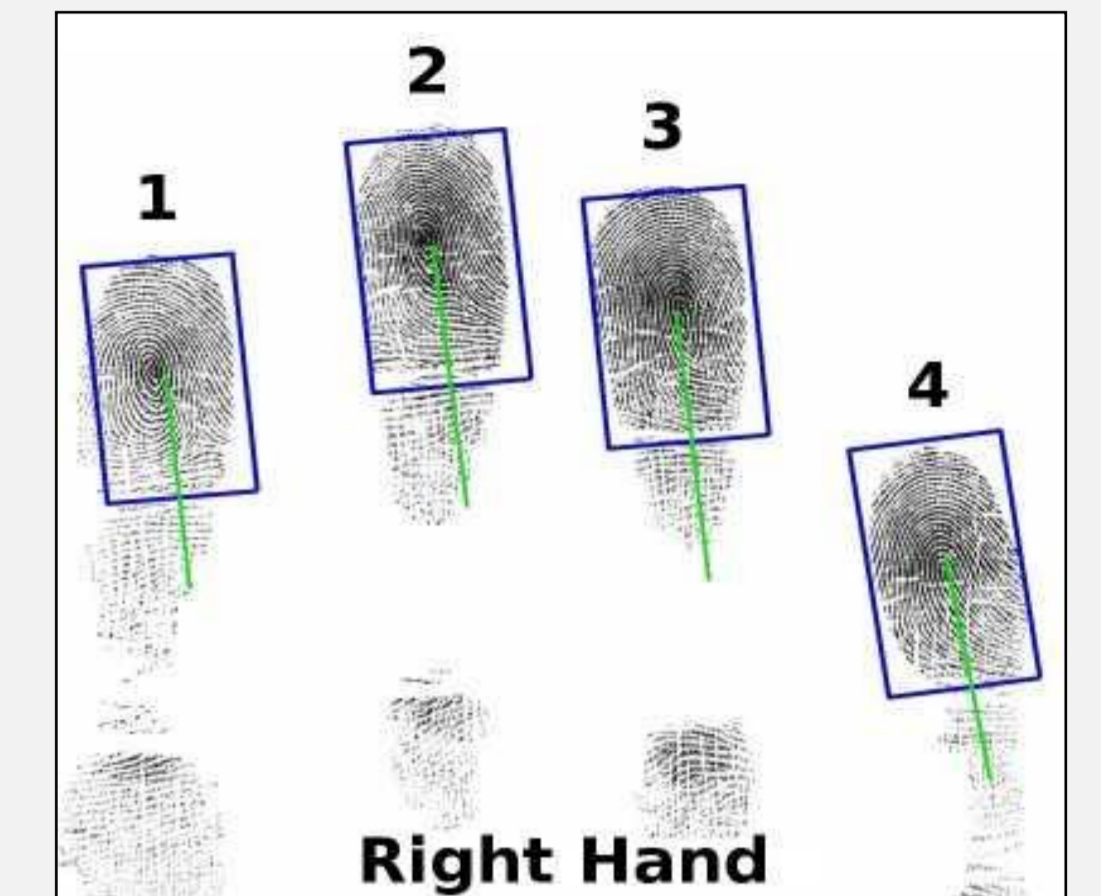


## Abstract

This poster presents a novel approach in segmenting multiple fingertips from an image. Such an image is taken by a scanner capable of recording several fingers simultaneously. A combination of two-staged mean shift and ellipse-fitting algorithms as well as an elaborate subsequent set of rules is used to segment the single fingertip images. First, the mean shift as a well-established feature-space analysis technique is used to identify the different components of the fingers. Then the orientation and size of each component is determined by the application of a robust ellipse-fitting algorithm. Finally the rules locate the fingertips. Extensive experimental evaluations demonstrate the success of the approach.

