BODY HEIGHT ESTIMATION USING A SINGLE CAMERA

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Abstract

Due to increasing interest in maximizing passenger's comfort, body height estimation aims to facilitate ingress by means of individually adjusted seat positions. Our algorithm robustly extracts approaching drivers in panoramic images for various parking scenarios. Based on extracted head and foot points, our approach estimates the camera pose relative to a ground plane. Thus, it enables absolute height estimation using a single omnidirectional camera attached to the car.

Motivation and Objectives

- **Motivation:**
  Increasing passenger's comfort during ingress by means of individually adjusted seat positions based on body height data stored in the car system or personal keys
  $\Rightarrow$ Function not suitable for rental cars, risk of potential accidents by mistakenly used keys
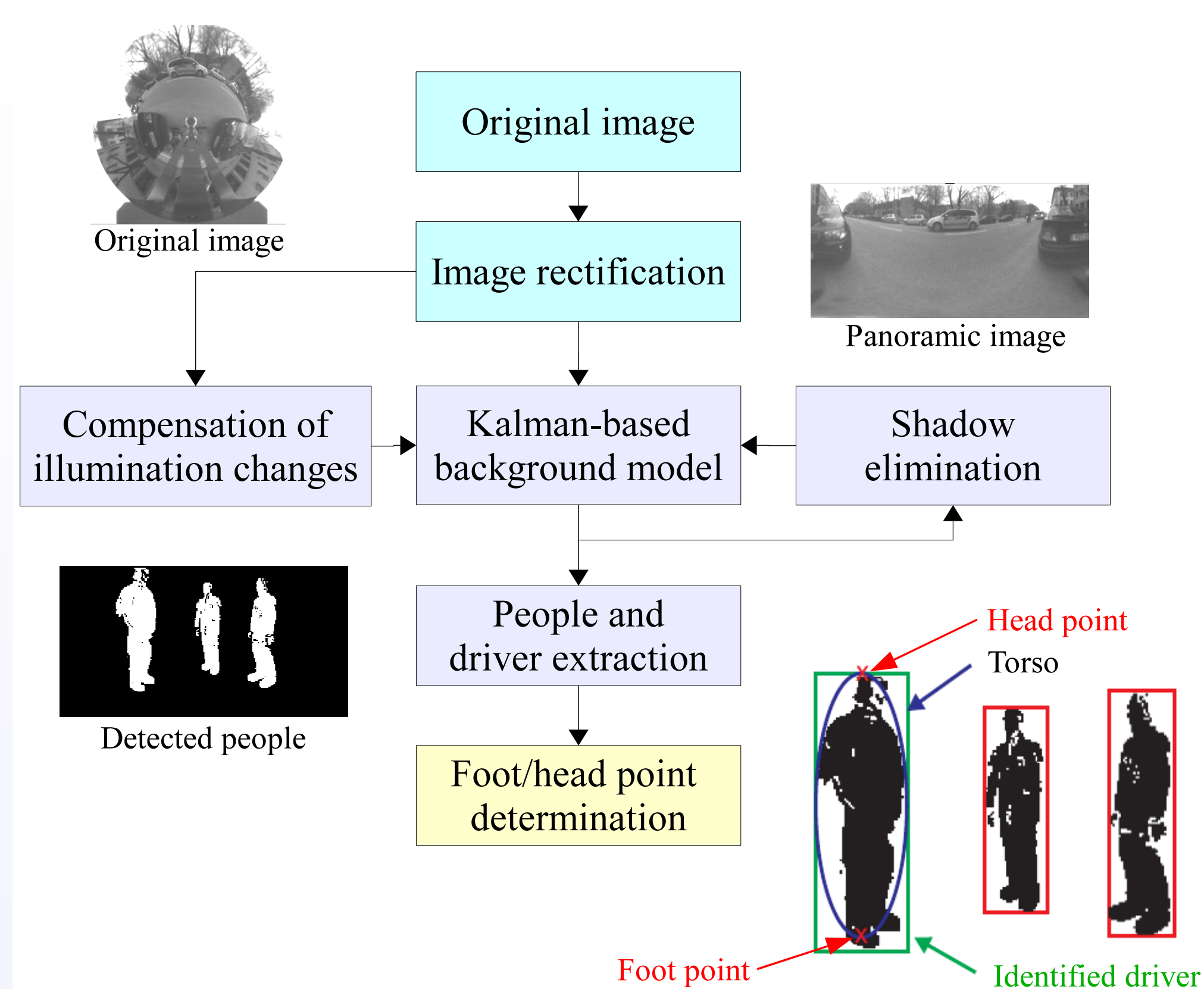
- **Objectives:**
  Absolute body height estimation of approaching drivers for individually adjusted seat positions using a single omnidirectional camera

