GESTURE RECOGNITION

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OUTLINE

- Introduction.
- Problem Statement.
- Literature Review.
  - Gesture Modeling.
  - Gesture Analysis
  - Gesture Recognition.
- People Detection in Images.
- Conclusion.

INTRODUCTION

- We all know what a gesture is?
- Gesture recognition has wide range of applications.
  - Recognizing sign language.
  - Medically monitoring patients' emotional states or stress levels or monitoring alertness of a driver.
  - Developing aid for the hearing impaired.
  - Surveillance in public places, Modeling the behavior.
  - Many mobile devices such as smart phones and tablets.
  - Smart homes.

PROBLEM STATEMENT

- Can computer vision be used to help elderly people in home? If so, then how?

LITERATURE REVIEW(Gesture Modeling)

- Gesture Modeling.
  - Temporal modeling.
    - Preparation or Pre-stroke.
    - stroke.
    - Retraction or Post-stroke.
  - Spatial modeling.
    - 3D based.
      - 3D model-based gestures use articulated models of the human hand , arm or body to estimate the human body movement parameters. Such movements are later recognized as gestures
    - Appearance based.
      - Appearance-based models directly link the appearance of the hand , arm or body movements in visual images to specific gestures

LITERATURE REVIEW(Gesture Modeling)

- 3D based
  - Parameters-Joint angles, Palm position,..
  - Volumetric models and skeletal models.
  - Volumetric models.
    - *analysis-by-synthesis* [R. Koch, 1993].
    - *Simple 3D geometric structures* [V.I. Pavlovic et al., 1996].
  - Skeletal models.
    - Uses reduced set of joint angle parameters together with segment length.
    - Used in biomechanics and morphology.
    - Uses DOF, [Kuch, 1996] used 26 DoF in his hand model.

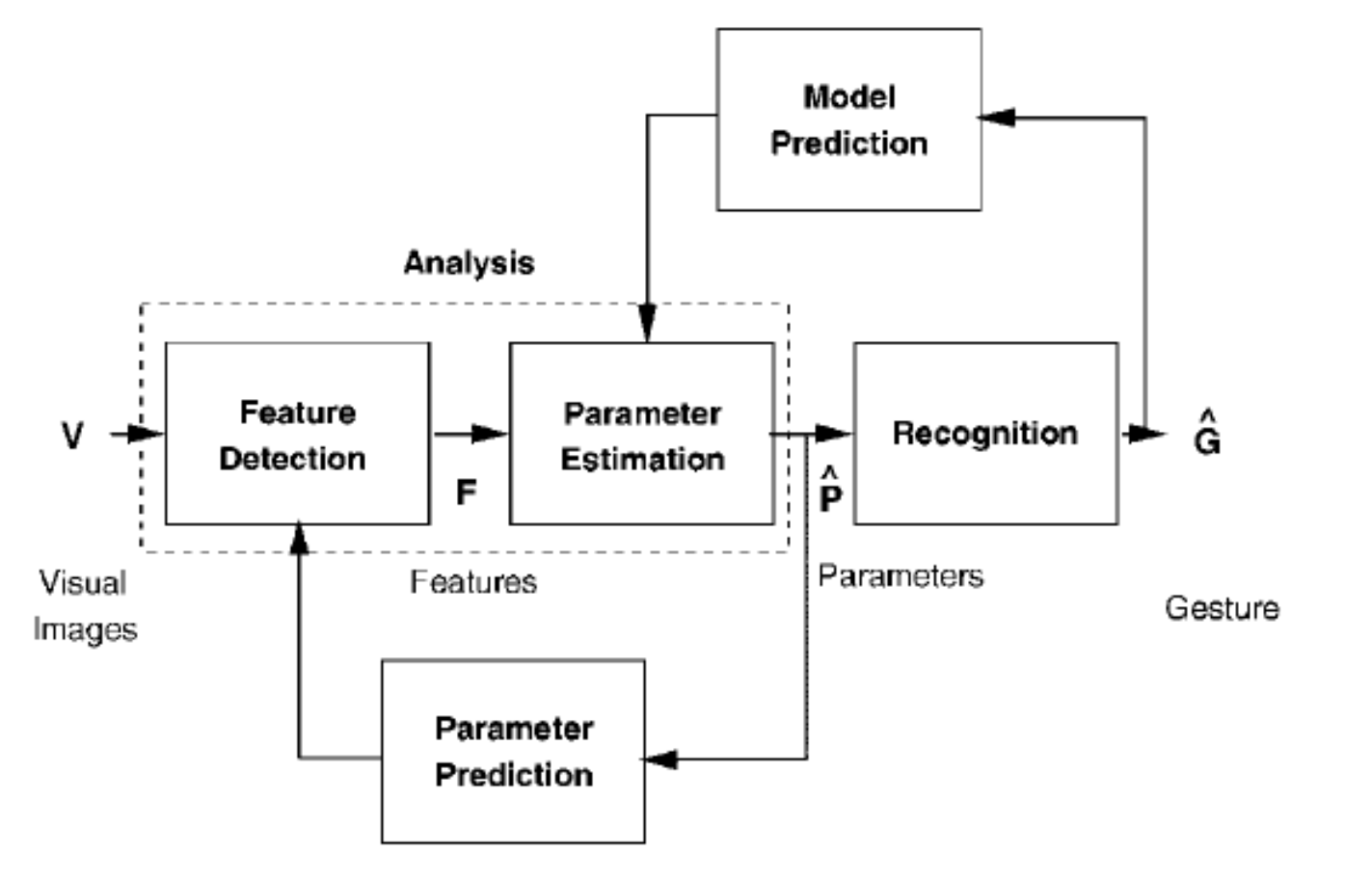
LITERATURE REVIEW (Gesture Modeling)

