Video-Based Moving Object Detection

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TARGET DETECTION BY IMAGE DIFFERENCING

If you don't know anything about the video other than frames are consecutive and video rate is fast compared to scene motion

[Morris '04]

Problems: Illumination changes, overlapping changes, scene vibrations

TARGET DETECTION BY BACKGROUND SUBTRACTION

If:
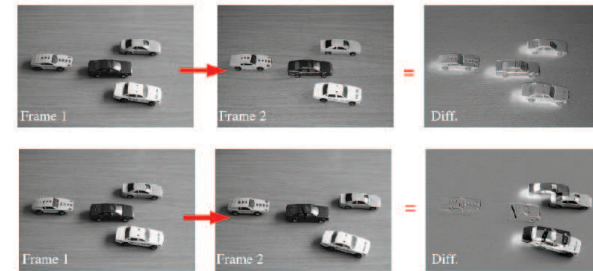
- Camera stationary with no autofocus/gain

- Illumination constant

- Largely isolated moving objects

use background subtraction

$$\mid current - background \mid > threshold$$

BACKGROUND SUBTRACTION CODE

```
% sub background & select pixels with a big difference
fore = (abs(Imwork(:,:,1)-Imback(:,:,1)) > 10) ...
   | (abs(Imwork(:,:,2) - Imback(:,:,2)) > 10) ...
   | (abs(Imwork(:,:,3) - Imback(:,:,3)) > 10);

% erode to remove small noise
foremm = bwmorph(fore,'erode',2);

% select largest object
labeled = bwlabel(foremm,4);
stats = regionprops(labeled,['basic']);
[N,W] = size(stats);
```
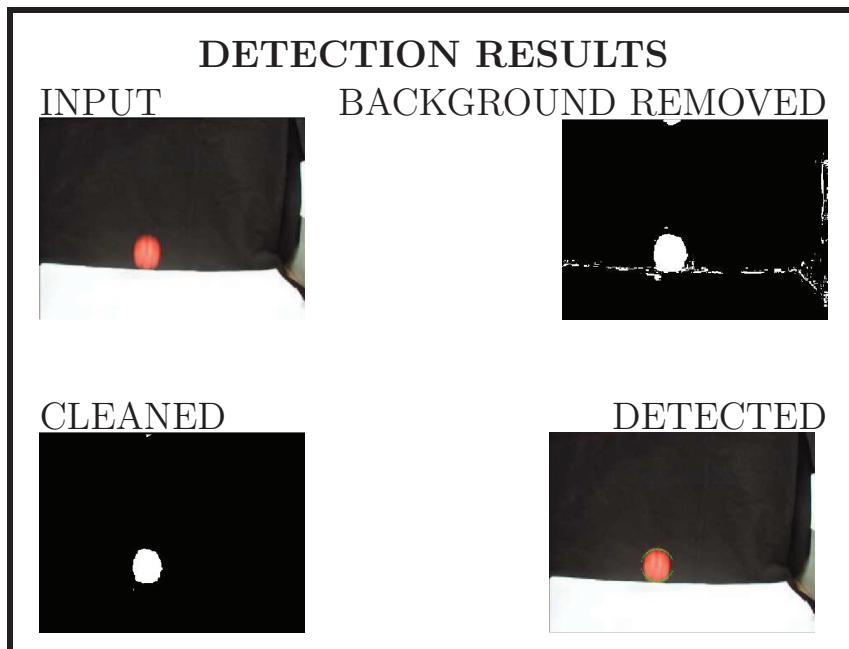
```
% do bubble sort (large to small) on regions in case
% there are more than 1
for i = 1 : N
  id(i) = i;     % aux variable to hold region id
end
for i = 1 : N-1
  for j = i+1 : N
    if stats(i).Area < stats(j).Area
      tmp = stats(i);
      stats(i) = stats(j);
      stats(j) = tmp;
      tmp = id(i);
      id(i) = id(j);
      id(j) = tmp;

% get center of mass and radius of largest
```

```
centroid = stats(1).Centroid;
radius = sqrt(stats(1).Area/pi);
```

DETECTION RESULTS

INPUT   BACKGROUND REMOVED

CLEANED   DETECTED

What's wrong?

- Moving ball blurred

- Noisy observations

- Potentially poor contrast

We can track of positions for ball in frames $0 \ldots N$

Would like ability to predict position in frame $N + 1$

So: incorporate motion model in tracker

What We Have Learned

1. Moving object detection by background subtraction or inter-frame differencing

2. Some problems that arise with the methods