**Title** Facial Liveness Testing for the Web - an analysis of different methods

**Project Type** Computer Vision, Image Processing and Security

**Description** In order to avoid spoofing in facial recognition systems, liveness tests are needed. While various liveness tests exist, some require specialized hardware and are therefore not suitable. This project aims to select the most suitable methods for a web facial authentication system, and analyze their effectiveness in terms of security. A liveness test is suitable if it uses only one built-in camera (found within laptops in the webcam, or in mobile devices as the front camera), and potentially the device screen (which varies in size depending on the device used), and can be done in near real time.

**Preliminary Preparation**
- Existing liveness tests
- What are the datasets available for testing/training of these liveness methods?

**Minimum Objectives**
- Build the test framework, to test using several different datasets and different methods, comparing them.
- Implement the image quality based liveness test.

**Intermediate Objectives**
- Implement the eye tracking liveness method.
- Implement the CNN based liveness method (involving texture and temporal metrics).

**Advanced Objectives**
- Implement the facial flashing liveness test.

**References**
- Keras (`https://keras.io`) for Machine Learning
- OpenCV (`https://opencv.org/`) for Image Processing
- Image quality based liveness test (`https://ieeexplore.ieee.org/document/6671991`)
- Eye tracking liveness test (`https://waset.org/publications/5308/liveness-detection-for-embedded-face-recognition-system`)
- CNN based liveness test (`https://arxiv.org/pdf/1408.5601.pdf`)
- Facial Flashing liveness test (`https://arxiv.org/pdf/1801.01949.pdf`)

# Facial Liveness Tests

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|---|---|
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| **DATE** | 10/18/18 |

| TASK TITLE | Durham Week |
|---|---|
| **Dataset Integration** | |
| NUAA dataset integration | 2 |
| REPLAY-ATTACK dataset integration | 2 |
| **Test Framework** | |
| Generic Model Implementation | 1 |
| Dataset Manager (for test data) using datasets above | 1 |
| Test Runner | 2 |
| **Quality Liveness Test** | |
| ReferenceImage creator (Gaussian subtraction) | 1 |
| Implementation of simple metrics (1-19) | 3 |
| Implementation of specialised metrics (20 onwards) | 3 |
| Vector consolodation (providing the vector from the metrics) | 1 |
| Linear classifier layer | 3 |
| **Eye Tracking Liveness Test** | |
| Eye Detection | 1 |
| Face Region Normalization | 2 |
| Eye region binarization | 1 |
| Variation calculator | 1 |
| Variation classifier | 1 |
| **CNN Liveness Test** | |
| Facial localization | 2 |
| Spatial augmentation | 2 |
| Temporal augmentation | 2 |
| Convolutional Neural Network (ImageNet) | 2 |
| **Face Flashing Liveness Test** | |
| Generation of parameters | 1 |
| Initialization of front end | 1 |
| Presentation of challenge | 1 |
| Response collection | 2 |
| Repetition of response | 1 |
| Timing Verification | 3 |
| Face verification | 3 |
| Expression verification | 2 |