Person Following Robot using Selected Online Ada-Boosting with a Stereo Camera
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Introduction

- The robot follows the target (human) in real time in a dynamic environment. Problems addressed: Tracking and following behavior.
- Problem of Person Following: dynamic environments (target might be occluded, lighting variations, appearance changes, etc. see Figure 3)
- A novel algorithm Selected Online Ada-Boosting (SOAB) is proposed. On top of Online Ada-Boosting approach, depth is used as an additional tool in SOAB.
- The robot follows the target (human) in real time in a dynamic environment. Problems addressed: Tracking and following behavior.
- Problem of Person Following: dynamic environments (target might be occluded, lighting variations, appearance changes, etc. see Figure 3)

Approach

Data: CameraStream
- fetch left and right image from CameraStream;
- select target to track;
- calculate curDisp;
- preDisp ← curDisp;
- pre-train OAB;

while true do
  fetch left and right image from CameraStream;
  run OAB to extract a positive patch $I_p$;
  curDisp ← Mean($I_p$); $\gamma$)
  $R = \sum \{|I_p| | 0 \leq \gamma R \leq \beta \}$;
  if $R \geq \gamma$ then
    update the classifier;
  end
  preDisp ← curDisp;
end

Algorithm 1: SOAB

Navigation Module

- Linear and Angular Velocities are proportional to the disparity and the x-coordinate of the centroid.
- The robot always keeps the centroid of the target in the center of the image.
- Robot could run up-to speeds of 1.0 m/s.

Fig. 1. Linear and Angular Velocities as functions of disparity and x-coordinate of the centroid.

Stereo Dataset and Experimental Results

- Indoor Dataset (4 places) built at Lassonde Building at York University.
- Frame rate: 15fps, Resolution: 640 x 480
- Dataset covers different challenging situations as shown in Fig 3.

Fig. 3. Different Cases our approach (Selected Online Ada-Boosting) can handle. (a) standing side-by-side with same clothes. (b) Front crossing with same clothes. (c) appearance changed (e) picking a bag. (f) wearing a bag. (g) sitting. (h) squatting. (i) side facing. (k) illumination changes.

Fig. 4. Performance of our system in 4 different places (RMS error). (a) Hallway Sequence. (b) Multiple Crossings Sequence. (c) Same Clothes Crossing Sequence. (d) Lecture Hall Sequence.

Fig. 5. Red Box is tracking using original OAB algorithm. Yellow box is tracking using SOAB with depth ratio threshold $\gamma = 0.6$. (a-h) are sequences from a university hallway. (i-n) are sequences showing crossings with same clothes.

References

