Smart Camera Project

Description

- **Motion-based multiple object tracking** uses background update and segmentation to detect objects. The assumption is that the camera if fixed, so everything that moves is foreground and what does not move is background
- Detection features are matched over time to create new tracks and update old ones
- If the camera moves, the background moves. The **motion-based multiple object tracking** will fail because of a sudden change in all pixels' Gaussian models. All tracks will be lost until the camera stops and some time passes for a new model of the background to be created
- **Particle filter tracker** is a single object tracking that does not assume a fixed camera. Random particles (locations) are used to collect measurements, assess the closeness of these measurements to a known model, and sample more where the measurements suggest the object is located
- The weakness of the **Particle filter tracker** is in needing to learn a known model. It needs a detection!
- Your job is to integrate both. Use the **motion-based multiple object tracker** to detect you standing in front of the camera, then once you have a detection (a model of yourself) pass it to the **particle filter tracker** to continue to track it under camera motion
- Use the center of the frame and your location in the scene to create the error signal. The difference between the two.
- Feed the error to a PID tracker to control motors that change where the camera is looking
- The camera will follow you

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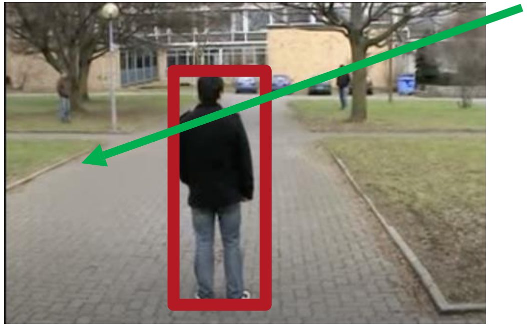
Note Camera is Moving

Model

Scene



Multiple Object Tracker

Finds the Object

Particle Filter Tracker
Tracks the Object

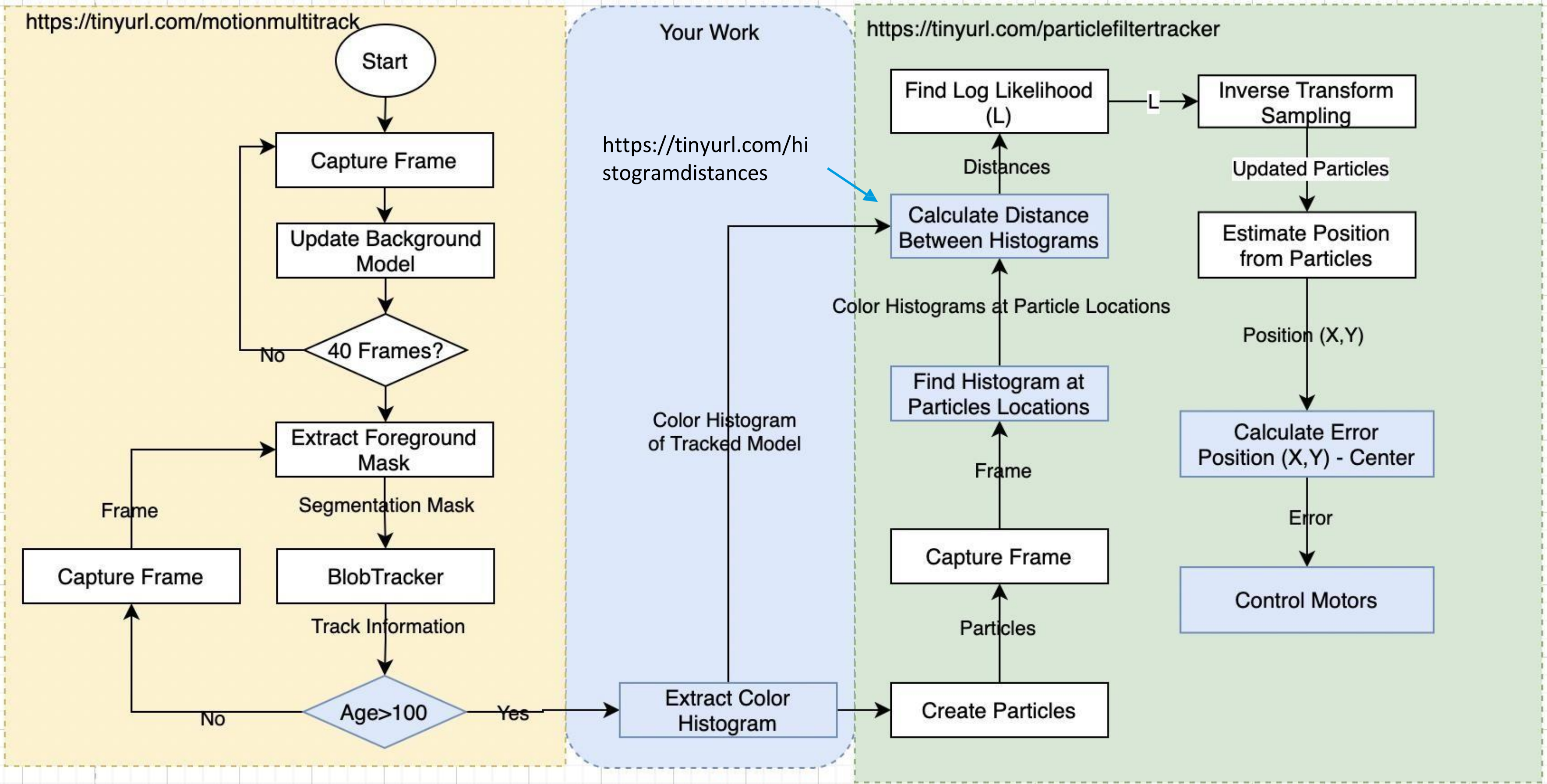
Controlling Servo Motors using Arduino and Matlab

https://www.mathworks.com/help/supportpkg/arduinoio/examples/control-servo-motors.html

Camera Pan Tilt Mount for Servo Motors

https://www.servocity.com/spt200-pan-tilt-kit/

What you need to do


https://tinyurl.com/motionmultitrack
Start
Capture Frame
Update Background Model
40 Frames?
No
Extract Foreground Mask
Segmentation Mask
Frame
Capture Frame
BlobTracker
Track Information
Age>100
No
Yes
Your Work
https://tinyurl.com/histogramdistances
Color Histogram of Tracked Model
Extract Color Histogram
https://tinyurl.com/particlefiltertracker
Find Log Likelihood (L)
L
Inverse Transform Sampling
Distances
Updated Particles
Calculate Distance Between Histograms
Estimate Position from Particles
Color Histograms at Particle Locations
Position (X,Y)
Find Histogram at Particles Locations
Calculate Error Position (X,Y) - Center
Frame
Error
Capture Frame
Control Motors
Particles
Create Particles

Rules and Deliverables

- You can work individually or in a team of two students
- The deliverables are a 10 minutes **presentation and demonstration** and a **project report**
- Project demos and presentations will take place during the last lecture. Project reports are due on the day of the last lecture. **The deadline is final.** No late submissions will be considered.

Submission

- The Matlab script used for developing and testing your algorithm
- The PDF of the Project Report
- Overleaf History Tracking report showing the contribution of each member
- Teams channel conversations (proof of collaboration)
- URL of your demonstration YouTube Link (Unlisted, Not for Children)