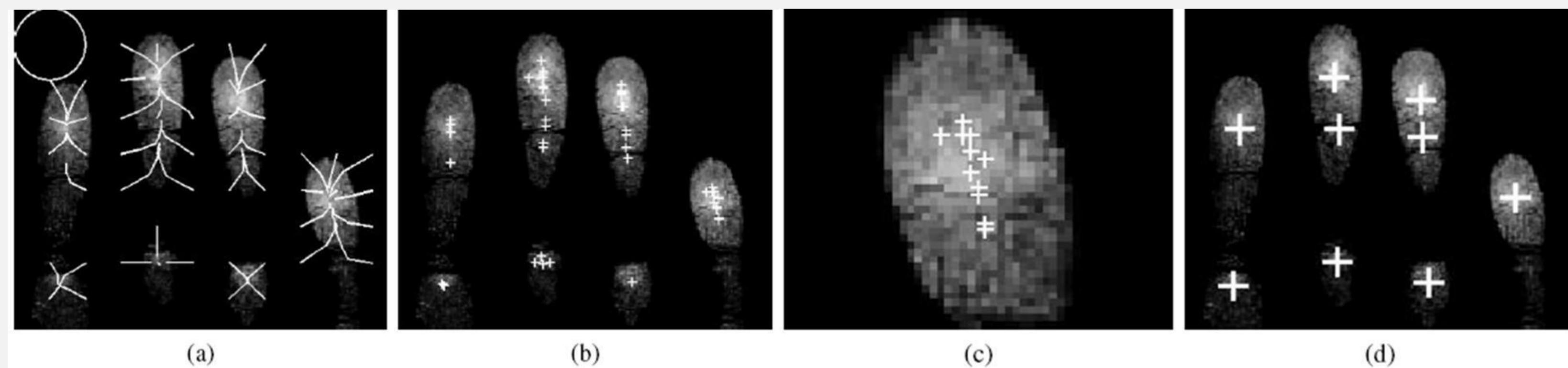
## Goals

- Correct segmentation of the fingertips (size, orientation)
- Assignment and classification of the fingers
- Left or right hand detection
- Performance (real time capability)



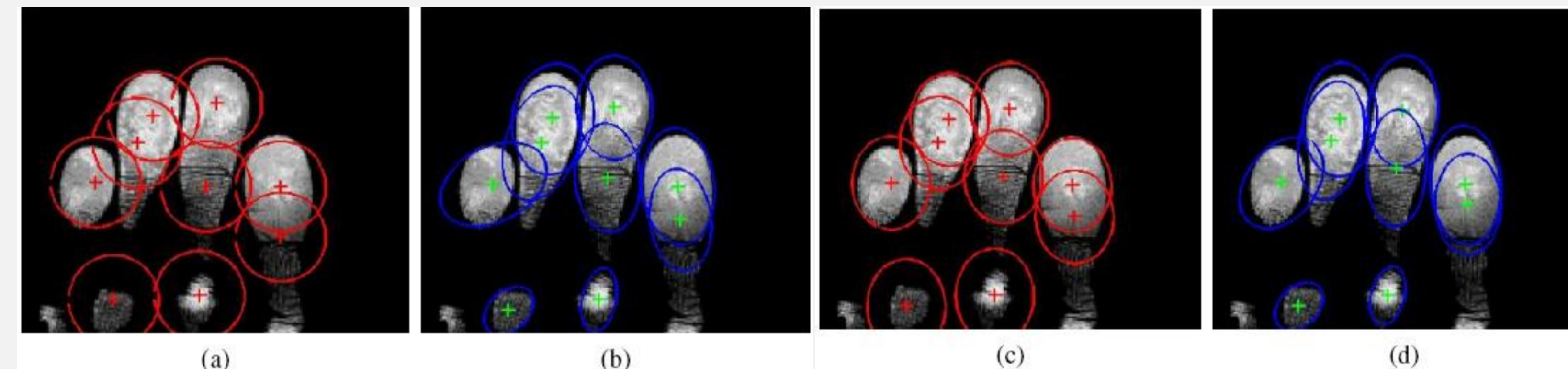
## Segmentation Approach

### 1. Mean shift



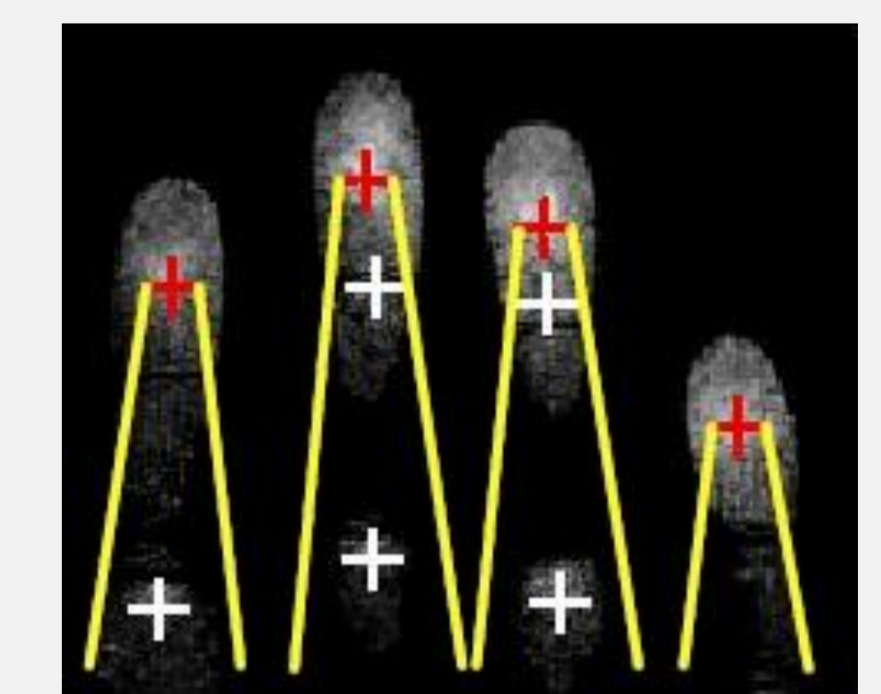
- Use two-staged mean shift [1] to identify components of the fingers.
- 1<sup>st</sup> run detects components.
- 2<sup>nd</sup> run merges modes.