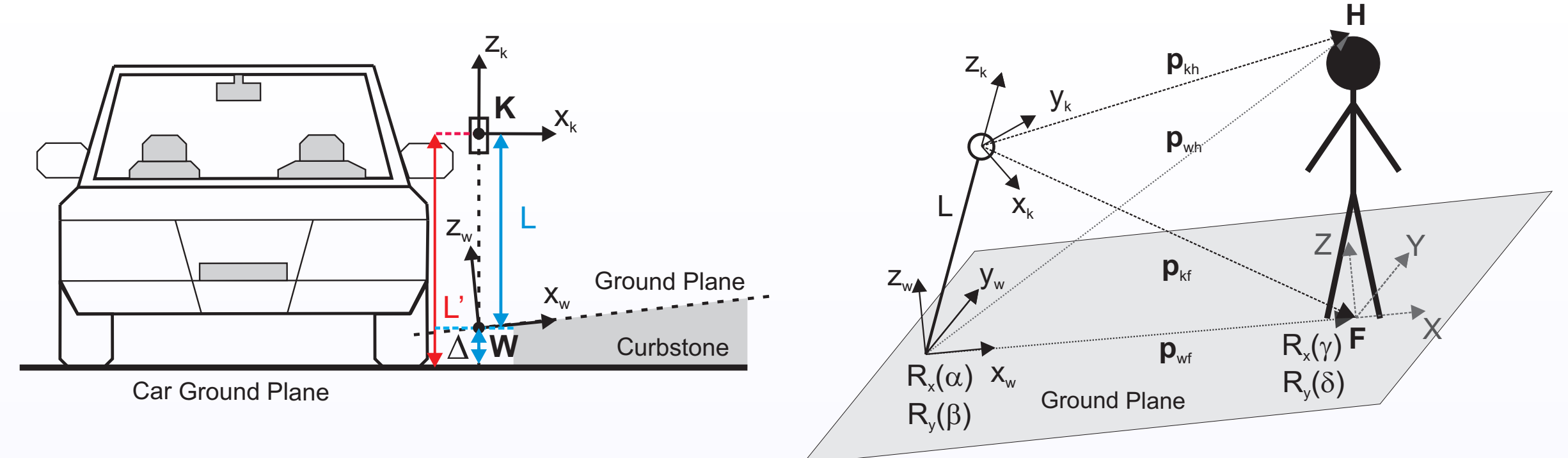Omnidirectional camera integrated with the side-view mirror of the car

