Rapid Product Development

ME-617

IIT-Bombay

MOTION TRACKING USING WEBCAM

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Introduction

- **Real time motion tracking**: Detecting and tracking moving objects through a sequence of images

Motion tracking and recognition is one of the problems that the computer vision field struggles to accomplish. The ability to track and retain information about an object over long time periods has numerous applications from intelligence to traffic control to human-computer interaction.

- Useful for monitoring activity in public places.
- Key ingredient for further analysis of video sequences.
- Information about the location and identity of objects at different points in time.

Examples: 1) Detecting unusual object movements (e.g. someone being mugged at an ATM)

2) Coordinated activities (e.g. strategic plays in a football game).

Overview

- Finding how objects have moved in an image sequence
    1. Movement in space
    2. Movement in image plane
- Camera options:
    1. Static camera, moving object
    2. Moving camera, static object

Different ways of motion tracking

- Magnetic Field Interference
- Acoustic
- Lasers
- Electro-optical
- Mechanical

Basic real time tracking algorithm

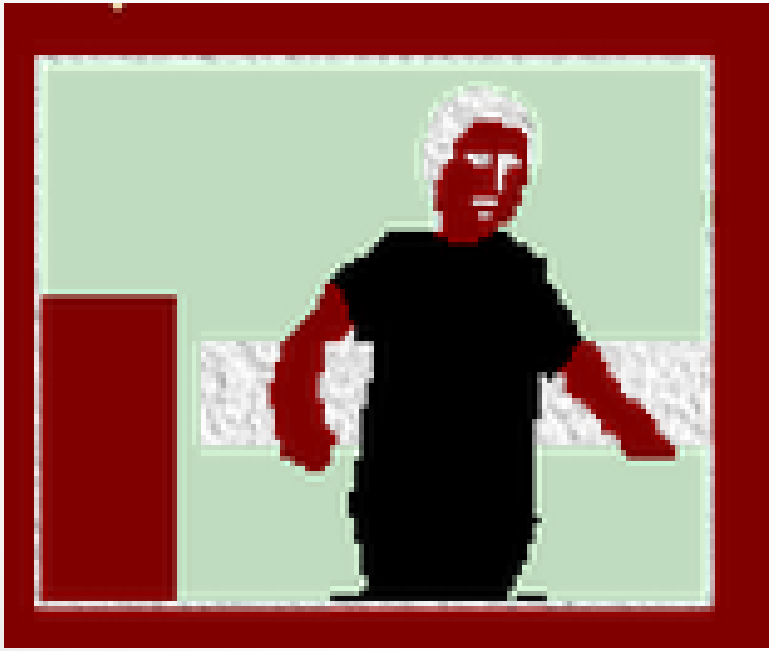
- The tracking algorithm consists of 2 major processing steps:

1. Frame subtraction

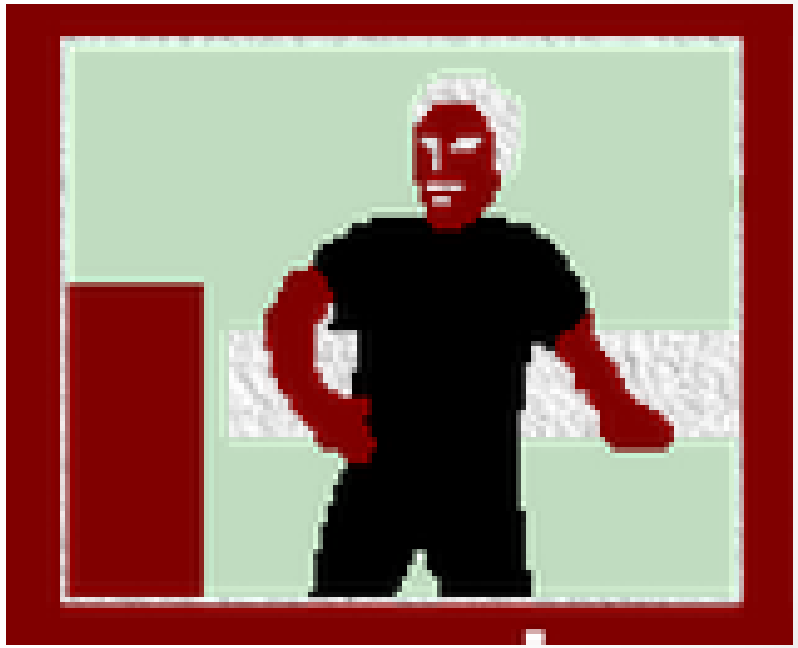
2. Thresholding

The processing steps for frame subtracting and thresholding are defined mathematically as follows.

