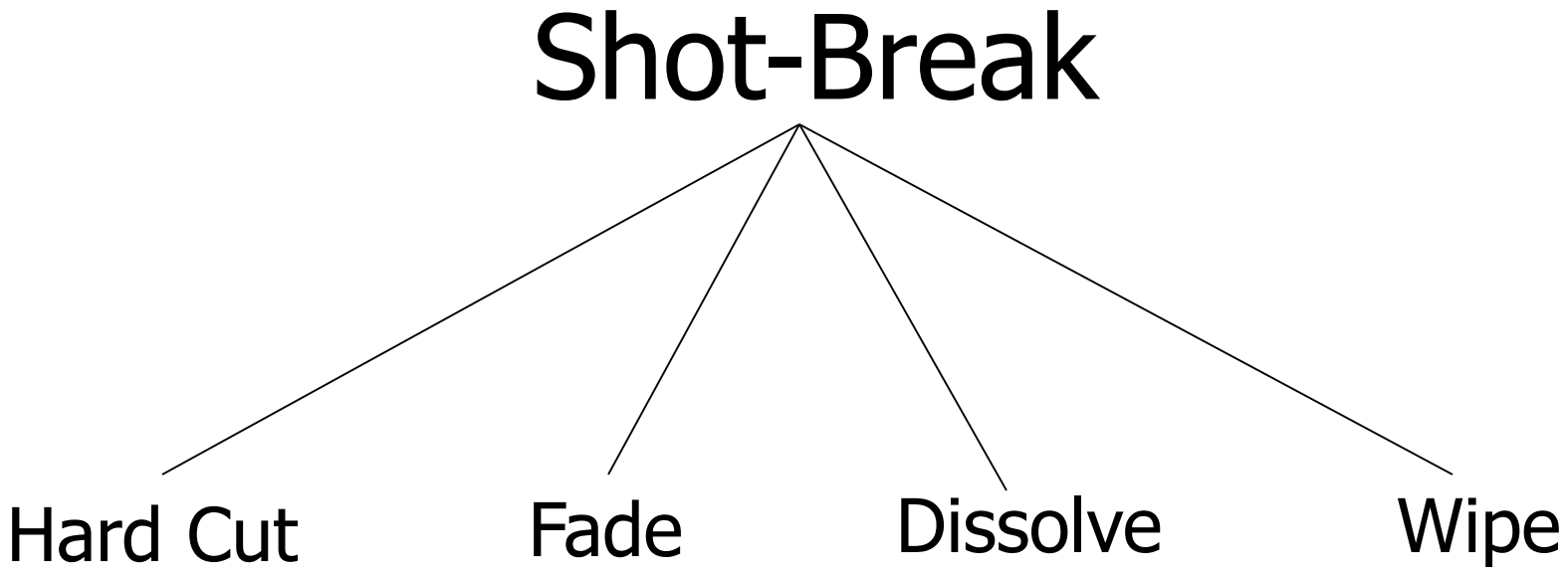
Break down the video into smaller manageable parts

called “Shots”

What is Shot?

- A sequence of frames captured by a single / multiple cameras in a continuous action.
- Most basic unit of video data.
- Shot-break is the transition from one shot to the next.

