Image Processing Pipeline for Facial Expression Recognition under Variable Lighting

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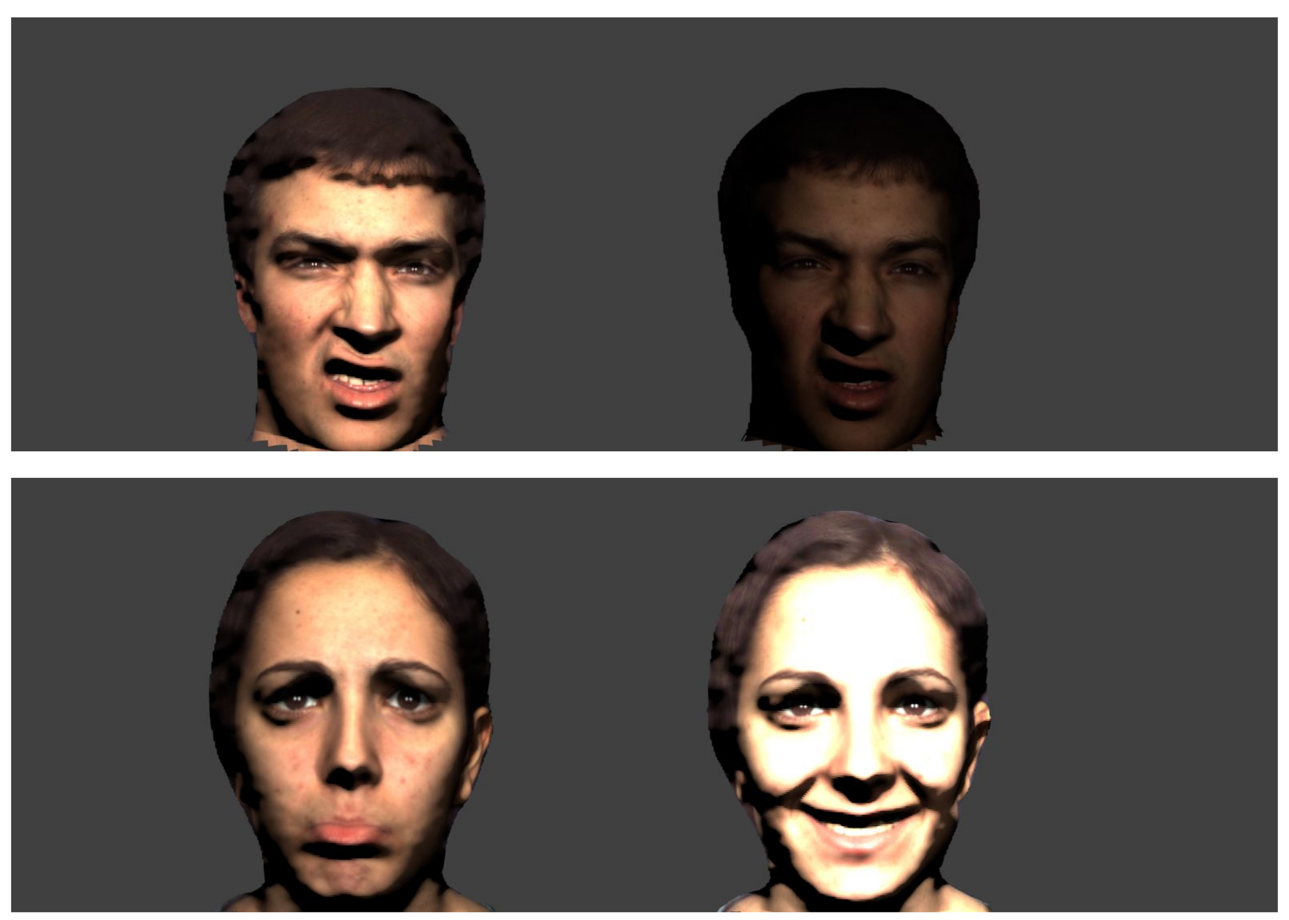
Motivation

In the Wall Lab of Stanford Medical School, expression recognition is used in a Google Glass application that helps children and adults with Autism detect the emotions of people they are interacting with. For most practical applications, the emotions recognition task is done in real-world conditions where the lighting is diverse and far from being uniform. We study emotion detection under variable conditions. Our hope is that this research increases classification accuracy under real world conditions.