- Appearance based models.
- [Cootes,1995] used deformable 2D templates for tracking the hand motion.
- Templates consists of point set, point variability parameters and external deformations.
  - point sets describe the “average” shape within a certain group of shapes.
  - Point variability parameters describe the allowed shape deformation (variation) within that same group of shapes.
  - External parameters or deformations are meant to describe the global motion of one deformable template. Rotations and translations are used to describe such motion.

LITERATURE REVIEW(Gesture Modeling)

- [Cui et.al] use 2D hand image sequences as gesture templates.
- The majority of appearance-based models, use parameters derived from images in the templates.
- They include: contours and edges, image moments, and image eigenvectors etc.
- Some group of models use finger tip positions as parameters.

LITERATURE REVIEW(Gesture Analysis)



LITERATURE REVIEW(Gesture Analysis)

- Feature detection has 2 stages
  - Localization .
    - Color cues .
      - Color based localization of the gesturer[R. Kjeldsen et.al, 1993].
      - Skin color varies in different lightening condition.
      - Restricted background and uniform clothing [Davis et al., 1994].
      - Uniquely colored gloves or markers on hands[Y. Kuno et al., 1994].
    - Motion cues.
      - Motion cues are used along with certain assumptions about the gesturer.
      - [W.T. Freeman et.al, 2005] assumes that only one persons at a given time against a stationary background.
      - Fusion of motion and color overcomes the above drawbacks to some extent.

LITERATURE REVIEW(Gesture Analysis)

- Feature detection has 2 stages

  - Features and detection.
    - Silhouettes are among the simplest, yet most frequently used features. [J.J. Kuch et al., 1995] has used it in 3D model and [M.W. Krueger, 2003]has used it in appearance based models.
    - Contours, edges and segments are used both by the 3D based models and appearance based models use these features for detection.
    - In case of occlusions multiple cameras can be used. [J. Lee et al., 1995].

LITERATURE REVIEW(Gesture Analysis)

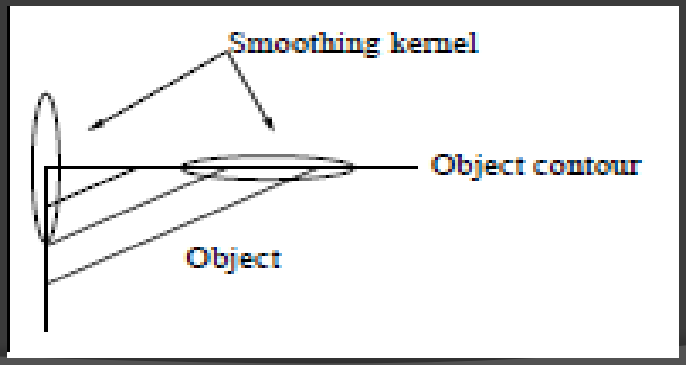
- Parameter Estimation.
- The estimation of parameters usually coincides with the estimation of some compact descriptions of image or image sequence.
- In case of deformable 2D template based models . The parameter estimate are obtained through PCA on the set of training data. This technique is also extended to the estimation of parameters in 3D case [T. Heap et al., 2005].
- external deformations or global motion parameters such as rotation and translation can be estimated by using kalman filtering or particle filtering techniques [T. Heap et al., 2005]..

