

Introduction

The difference between a ‘bad’ photo and a ‘good’ photo is often a matter of whether or not the person in the photo is smiling. With the help of feature recognition and corner detection, we can identify smiles in a photo, and determine whether or not it is good.

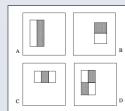
Objective

Automatically identify the best photo of a person based on their smile.

Background

Viola-Jones Feature Recognition Algorithm:

Scan the image with Haar features. From their response to the image, determine where the face is.



Example Haar Features (Viola, 2001)

Shi-Tomasi Corner Detection Algorithm:

$$M = \sum_x \sum_y w(x, y) \begin{bmatrix} I_x^2 & I_x I_y \\ I_x I_y & I_y^2 \end{bmatrix}$$

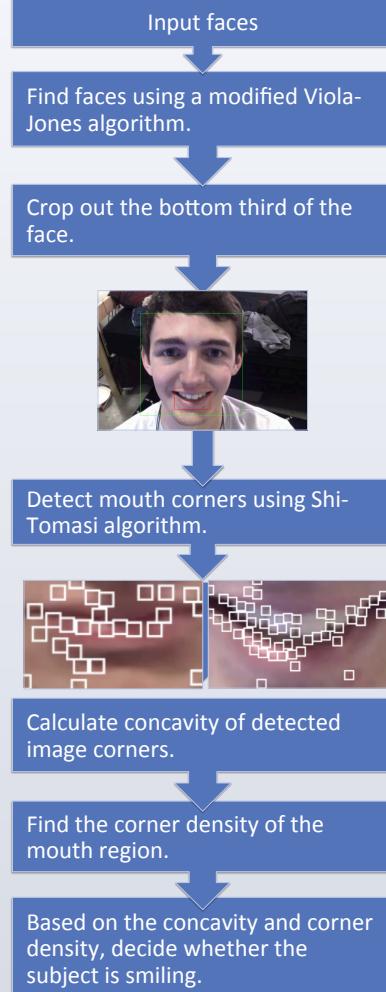
I ~ Intensity of the Window

$$R = \min(\lambda_1, \lambda_2)$$

R ~ Corner Significance Parameter

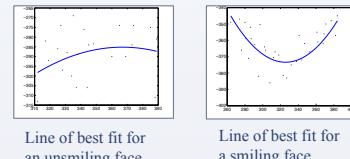
λ_1, λ_2 ~ Eigenvalues of M

Method

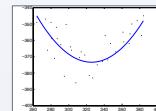


Results

Plots of mouth corner detection points



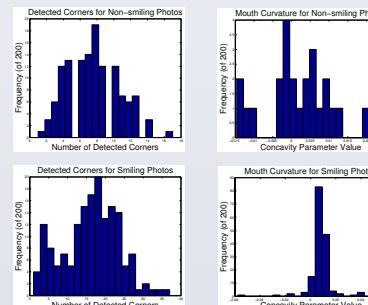
Line of best fit for an unsmiling face



Line of best fit for a smiling face

	Number of Mouth Corner Detections	Concavity of the Line of Best Fit
Smiling Face	16.3	0.0124
Unsmiling Face	7.7	0.0016

Average number of mouth corner detections and average concavity. Data collected from 200 subjects.



Maximum Frequency for Non-Smiling Concavity is 4
Maximum Frequency for Smiling Concavity is 90

	Number (200)	Total %	Procedure Validity
Correct Recognitions	121	61%	93%
False Positives	9	5%	7%
Inconclusive	70	35%	

Statistical Analysis of 200 subjects. Each subject has one smiling and one non-smiling photo.

Conclusion

Using feature recognition and corner detection, we were able to successfully identify smiles that show teeth very accurately. We found closed mouth smiles were harder to detect. With our procedure closed mouth smiles were often categorized as inconclusive.

Our system could prove to be a helpful application in digital photography, where it could be used to automatically select the best image in a set of similar images. Our system would be made even more useful if it were extended to work with video. Among possible video applications is marketing analysis of customer reaction.

References

M. Jones and P. Viola, “Robust real-time object detection,” *Workshop on Statistical and Computational Theories ...*, 2001.

S. Jianbo and C. Tomasi, “Good Features to Track,” 1994.

M. Castrillón, O. Déniz, C. Guerra, and M. Hernández, “ENCARA2: Real-time detection of multiple faces at different resolutions in video streams,” *Journal of Visual Communication and Image Representation*, vol. 18, no. 2, pp. 130–140, Apr. 2007.

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