Dataset

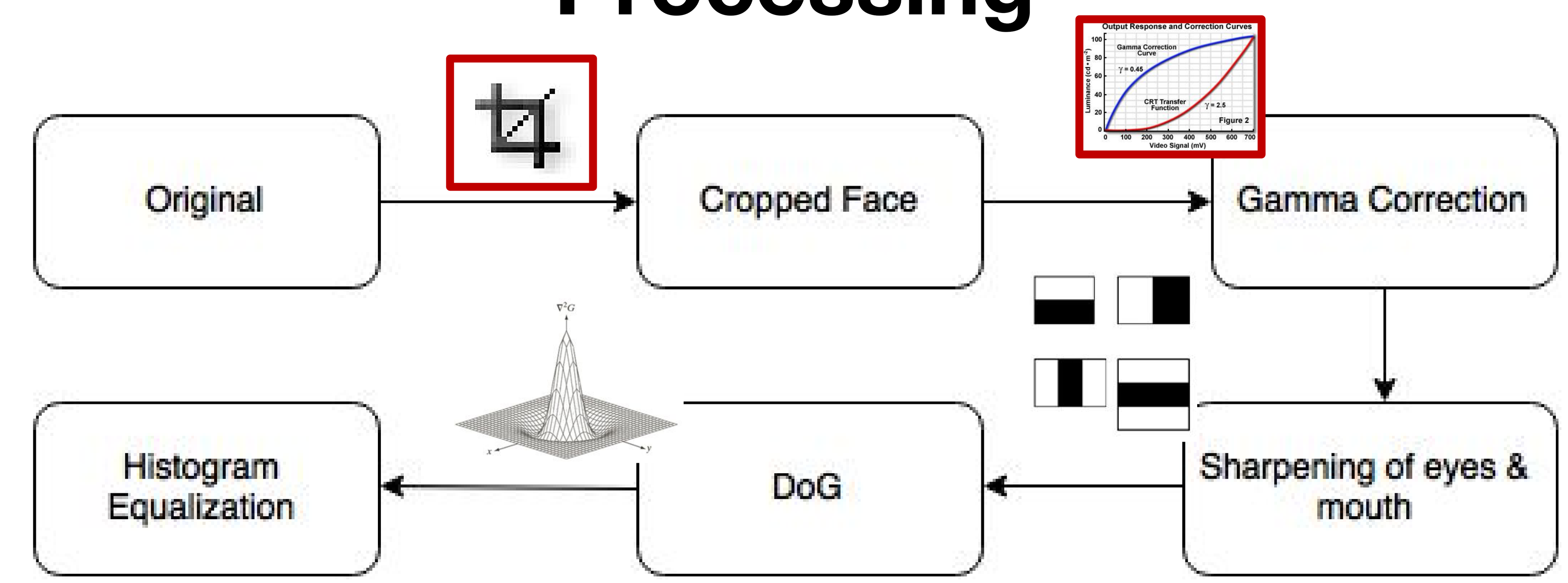
We use the Binghamton University 3D Facial Expression Database to generate images of facial emotions. Then, we use a Blender library to simulate different lighting conditions affecting the 3D facial model and then projecting to 2D images.



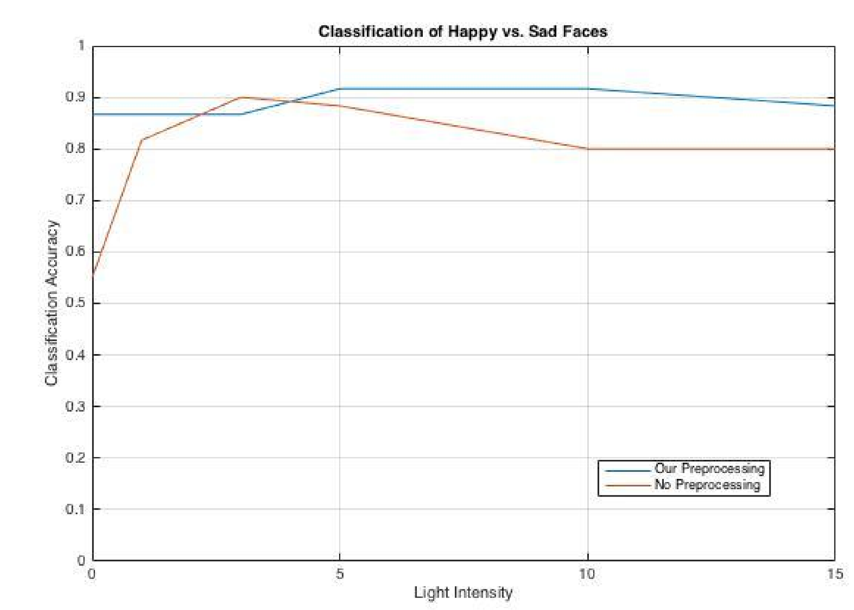
Related Work

Many keypoint detection procedures lose accuracy under different lighting. Furthermore common classification procedures such as Fisherface are also affected.

