Title: Preprocessing and Descriptor Features for Facial Micro-Expression Recognition
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Project Goals:
Facial micro-expression recognition is an interesting and expanding field with important applications. Facial micro-expressions, which last on the order of ¼ to ⅓ of a second (as opposed to up to 4 seconds for macro-expressions), result when one attempts to suppress their true reaction to an event [1]. Due to the short nature of these expressions, detection and classification of these facial movements is a difficult task. However, if classified properly, facial micro-expression recognition could allow for wide use in law enforcement (detection of deceit or hostile intent), business negotiations, marketing strategy, and general psychology study on human emotions [1].

Our approach to performing facial micro-expression recognition will mirror that of the Xiaobai Li and Tomas Pfister from the University of Oulu, who have produced several leading papers on the subject [2,4]. Their approach has involved use of the SMIC Database (Spontaneous Micro-Expression Database) for developing a method for detection and classification of micro-expressions. We have obtained access to the SMIC Database, which contains both raw and preprocessed images for use. We will perform our own preprocessing, which will involve cropping and normalizing the images. Our approach will use eye position found using a Haar eye detector and feature points from an active shape model (ASM) deformation, as performed by Pfister and Li [4]. Additional work will include implementing LBP-TOP (Local Binary Patterns in Three Orthogonal Planes) as well as a newly developed feature descriptor, LGCP-TOP (Local Gray Code Pattern in Three Orthogonal Planes), developed by Islam [5]. Finally, we will implement multiple machine learning techniques (MKL - Multiple Kernel Learning and RF - Random Forest) to attempt to improve detection and classification accuracy from baseline results using Support Vector Machines (SVM's).

Our project goals are organized as such:

1) Preprocessing of Images for SMIC Database (Haar transform, image cropping)
2) Implement additional feature descriptor (LGCP - Local Gray Code Pattern) for facial micro-expression detection and classification
3) Implement additional machine learning methods (MKL, RF) to test for improved detection and classification accuracy

We will not be using a DROID camera phone.

References:
[1] Ekman, Paul, and Wallace V. Friesen. "Nonverbal leakage and clues to deception." Psychiatry 32.1 (1969): 88-106.

[2] Li, Xiaobai, et al. "A spontaneous micro-expression database: Inducement, collection and baseline." Automatic Face and Gesture Recognition (FG), 2013 10th IEEE International Conference and Workshops on. IEEE, 2013.

[3] Yan, Wen-Jing, et al. "CASME II: An improved spontaneous micro-expression database and the baseline evaluation." PloS one 9.1 (2014): e86041.

[4] Pfister, Tomas, et al. "Recognising spontaneous facial micro-expressions."Computer Vision (ICCV), 2011 IEEE International Conference on. IEEE, 2011.

[5] Islam, Mohammad Shahidul. “Local Gray Code Pattern (LGCP): A Robust Feature Descriptor for Facial Expression Recognition.” International Journal of Science and Research (IJSR), 2013.