Pftracker Documentation

Release 1.0

Juan Reyes L.

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Pftracker is a video tracker program that uses particle filter tecnique in order to follow some user defined target frame to frame.

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CHAPTER

ONE

INSTALL

Dependencies: OpenCV Library (libcv-dev >= 2.1 and libhighgui-dev >= 2.1)

1. Decompress pftracker.tar.gz

```
tar -xvzf pftracker.tar.gz
```

2. Enter to the created directory

```
cd pftracker
```

3. Compile the source

```
make
```

This will generate an executable called pftracker in the bin directory.

CHAPTER

TWO

USE

Pftracker can adquire the images from two kinds of sources:

- A video file
- The computer webcam

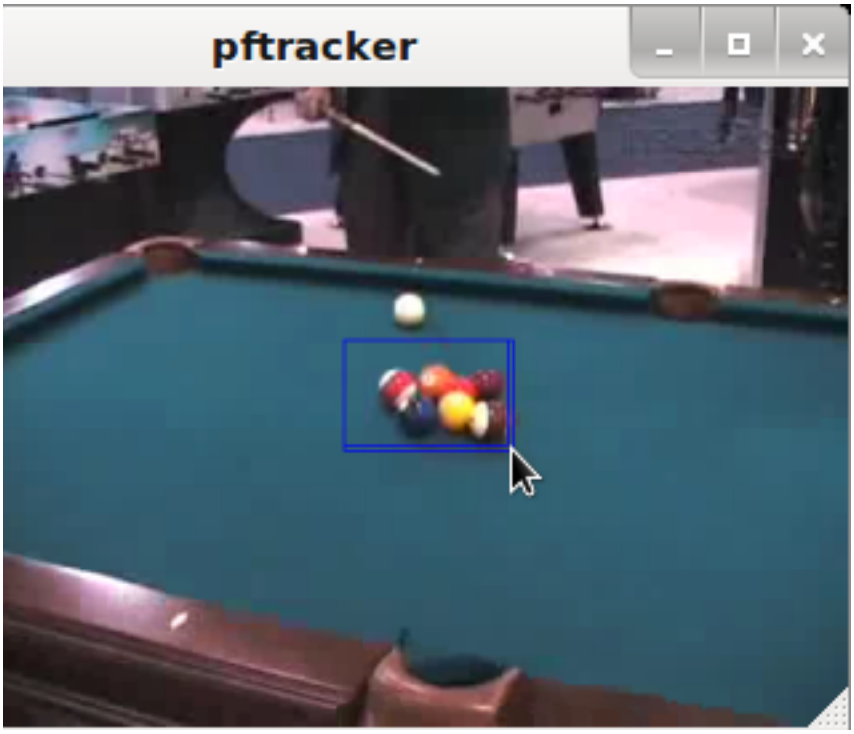
In order to get the image from a video file using default parameters:

```
./bin/pftracker -v somevideo.avi
```

In order to get image from the computer webcam using defaults parameters:

```
./bin/pftracker
```

After executing a window with the adquired images will be displayed at very slow motion until the user select with the mouse the region containing the tracking target. In order to do this selection mantain pressed the left button of the mouse next to the target and a rectangle will be displayed, the selection ends when the button is released.



After this the tracker will try to put a red rectangle over the desired target frame by frame :

Other options

Print help message:

```
./bin/pftracker -h
```

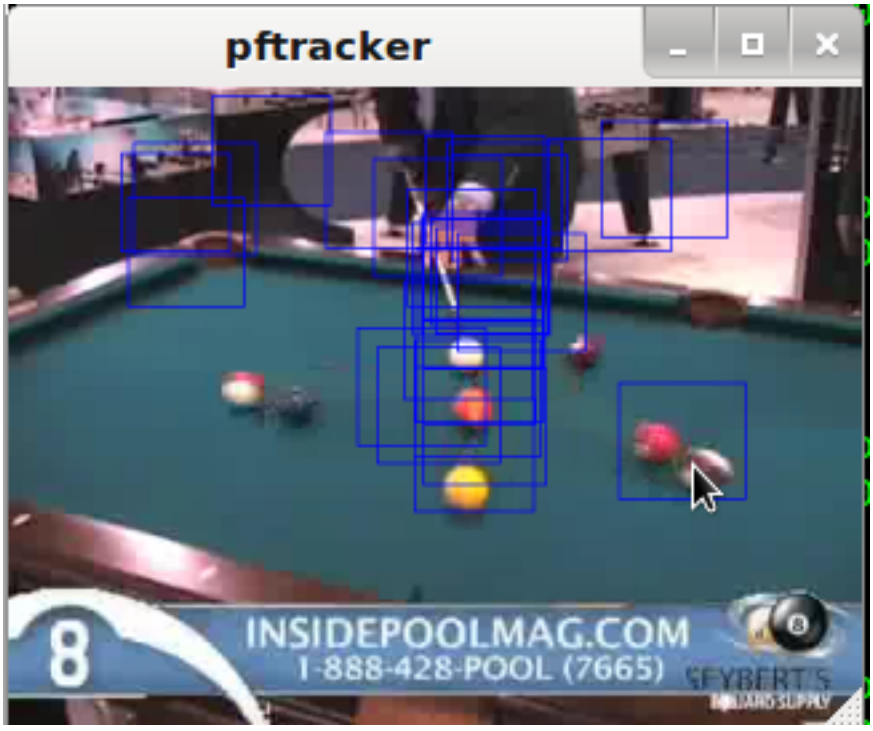
Printed messsage:

```
Usage:  ./bin/main [-p particlesNumber] [-v videoPath] [-sp] [-sd
particle_pos_sd] [-sds scale_factor_sd] [-h] The -sp option means show
particles The -h option prints this instructions
```

With the -sp option the rectangle of each particle is drawed:

```
./bin/pftracker -v video/shoot.mpg -sp
```

With the -p option is posible to specify the number used particles and with sd the standard deviation of the gaussian random number centered at zero that is added to the particle position at each frame. At more sd, more dispersed particles:



The -sds is the standard deviation of the gaussian random number centered at zero that is added to the particle scale at each frame.

The default values for this variables are:

standard deviation 15

scale standard deviation 0.1

number of particles 100

CHAPTER

THREE

HOW IT WORKS

- Pftracker has the following execution flow:

1. Adquire image.
2. When the user select the target, initialize particles.
3. Move particles.
4. Select best particle comparing the histogram of the target with histogram of the particle.
5. Resample particles (duplicating the first half better particles).

The histogram is normalized before comparison, the sum of all its values is equal to one.

The histogram comparison is made with the Bhattacharyya distance:

$$d(H_1, H_2) = \sqrt{1 - \frac{1}{\sqrt{\bar{H}_1 \bar{H}_2 N^2}} \sum_I \sqrt{H_1(I) \cdot H_2(I)}}$$

Where N is the number of histogram bins.

The movement of the particles is made in the following way:

```
particle.x = particle.x + gaussianNumberCenteredAtZero(SD)
```

```
particle.y = particle.y + gaussianNumberCenteredAtZero(SD)
```

The same procedure is made with the particle scale (the factor by which is multiplied the initial width and height selected by the user).

CHAPTER

FOUR

ABOUT

This program was developed by Juan Reyes L. (juan.reyes.lopez at gmail dot com) as final project for the course Stochastic Processes Simulation dicted by Héctor Allende at Universidad Técnica Federico Santa María (Chile).

Program based on Particle Filter Tracker by Rob Hess http://blogs.oregonstate.edu/hess/code/particles/

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