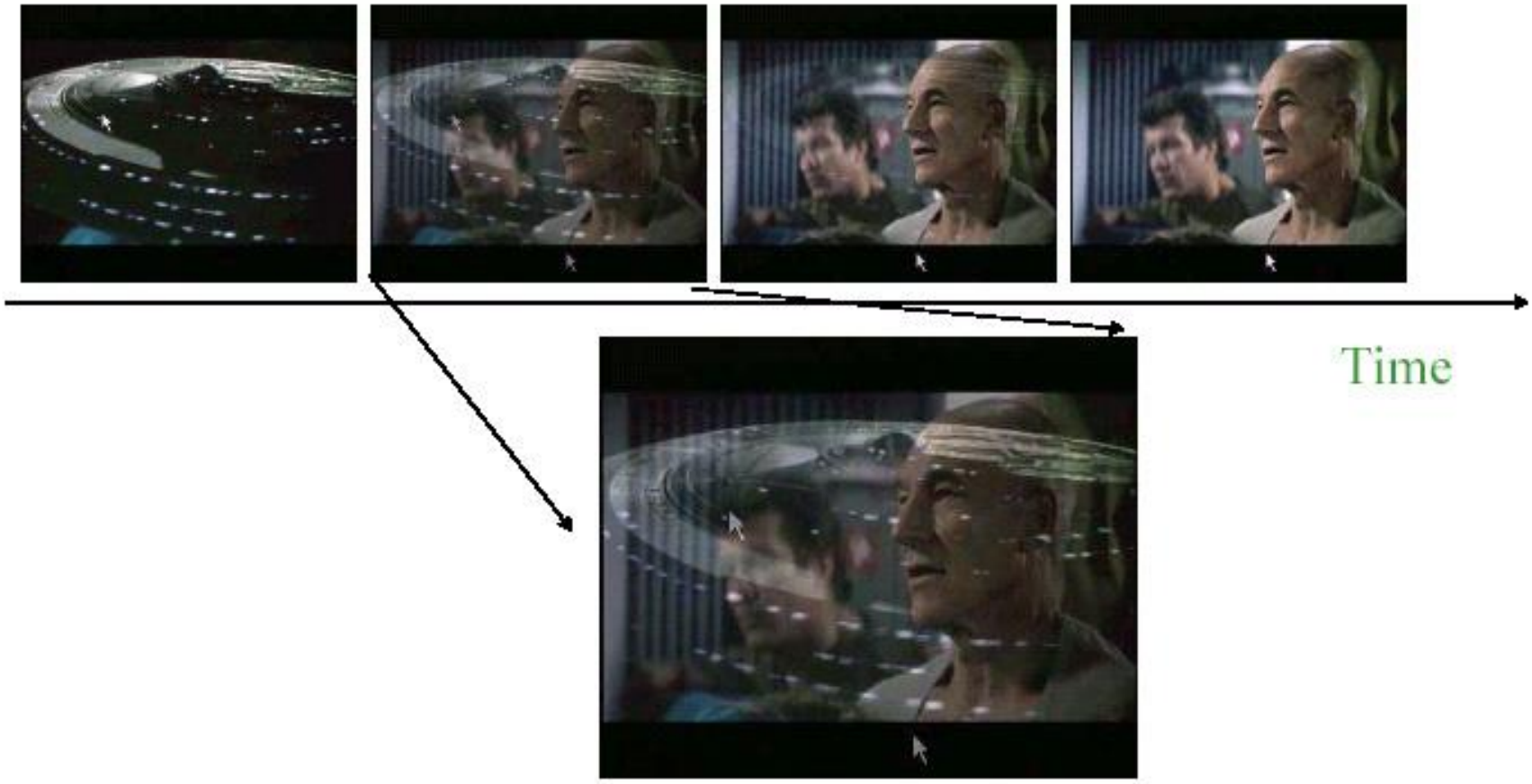
Types of Shot-Break



Hard Cut

Fade

Dissolve



Wipe

Shot Detection Methods

Goal:

To segment video into shots

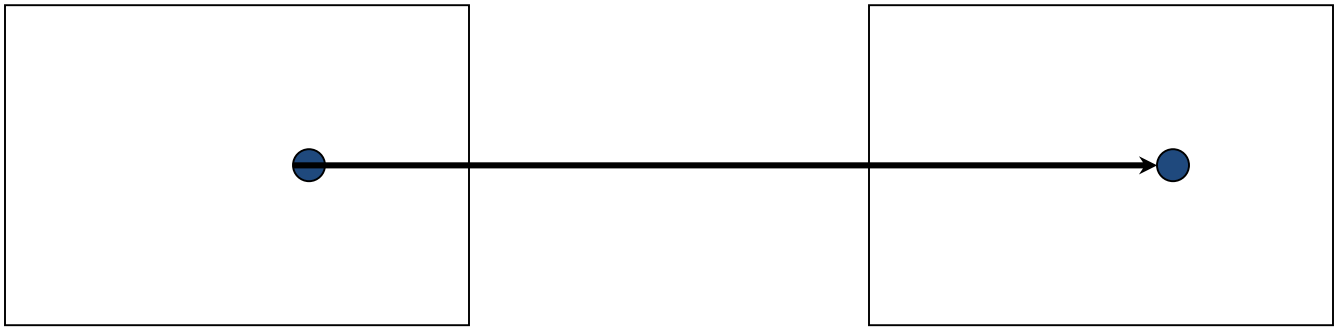
Two ways:

- Cluster the similar frames to identify shots
- Find the shots that differ and declare it as shot-break

Shot Detection Methods

- General Approaches
  - Pixel Comparison
  - Block-based approach
  - Histogram Comparison
  - Edge Change Ratio

Pixel Comparison

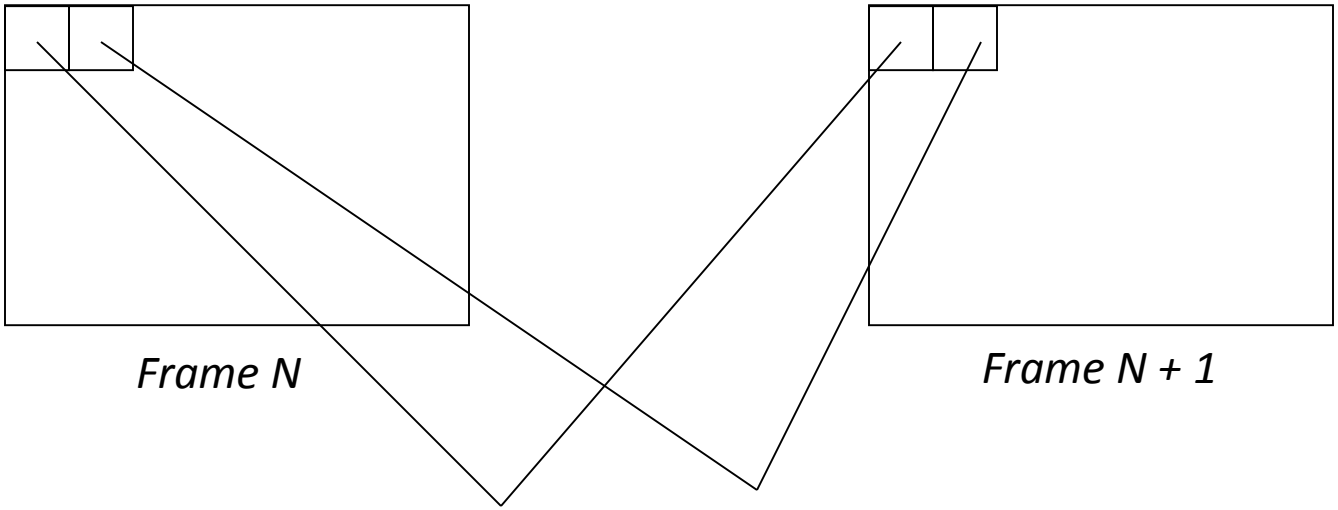


Frame N

Frame N + 1

$$D(i,i+1)= \frac{\sum_{x=1}^{X} \sum_{y=1}^{Y} | P_i(x,y) - P_{i+1}(x,y) |}{XY}$$