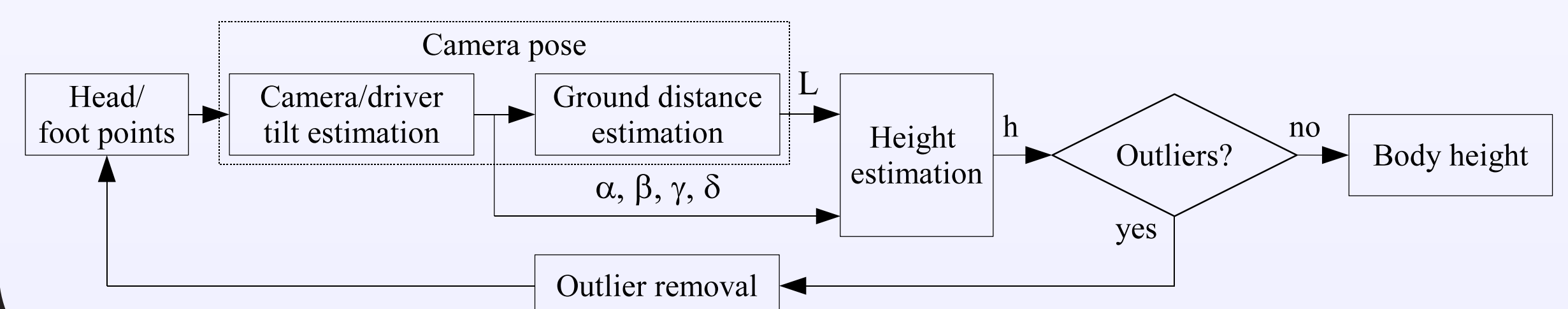## Driver Extraction

Algorithm for head/foot point extraction

- **Robust people detection and driver identification in low-resolution panoramic images**
- **Torso-based head/foot point ($\mathbf{p}_{kh}$, $\mathbf{p}_{kf}$) extraction**

Camera Pose and Height Estimation

Camera pose relative to the ground plane   Camera (α, β) and driver tilt (γ, δ)

- Prerequisites for absolute body height estimation: Known camera pose (orientation (α, β), distance (L)) relative to the ground plane and calibration distance (L')

- Image-based camera pose and absolute body height estimation using n sets of head/foot points


