WMCA Database

The Wide Multi Channel Presentation Attack (WMCA) database consists of 1679 short video recordings of both bonafide and presentation attacks from 72 different identities. The data is recorded from several channels including color, depth, infra-red, and thermal.

Here we provide the preprocessed images of color channel for the data used in the reference publication.

The WMCA database is produced at Idiap within the framework of "IARPA BATL" and "H2020 TESLA" projects and it is intended for investigation of presentation attack detection (PAD) methods for face recognition systems.

Figure 1.1: Examples of preprocessed data from color channel for different bonafide presentations.

1.1 Acknowledgments to reference publication:

If you use this database, please cite the following publication:

@article{George_TIFS_2019,

       author = {George, Anjith and Mostaani, Zohreh and Geissenbuhler, David and Nikisins, Olegs and

            Anjos, André and Marcel, Sébastien},

       title = {Biometric Face Presentation Attack Detection with Multi-Channel Convolutional Neural

            Network},

       journal = {IEEE Transactions on Information Forensics and Security},

       year = {2019},

       publisher = {IEEE}

}

1.2 Database Description:

The color images were captured with an "Intel RealSense SR300" camera. The data is captured during 10 seconds at frame rate of approximately 30 frames per second (fps). The camera resolution is 1920×1080 for the color channel.

The data was captured during several sessions with different environmental conditions. Session 4 was dedicated to presentation attacks only. The information about the sessions can be found in Table 1.1.

1.3 Presentations:

The presentations in the database can be grouped into different categories:

1. **Bonafide:** Includes bonafide data from participants with and without medical glasses. Some participants were asked additionally to wear a pair of unisex glasses with black rim that had no correction (Fig. 1.2).

Table 1.1: Session description for WMCA data collection

Session	Background	Illumination
1	uniform	ceiling office light
2	uniform	day-light illumination
3	complex	day-light illumination
4	uniform	ceiling office light
5	uniform	ceiling office light
6	uniform	side illumination with LED lamps
7	complex	ceiling office light

Figure 1.2: The unisex glasses with no correction used in some of the bonafide recordings.

2. **Glasses:** Different models of disguise glasses with fake eyes (funny eyes glasses) and paper glasses. These attacks constitute partial attacks (Fig. 1.3).

3. **Fake head:** Several models of mannequin heads were used, some of the mannequins were heated with a blower prior to capture (Fig. 1.4).

4. **Print:** Printed face images on A4 matte and glossy papers using professional quality Ink-Jet printer (Epson XP-860) and typical office laser printer (CX c224e). The images were captured by the rear camera of an "iPhone S6" and re-sized so that the size of the printed face is human like.

5. **Replay:** Electronic photos and videos. An "iPad pro 12.9in" was used for the presentations. The videos were captured in HD at 30 fps by the front camera of an "iPhone S6" and in full-HD at 30 fps

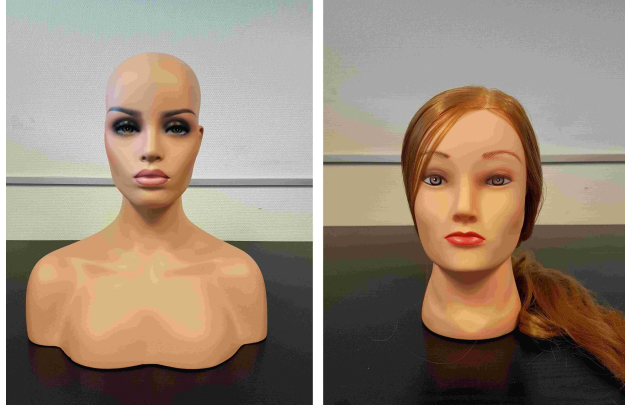Figure 1.3: Sample images of glasses used as presentation attacks.

Figure 1.4: Sample images of mannequin heads.

by the rear camera of the "iPad pro 12.9in". Some of the videos were re-sized so that the size of the face presented on the display is human like.

6. **Rigid mask:** Custom made realistic rigid masks and several designs of decorative plastic masks (Fig. 1.5).

7. **Flexible mask:** Custom made realistic soft silicone masks (Fig. 1.6).

8. **Paper mask:** Custom made paper masks based on real identities. The masks were printed on the matte paper using both printers mentioned in the print category (Fig. 1.7).

The number of presentations in the database can be found in Table 1.2.

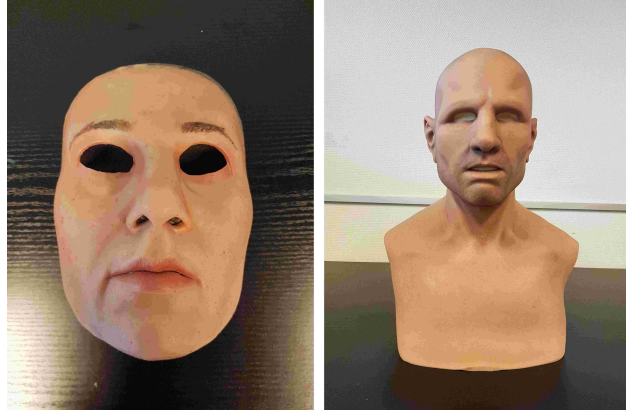Figure 1.5: Sample images of rigid masks.

Figure 1.6: Sample images of flexible masks.

1.4 File Naming Convention:

The file names in the database encode some information about the type of data they contain, for example bonafide or presentation attacks. Each saved file has the following name format:

<client_id>_<session_id>_<presenter_id>_<type_id>_<pai_id>.hdf5

- **client_id:** This three digit number presents the identity of what is presented to the system. For bonafide, it is the ID given to the subject upon arrival and for the attacks, it is a number given to a PAI. Please note that if the identity of a subject is the same as the identity of a PAI, this number is the same for both cases. One example is the silicon masks. If a silicon mask is made from subject 'x's'

Figure 1.7: Sample images of paper masks.

face and subject 'x' also participated as bonafide in the data collection the 'cline_id' for bonafide and silicon mask is the same.