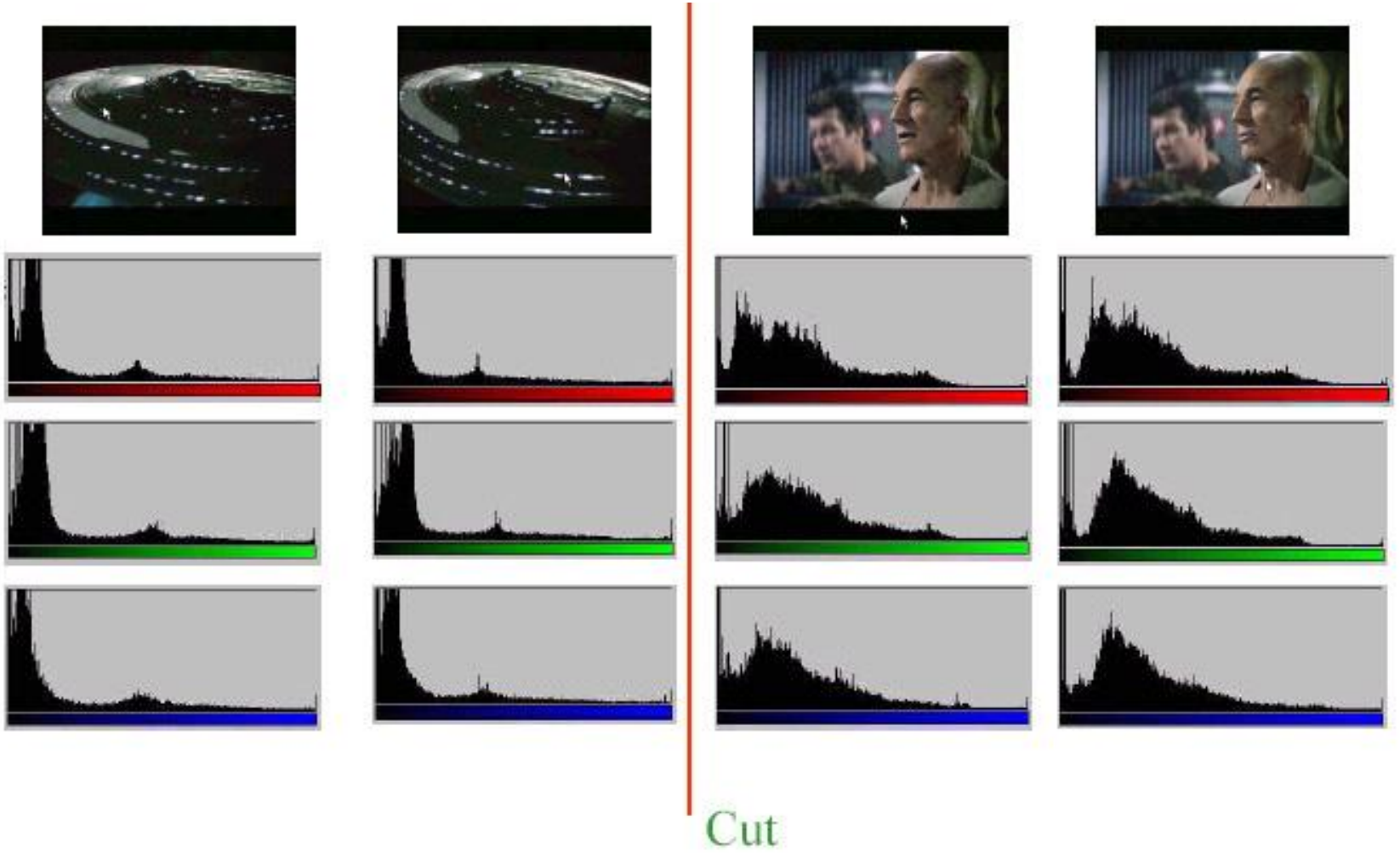
Block – Based Approach



