Accurate Single View Model Based Head Pose Estimation

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Abstract

- Head pose estimation from single view images.
- The 6DOF was estimated using Pose from Orthography and Scaling with iTeraTions (POSIT) where a statistical anthropometric 3D rigid model is used as an approximation of the human head, combined with Active Appearance Models (AAM) for facial features extraction and tracking.
- The results show that orientations and head location were, on average, found within 2° or 1cm error standard deviations respectively.

Active Appearance Models

- Shape Model
  \[ x = (x_1, x_2, \ldots, x_n)^T \]
  - Generalized Procrustes Analysis
- Texture Model
  \[ g = (g_1, g_2, \ldots, g_m)^T \]
  - Piecewise Affine Warp
- Combined Model
  \[ b = \begin{bmatrix} W_b \Phi_b \end{bmatrix}_{(x, g)} \quad \Phi_a = \Phi_b \quad \Phi_a = \Phi_b \quad \Phi_a = \Phi_b \]
  - Principal Components Analysis (PCA)
  - Low Memory PCA
  - Updating the appearance parameters, \( \sigma \), and pose

Anthropometric 3D Model

- Suitable rigid body model that describes the 3D face of several individuals
- Physical model
- 3D laser scan
- Sparse model
- Comparison between the estimated pose (AAM+POSIT) with the one estimated from a planar checkerboard

Examples of Head Pose Estimation

-POSIT - Pose from Orthography and Scaling with Iterations
  - POSIT is a fast and accurate iterative algorithm for finding the 6DOF of a 3D model given a set of 2D image projections and 3D points correspondences
  - The application with AAM fitting plus POSIT pose estimation runs at 5 fps on 1024x768 images using a Intel 3.4GHz P4 under Linux OS. AAM is based on 58 landmarks sampling 48178 pixels with color information (m=144534)

3D glasses Augmentation

- A 3D model of glasses is backprojected on image with the estimated 6DOF

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http://aifi.isr.uc.pt