### 2. Ellipse fitting



- Calculate size and orientation of potential fingertips using properties of the covariance matrix [2].
- Re-estimation using elliptical search window turned into direction of average angle for more accurate results.

### 3. Finger logic

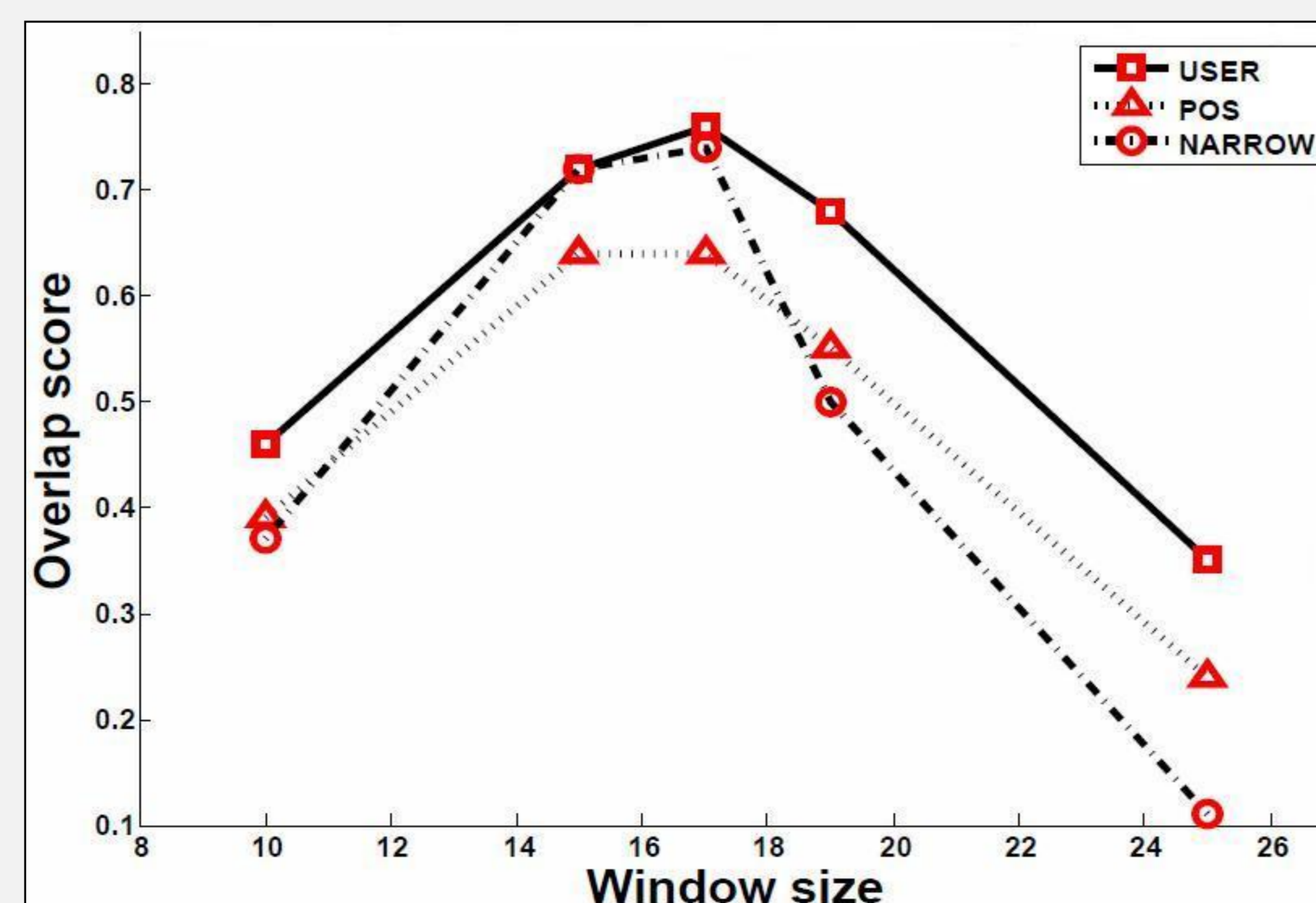


- Use of orientation normalized image.
- Select topmost modes.

## Results

- Segmentation results measured with **Overlap Score** and **Precision/Recall**
- 150 Images (3 simulated scenarios)

- **Overlap Score: 71%**
- **Precision: 76%**
- **Recall: 86%**



## Conclusion

- Combination of mean shift and ellipse fitting algorithm
- Robust and accurate detection
- Very good results
- Real time capable

## References

- [1] Comaniciu D. and Meer P. Mean shift: A robust approach toward feature space analysis. In IEEE Transactions on Pattern Analysis and Machine Intelligence, volume 24, 2002.
- [2] Bradski R. Computer vision face tracking for use in a perceptual user interface. Intel Technology Journal Q2, 1998.