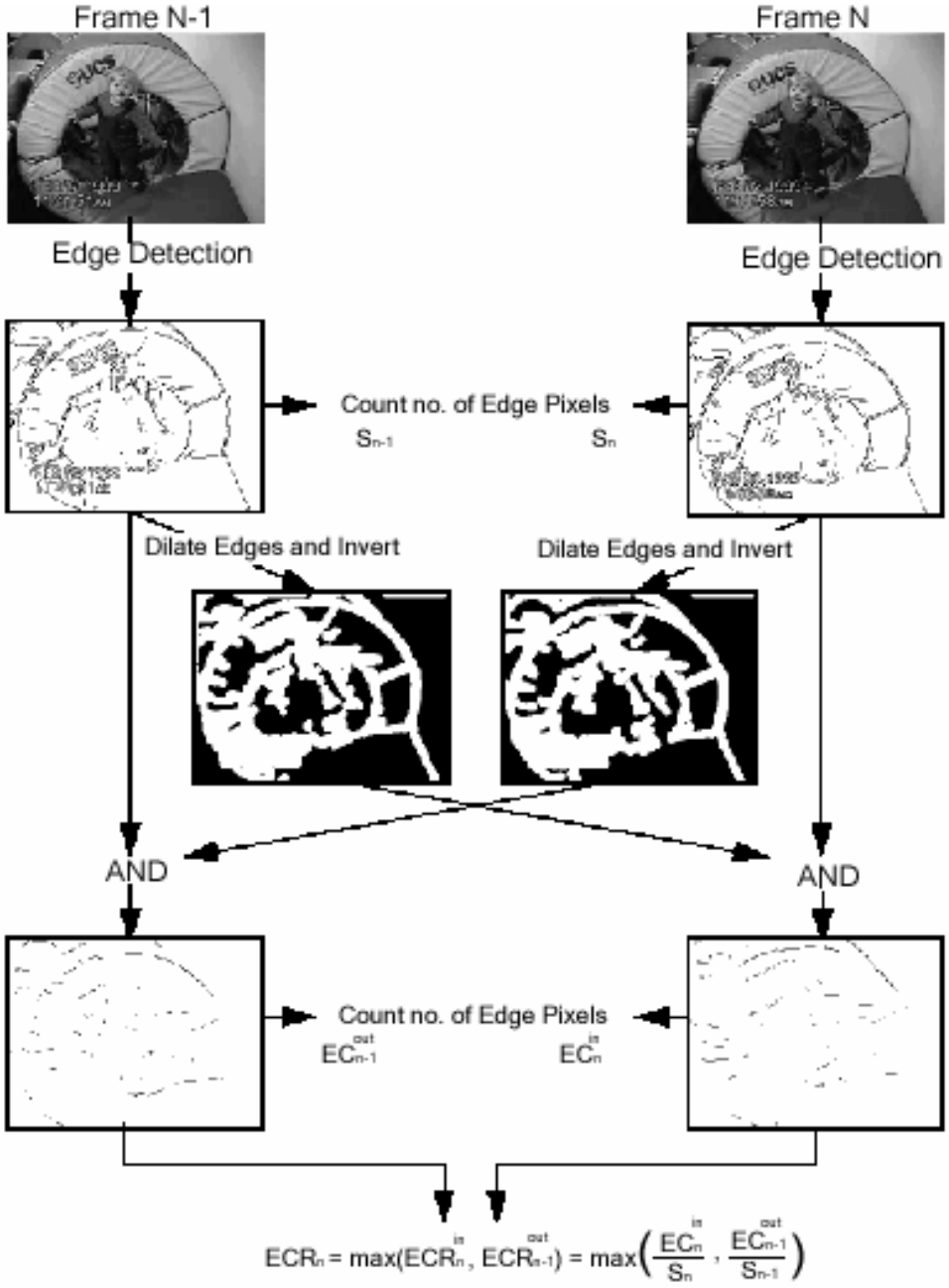
Compares statistics of the corresponding blocks

