

ARAVIND  
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## Lecture 24 Video Processing

Muybridge Experiment:

Viewing photos one after another really fast

Video has a set of frames captured in a timely manner. So we need a buffering mechanism

Capture → Isolate → Store

CCD vs CMOS

↳ Uses 'rolling shutter'

↳ Exposed line by line rather than at once

↳ Leads to issues [capturing diff portions at diff time]

Importance of motion

→ HVS routinely perceives & interprets motion

→ Functional MRI

→ By measuring increase in blood flow to local vasculature

→ Gait-based biomechanics

→ Characterising based on walking heat

Camera Motion

→ Difficult when camera is also moving

→ Main idea is optical flow

Optical flow field measures the displacement

→ Capture how intensity has changed

→ Uses:

↳ Focus on compression where there's lot of motion

↳ Temporal Redundancy

Background Subtraction

Identify foregrounds in image

Widely used in:

→ Traffic monitoring

→ Human-action recognition

→ Object tracking

→ HCI

Requirements

→ Handle sudden illumination changes

→ High freq. repetitive motion in bg

→ Long term scene changes

Simple Approach:

→ Estimate bg at time  $t$

→ Subtract estimate bg from inp frame

→ Apply threshold to absolute diff to get mask

Frame differencing

$$B(x, y, t) = I(x, y, t-1)$$

$$|I(x, y, t) - I(x, y, t-1)| > T_h$$

Mean filter:

$$B(x, y, t) = \frac{1}{n} \sum_{i=0}^{n-1} I(x, y, t-i)$$

$$|I(x, y, t) - \frac{1}{n} \sum_{i=0}^{n-1} I(x, y, t-i)| > \tau_h$$

Median filter

$$B(x, y, t) = \text{median} \{ I(x, y, t-i) \} \quad \text{where } i \in \{0, \dots, n-1\}$$

Advantages:

Easy to implement

pretty fast

Corresponding by models with constant

Disadvantages:

- Accuracy depends on object speed & frame rate
- Mean & Median have high & relatively high memory requirements

$$B(x, y, t) = (1-\alpha) B(x, y, t-1) + \alpha I(x, y, t)$$

→ Learning rate.

→ How much to retain  
&  
How much to  
consider current.

When  $\alpha = 0$ , takes previous only

↓  
Tunable  
parameters

	fast	slow
$\alpha_{low}$		✓
$\alpha_{high}$	✓	

Can make alpha adaptive as well

→ Threshold is a function of time → Disadvantage

Method based coding

Object based coding

- ↳ Attempt to replace blocks by objects
- ↳ Segmentation is difficult

Motion interpretation

- Scene change detection
- Cut, dissolve, wipe description
- Analyse each video segment