



# AN UNCONSTRAINED METHOD FOR LIP DETECTION IN COLOR IMAGES

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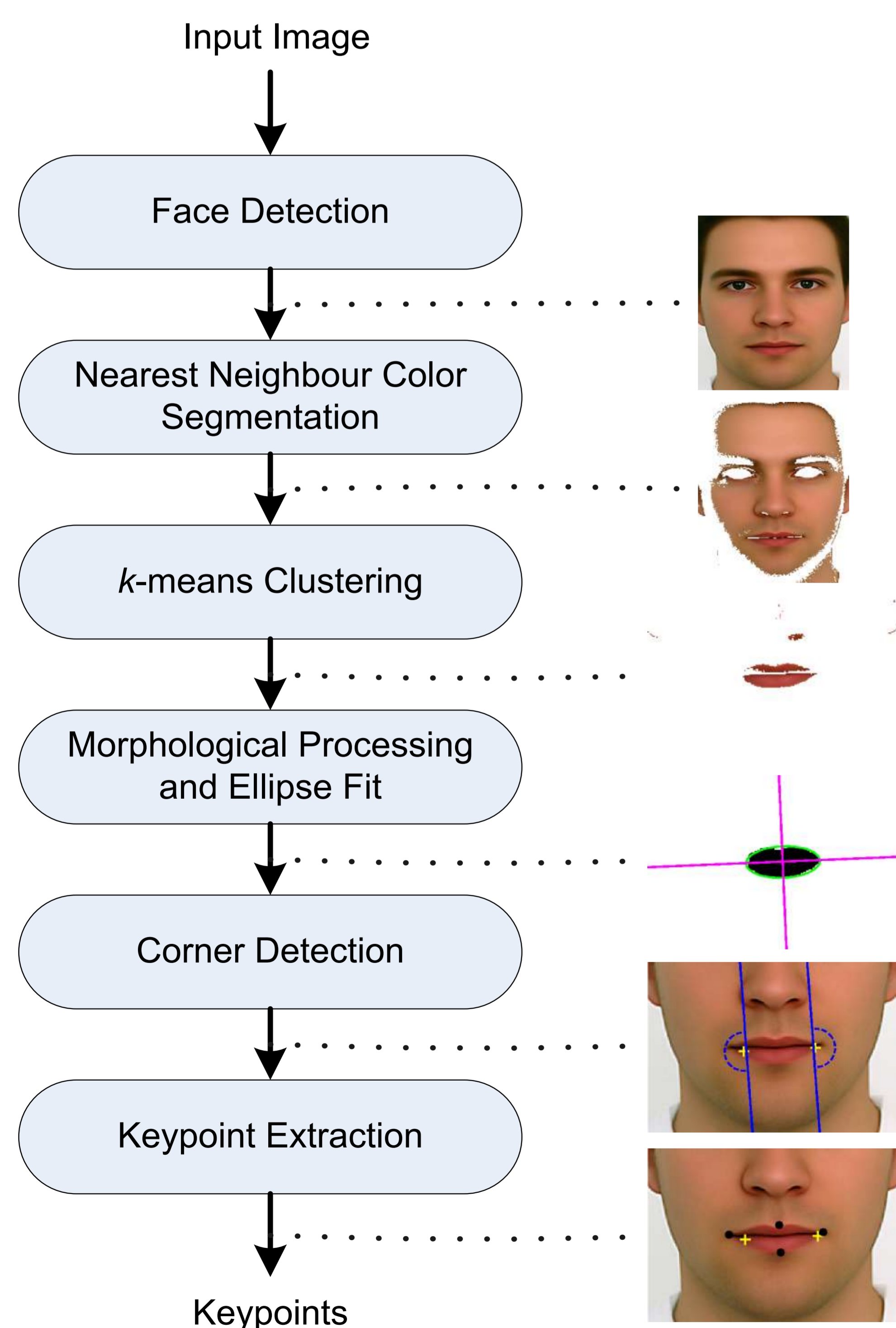
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## Motivation

- Increasing interest for lip detection which stems from its usefulness in a wide range of applications
- Efforts towards an unconstrained system for lip detection that does not impose certain restrictions on users
- We propose a simple, computationally efficient system that avoids time consuming preprocessing steps or parameter initialization