Counts the number of significantly different blocks

Histogram Comparison



Edge Change Ratio



Comparison

Method	Advantages	Disadvantages
Pixel-Comparison	Simple, easy to implement	Computationally heavy, Very sensitive to moving object or camera motion
Block based	Performs better than pixel	Can't identify dissolve, fade, fast moving objects
Histogram comparison	Performance is better Detects hard-cut, fade, wipe and dissolve	Fails if the two successive shots have same histogram. Can't distinguish fast object or camera motion
Edge Change Ratios	Detects hard-cut, fade, wipe and dissolve	Computationally heavy Fails when there is large amount of motion

Problems with previous approaches

➔ Can’t distinguish shot-breaks with

- Fast object motion or Camera motion
- Fast Illumination changes
- Reflections from glass, water
- Flash photography

➔ Fails to detect long and short gradual transitions

what is video surveillance?

- Present Implementations?
  - Human detection systems.
  - vehicle monitoring systems.
- Advantages of video surveillance?
  - Keep track of information video data for future use.
  - Helpful in identifying people in the crime scenes etc..
- Disadvantages of the present system?
  - It’s difficult to maintain heavy amount of raw video data.
  - Human interaction.
  - Require higher bandwidth for transmitting the visual data.

Video surveillance in the context of Computer Vision

- **Detection and tracking of moving objects** are the important tasks of the computer vision.
- The video surveillance systems not only need to track the moving objects but also **interpret their patterns of behaviours**. This means solving the information and integration the pattern.

- Advantages
  - Minimizes the user interaction.
  - Minimizes the cost and time.

Need for Traffic Monitoring

- To reduce the traffic congestion on highways
- Reduce the road accidents
- Identifying suspicious vehicles. Etc..,

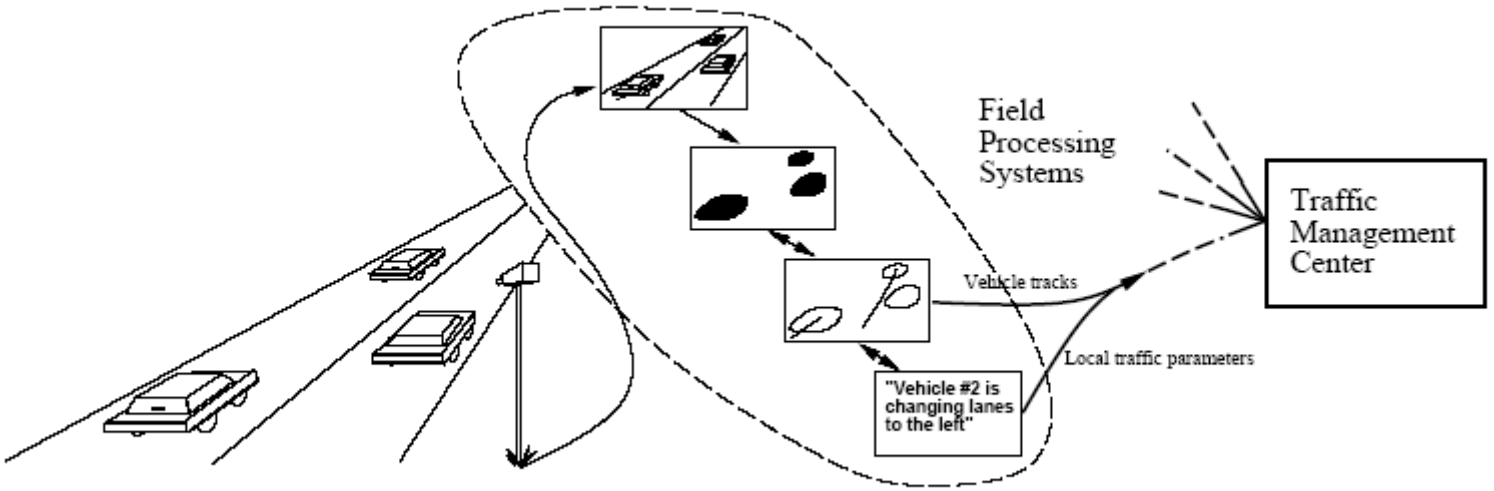
Traffic Monitoring in Computer Vision

- **The seeking for better traffic information, an increasing reliance on traffic surveillance has resulted in a better vehicle detection.**

- **Taking some intelligent actions based on the conditions.**

- Traffic scene analysis in 3 categories:
  - A **vehicle detection and counting** system.
  - **Congestion monitoring** and traffic scene analysis.
  - **Vehicle classification and tracking systems** which involve much more detailed scene traffic analysis.