The two adjacent image frames from the video sequence are denoted as $\mathbf{I_1(x,y)}$ and $\mathbf{I_2(x,y)}$. Assume that the frame rate is sufficiently high with respect to the velocity of the movement.



$\mathbf{I_1(x,y)}$



$\mathbf{I_2(x,y)}$

The difference between $\mathbf{I_1(x,y)}$ and $\mathbf{I_2(x,y)}$ should contain information about the location and incremental movements of the object.

Say, $\mathbf{I_d(x,y) = I_2(x,y) - I_1(x,y)}$

$\mathbf{I_d(x,y)}$

The frame subtraction also serves as an important function of eliminating the background and any stationary objects. The difference image is thresholded into a binary image according to

$$I_t(x,y) = 1 \quad \text{for} \quad I_d(x,y) > a$$
$$= 0 \quad \text{for} \quad I_d(x,y) < a$$

where a is a threshold that determines the trade-off between sensitivity and robustness of the tracking algorithm. For colour images the threshold is applied to the sum of the red, green, and blue values for each pixels.

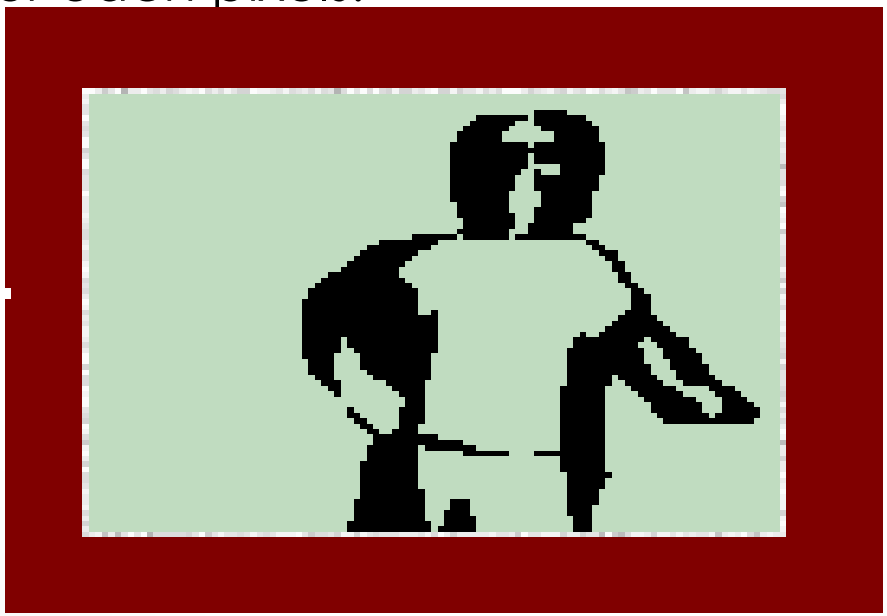


Image after thresholding

Code and Demos

Part A : Motion Tracking

Motion Tracking

Step 1: Capturing video stream using the webcam of laptop, and setting its parameters.

vid=videoinput(adapter name , id);

Step 2: Starting to capture the real time video

start(vid);

Motion Tracking

Step 3: Each time taking two consecutive frames and taking the difference between them to detect the edge motion.

getdata(vid,2);

flipdim(image , 1/2);

Step 4: The difference is in RGB format so first convert it in gray scale and then completely in black and white.

rgb2gray(image);

Im2bw(image , threshold);

Motion Tracking

Step 5: The images contains some noise which is required to be filtered.

```
medfilt2(image, [m,n]);
```