Processing

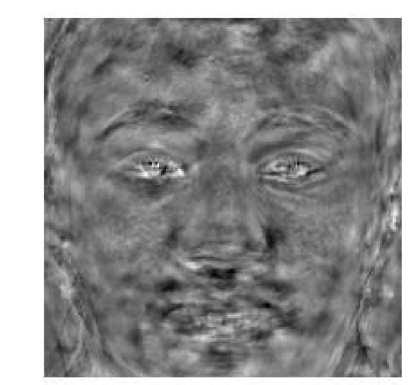


Experimental Results

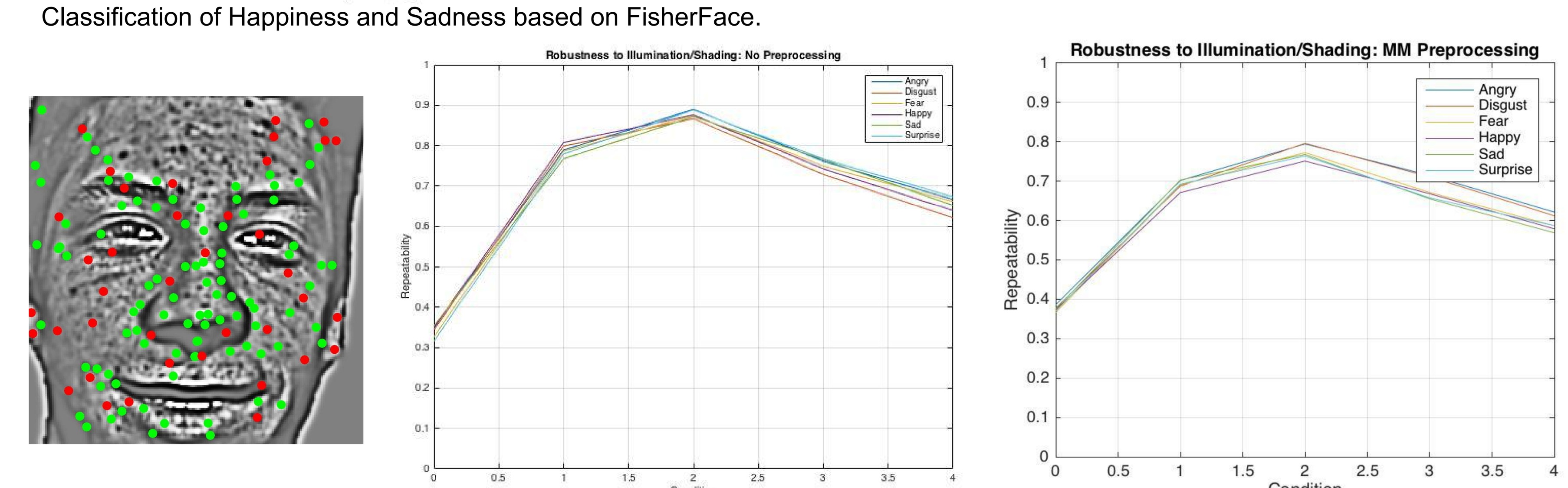


Classification of Happiness and Sadness based on FisherFace.

FisherFace of Preprocessed Faces



FisherFace of Non-preprocessed Faces



Sift Keypoint Detection Repeatability for Different Lighting Conditions. Conditions goes from less lighting to more lighting.

References

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[2] Xiaoyang Tan and B. Triggs. Enhanced local texture feature sets for face recognition under difficult lighting conditions. IEEE Transactions on Image Processing, 19(6).
[3] Lijun Yin; Xiaozhou Wei; Yi Sun; Jun Wang; Matthew J. Rosato. A 3d facial expression database for facial behavior research. 7th International Conference on Automatic Face and Gesture Recognition, 2006.