Algorithm for image-based camera pose and body height estimation

Results

- Implementation of the algorithms in a car prototype

- Precise driver detection and head/foot point extraction in panoramic images

- Height estimation with an accuracy of up to $2-3cm$ using at least 32 input data sets to overcome effects of noise
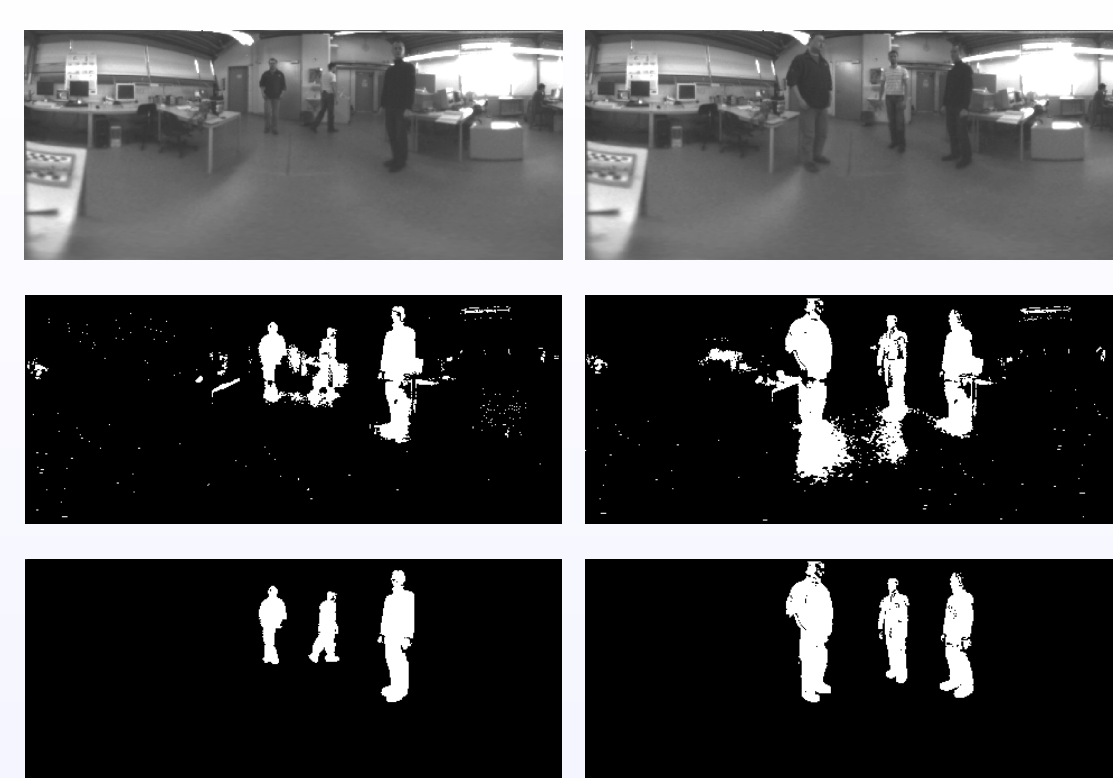
Top down: Indoor test scenario, people detection with the help of a GM-based background model and our method
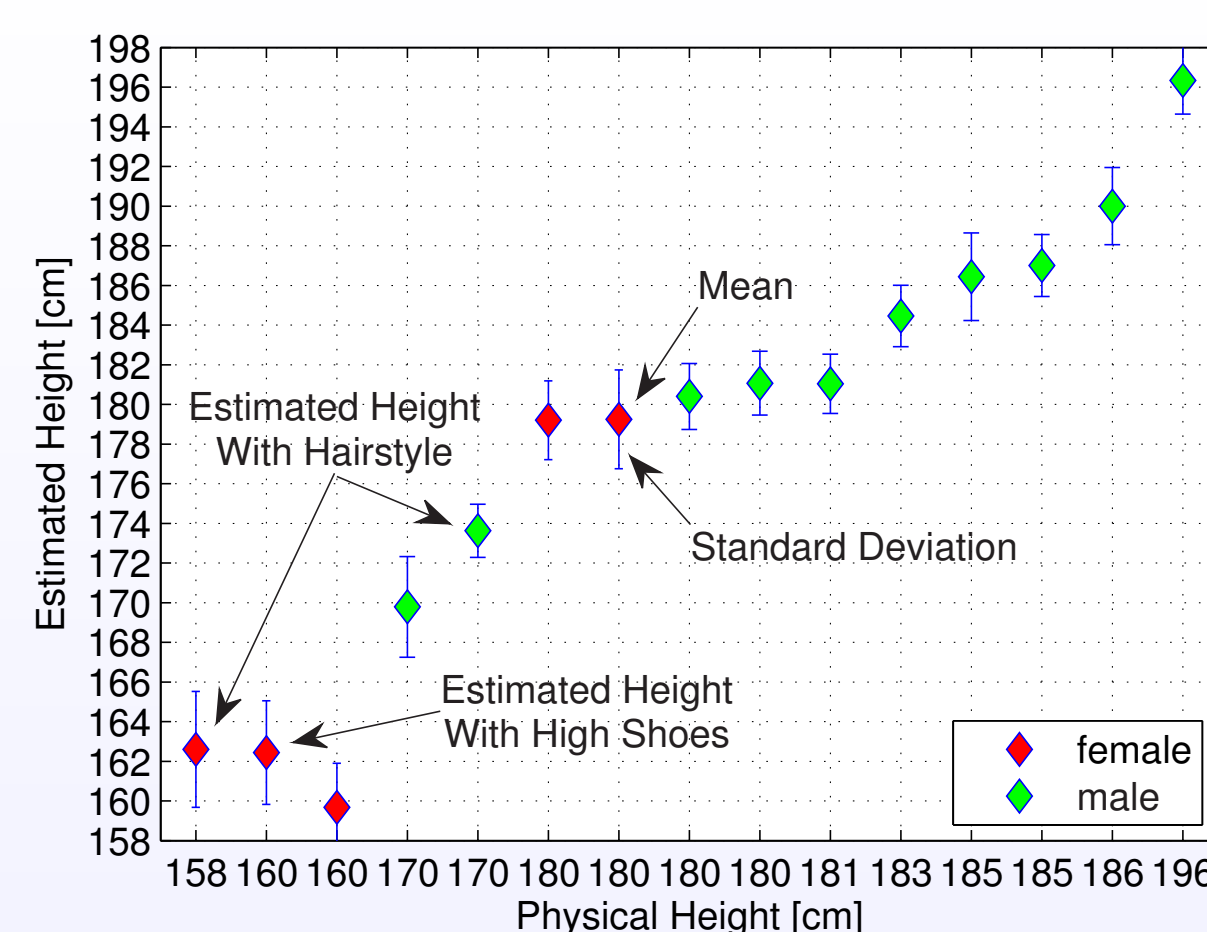
Estimated body heights of previously measured people

Estimated body height of a short and a tall person