Step 6: Showing the processed image and again repeating the same in while loop to get a video output

```
imshow(image);
```

Motion Tracking Demo

Part B : Red/Green/Blue color tracking

Color Tracking

Step 1: Capturing video stream using the webcam of laptop, and setting its parameters.

vid=videoinput(adapter name , id);

Step 2: Starting to capture the real time video

start(vid);

Color Tracking

Step 3: Each time we take a frame to process and continue working in while loop

Step 4: Eliminate other colors and keep only one (R/G/B)

```
imsubtract(image(: ,: ,1), rgb2gray(image) );
```

for red color

Color Tracking

Step 5: Eliminate the noise

medfilt2(image, [m,n]);

Step 6: Convert the gray scale image to black and white

Im2bw(image, threshold);

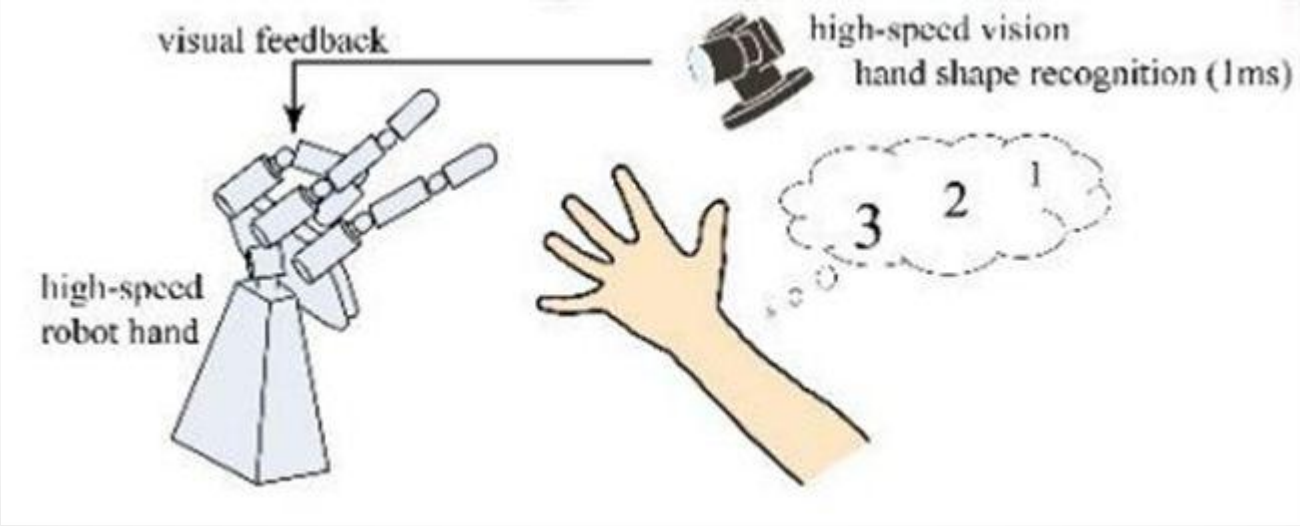
Step 7 : Showing the processed image and again continuing in while loop to get a video stream

imshow (image);

Color Tracking Demo

Future Scope

- Focusing on a particular object and tracking its moment the output can be given to a micro-controller which will move some physical object according to the tracked object.



- A special types of games are designed which tracks the motion of body of player and give feedback to the character in the game

References

- Help tool in matlab
- http://www.mathworks.in/help/imaq/basic-image-acquisition-procedure.html
- http://news.asiantown.net/r/24704/Tokyo-Robot-Unbeaten-at-Rock--Paper--Scissors-game
- http://www.dailymail.co.uk/sciencetech/article-1190240/You-controller-Microsoft-unveils-Xbox-360-device-banishes-joypad-puts-player-IN-game.html
- http://cres.usc.edu/pubdb_html/files_upload/464.pdf
- http://www.cs.cornell.edu/vision/wbell/tracker/
- http://www.cs.berkeley.edu/~flw/tracker/
- http://www.anc.ed.ac.uk/demos/tracker/