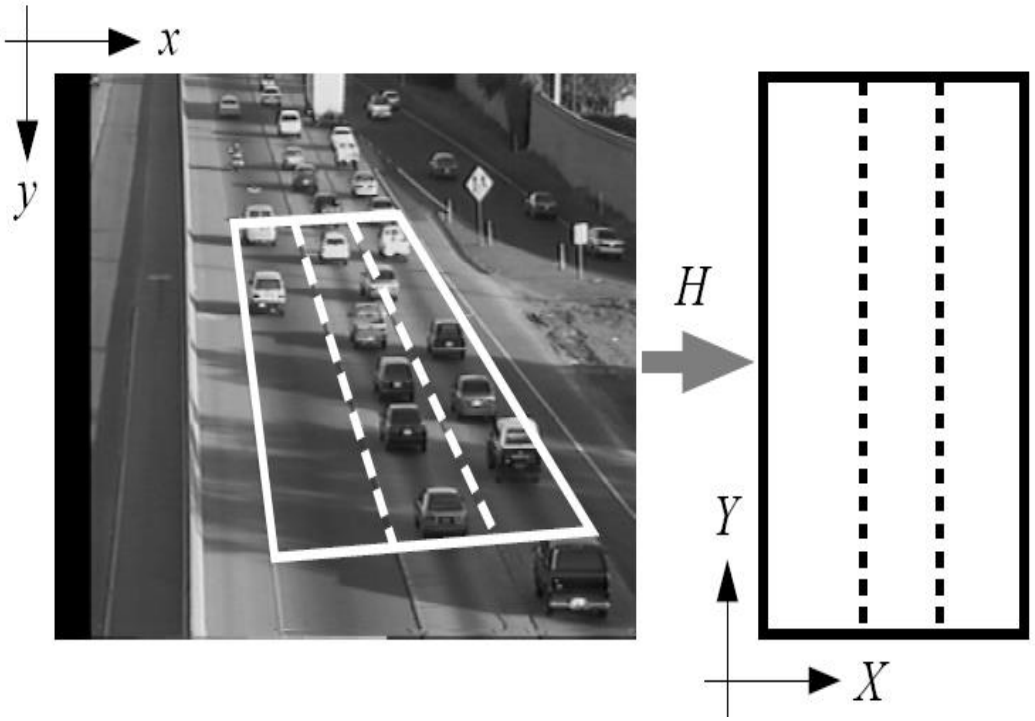
A Traffic Monitoring System



A real time traffic monitoring system

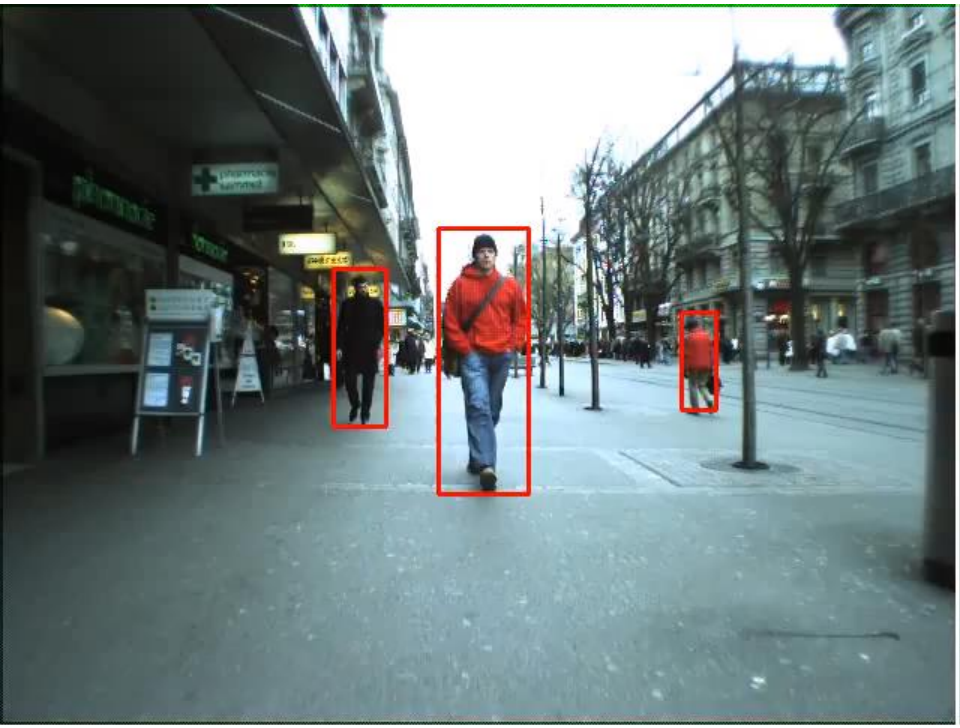
Feature based tracking algorithm

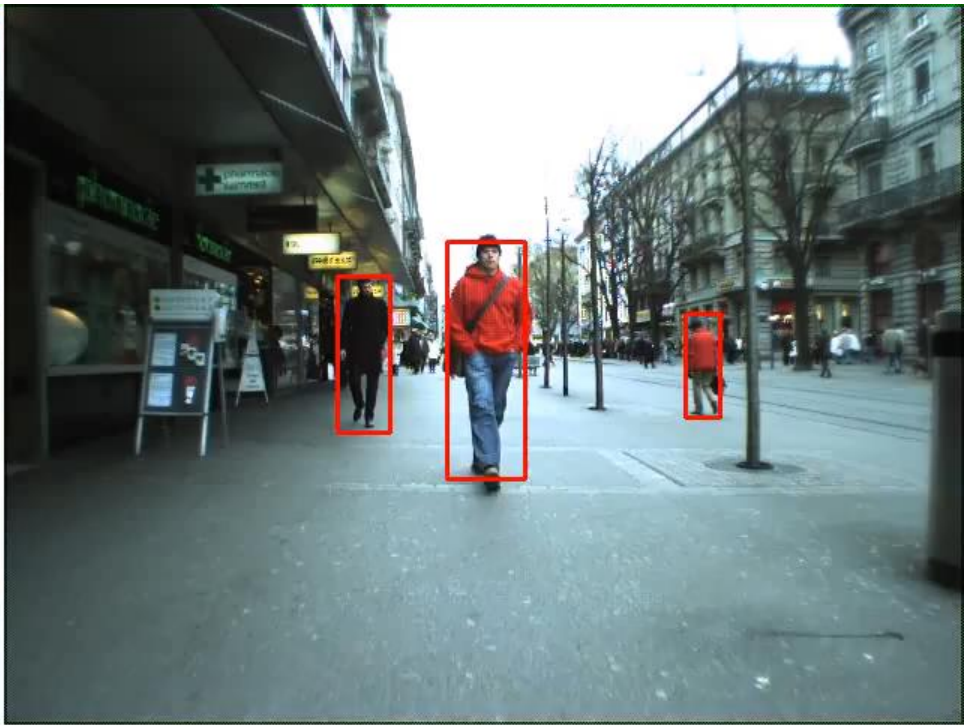
- Camera calibration
- Feature detection
- Vehicle tracking
- Feature grouping



Benjamin Coifman, Jitendra Malik, David Beymer

Pedestrian Detection





LatSVM-V2

LatSVM-V2+Our

False positive detected by LatSVM-V2, but not ours

True positives detected by ours but not LatSVM-V2