## System overview



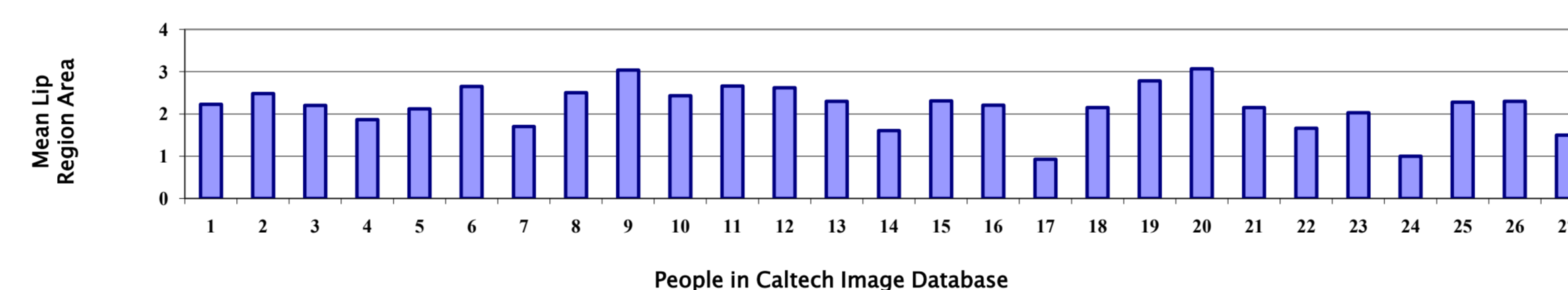
## Method

### Face Detection

- Viola - Jones real time face detector

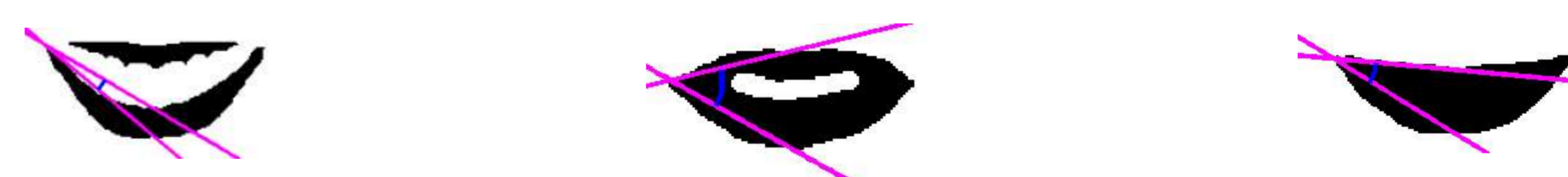
### Lip Segmentation

- Convert to the perceptually uniform  $L^*a^*b^*$  colorspace to increase color contrast between lip and non-lip regions
- Perform two category nearest neighbor classification, using two color markers created from the extreme  $a^*$  values and the corresponding  $b^*$  values, to discard unwanted non-lip pixels
- Apply k-means clustering method with an automatically adaptive number of clusters which is defined according to a lip size criterion (1 - 4% of the face image)



### Morphological Processing

- Morphological closing and connected component labeling
- Fit lip object using the best-fit ellipse
- Check whether the lip object constitutes the whole lips area or just the lower lip (if so find the corresponding upper lip object)



### Keypoint extraction

- Upper and lower keypoints: Intersection of the ellipse's minor axis with the lip object boundaries
- Use Harris corner detector to refine mouth corners located in dark areas, where chromatic information is not visible

### Datasets

- Caltech Image Database: 421 images of 27 different people
- GTAV Face Database: 848 frontal & near frontal images of 44 different people

## Results

Database	Failed Detection	Perfect Detection	Acceptable Detection
CID	3.8%	94.3%	96.2%
GTAV	2.5%	93.3%	97.5%



## Advantages

- Independent from specific color values
- Does not require training or prior assumptions about the underlying feature distribution
- Able to deal with the high variability of lip shapes and color
- Robust in challenging cases such as non-uniform lighting, bearded speakers, low color contrast between lip and non-lip area, small face size
- Unaffected by the yaw, pitch and roll angle as long as the lip region is visible

## Contact

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