- **session_id:** A two digit number given to a session as mentioned in Table. 1.1.

- **presenter_id:** It is a three digit number that identifies who is presenting the attack to the system. If a subject is presenting an attack to the system, this number is the subject's 'client_id'. If the attack is presented on a support, this number is '000'. If the data is bonafide this number is '000' as well since there is no presenter in this case.

- **type_id:** A one digit number describing the type of the attack presented to the system. The 7 mentioned attack types are grouped into 4 categories, namely, *facial disguise*, *fake face*, *photo*, *video*, and *makeup*. The detailed information about this regrouping is available as open source code[1]. For bonafide the 'type_id' is '0'.

- **pai_id:** A three digit unique number associated with each and every PAI. This number for bonafide with no medical glasses is '00', for bonafide with medical glasses is '01', and for bonafide with unisex glasses is '02'.

Here are some examples for more clarification:

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[1]`https://gitlab.idiap.ch/bob/bob.db.batl/blob/master/bob/db/batl/batl_config.py`

6

Table 1.2: Statistics for WMCA database

Category	Number of presentations
Bonafide	347
Glasses	75
Fake head	122
Print	200
Replay	348
Rigid mask	137
Flexible mask	379
Paper mask	71
TOTAL	**1679**

- 035_01_000_0_00.hdf5 : This is the bonafide file of client number 035 in session number 1 when they did not wear medical glasses.

- 005_01_000_0_01.hdf5 : This is the bonafide file of client number 005 in session number 1 when they did wear medical glasses.

- 530_03_001_2_18.hdf5 : This is a fake face attack where the identity 530 is presented to the camera by client number 001 in session 03.

- 018_02_000_3_10.hdf5 : This is a photo attack where the identity 018 is presented to the camera using stand in session 02.

1.5 Evaluation:

In the reference publication the color images obtained from "Intel RealSense SR300" are used along with data captured from several other channels. In this dataset we are providing only the preprocessed color images. Since the consecutive frames are correlated, only 50 frames from each video were selected. The

frames are uniformly sampled in the temporal domain. The total number of 1679 presentations including bonafide and presentation attacks were grouped into three subsets, train, dev, and eval. The data split is done ensuring almost equal distribution of PA categories and disjoint set of client identifiers in each set. Each of the PAIs had different client id. The split is done in such a way that a specific PA instrument will appear in only one set. A low level database interface is implemented that handles loading and spatial and temporal alignment of the data[2].

The preprocessing is done in several steps. First a face detection is performed. Once the face bounding box is obtained, face landmark detection is performed in the detected face bounding box. Then the images are aligned by transforming them such that the eye centers and mouth center are aligned to predefined coordinates. The aligned face images are resized, to the resolution of 128×128 pixels.

The preprocessed method is described in details in the reference publication and the implementation is available publicly [3]. The number of presentations in train, dev, and eval subset for the grandtest protocol of the reference publication is mentioned in Table 1.3.

Table 1.3: Statistics for train, dev, and eval subset of grandtest protocol

Subset	Bonafide	Presentation Attack	Both
train	124	441	565
dev	108	449	557
eval	115	442	557
TOTAL	**347**	**1332**	**1679**

Some example images of attack presentations are illustrated in Fig. 1.8

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[2]https://gitlab.idiap.ch/bob/bob.db.batl

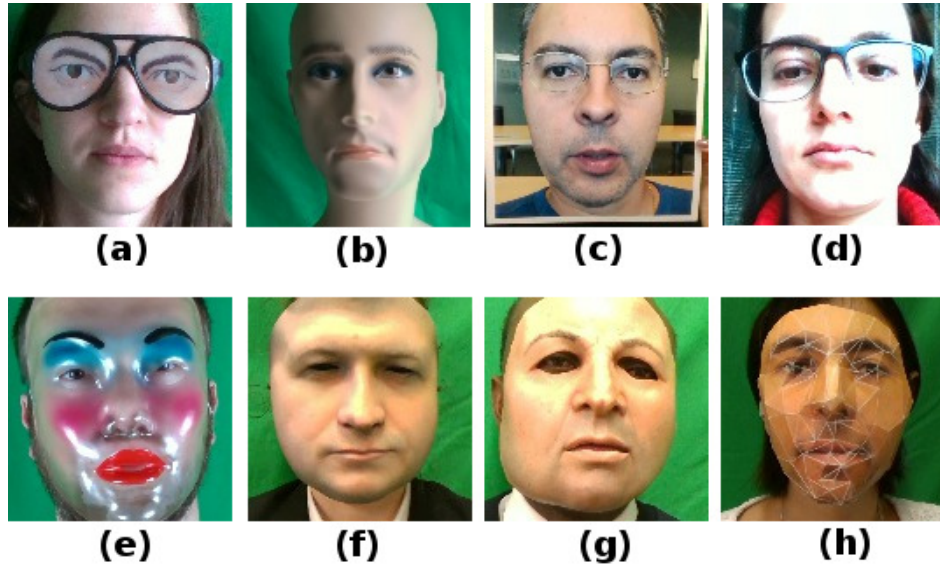[3]https://gitlab.idiap.ch/bob/bob.paper.mccnn.tifs2018

Figure 1.8: Examples of presentation attacks with different PAIs. (a): glasses (funny eyes glasses), (b): fake head, (c): print, (d): replay, (e): rigid mask (decorative plastic mask), (f): rigid mask (custom made realistic), (g): flexible mask (custom made realistic), and (h): paper mask.