## Monitoring The Elderly

1. Fall detection
2. Monitoring Medicine intake
3. Inactivity Recognition (pass out watching TV)
4. Report states of confusion
5. Gait Analysis as a biomarker of neurodegenerative diseases
6. Instability in limb movements (shaking hands, head, etc.)
7. (not in home but similar) driving evaluation

## Computer Vision Tasks

1. Delineate the person in a video as opposed to furniture
   - Background Modeling
2. Gait Modeling
3. Action & Activity Recognition
   - Actions (atomic elements)
     - Grab something
     - Walking
     - Getting up
     - Sitting down
   - Activity (composed of actions)
     - Getting food from kitchen
     - Playing soccer

## Background Modeling

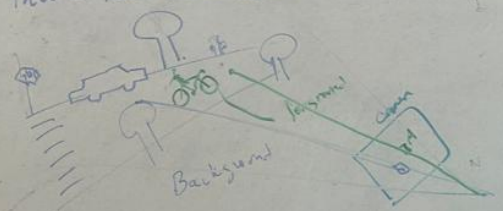
- Technique for segmenting ...

Basic idea: Model the ... examine ...

pixel is looking ...

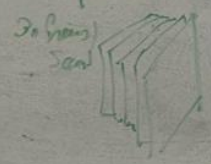
## Background Modeling

- Technique for segmenting out an area that is moving in a video



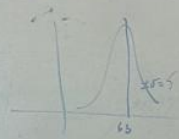

Basic idea: Model the intensity of the background at each pixel
examine deviations from it → foreground

pixel A is looking at paved road (Grey)




If pixel A reports 63 at t=1
65 at t=2
61 at t=3

because camera sensors are stochastic




Other sources of variation
- panning & slightly moving objects trees
- illumination changes sun / cloudy
- gradual changes day → night transition

Mixture of Gaussians Model

distribution $\sum_{i=1}^{M} \frac{1}{\sqrt{2\pi}\sigma_i} e^{-\frac{x-\mu_i}{2\sigma^2}}$

Work with a single Gaussian first

$G(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{x-\mu}{2\sigma^2}}$

Look at the last 30 frames

$\mu = \frac{I(x,y,1) + I(x,y,2) + \cdots + I(x,y,n)}{n}$

similarly for $\sigma$

If $|I| > k\sigma$ $k=3$ foreground

Multi-Gaussian Estimation
EM (Expectation Maximization)