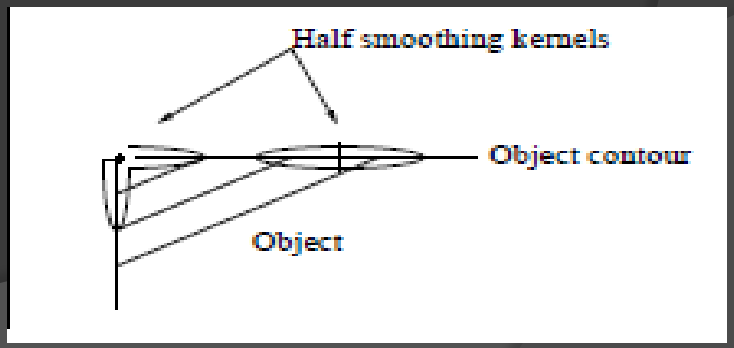
LITERATURE REVIEW(Gesture Recognition)

- Data analyzed from the visual images of gestures is recognized as specific gesture.
- Important task associated with the recognition process are.
  - Optimal partitioning of the parameter space.
    - Parameters are clustered using vector quantization or LDA .
    - For non-convex set of parameters non linear clustering schemes such as neural networks are one such option.
  - Implementation of the recognition procedure.
    - Different approaches based on Hidden marcov models and motion history images are used for gesture recognition.

Finding People in Images

- New contour based approach
- 2 stages designed to work together.
  - Contour detection .
  - Geometrical analysis.
- We use a new anisotropic edge detector with half smoothing kernels.

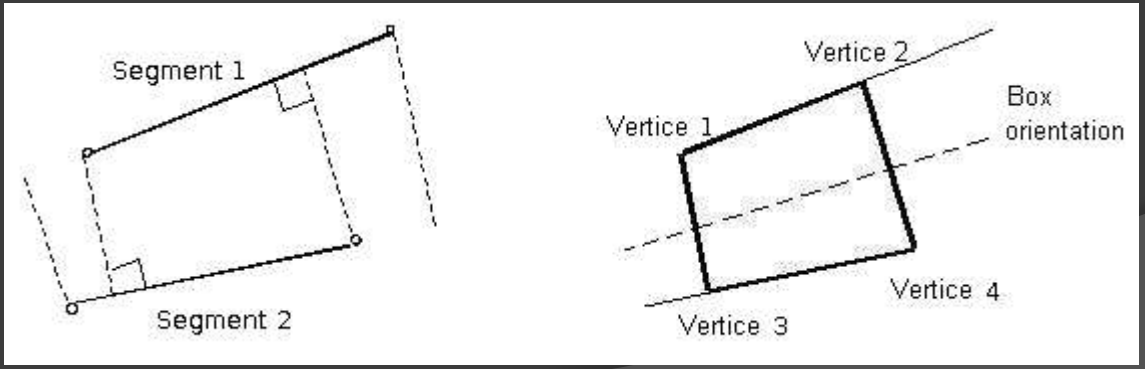




Finding People in Images

Finding People in Images

- Finding bodies.
  - Elementary groups: boxes.
    - We drop perpendiculars from each edge and form the boxes.
    - Once a box has been detected we find the orientation of the box.



Finding People in Images

- ribbons
  - **The grouping stage.**
    - **Boxes are organized in pre groups considering proximity, distribution of colors and box orientation**
  - **The chaining stage.**
    - A directional axis of the group is computed as the average orientation of all the boxes in the group.
    - Join the boxes to obtain longer structures**.**

Finding People in Images

Future work and conclusion

- Fails to detect when the legs and hands of human are completely covered .
- The chaining stage is computationally very intensive . This stage can be accelerated by using CUDA programming.
- In some cases it fails to detect the Torso correctly.
- Extend this method to the gesture recognition process.
- It is possible to come up with solutions based on computer vision for helping to maintain the elderly people at homes.

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Thanks And

Questions?