White Paper

Face Detection with iCAT

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Introduction

One of the features introduced in Netavis Observer 4.4 is face detection in iCAT. This functionality can be used to identify and count faces in a video stream. Additionally it is also able to provide age and gender information of people which is particularly useful for retail applications. The aim of this white paper is to provide a step-by-step guide for setting up face detection and evaluating its performance.

This document assumes basic knowledge of Netavis Observer and discusses the subject of face detection from a practical point of view. If you do not know how to use or find the mentioned UI controls of the Observer client, please refer to the Netavis Observer User Manual. In particular section 15 “Video analytics with iCAT” in the Observer User Manual provides complementary material to the information presented in this guide.

1 Setup

Setting up face detection is somewhat similar to setting up an "Object tracking region". The detector also consists of a **region** of interest definition and an adjustable **sensitivity**. It has two operation modes: **face detection only** and **face detection with age and gender detection**.

After the detector is activated it automatically generates default detection events. It is also possible to define custom **event triggers** for the detector when the scenario requires more customization (filtering, several fields, etc.) of the event generation process. Once at least one custom event trigger has been defined, it takes over the event generation and the generation of the default events is stopped.

1.1 Camera and installation considerations

- The face detector captures frontal faces therefore the camera should be mounted so it is level with faces and in a position where the faces are visible in a frontal view.
- The camera should not be tilted, ideally it is mounted horizontally.
- The detector should operate on a video stream with at least a 720p resolution and 15 fps.
- Avoid backlight as much as possible. Backlight makes facial details less visible and can degrade age and gender detection accuracy.
- High quality cameras with good low light behavior are ideal for face detection.
- The minimal detectable faces are approximately 30x30 pixels in size.

1.2 Setting up face detection only operation

If only face detection is needed and age and gender information is not relevant (e.g. when a person's face should be visible to open a door) use a face detection only setup. Switching off age and gender recognition does not only result in a lower CPU load but also enables faster detection (as faces are quickly detected and no time is needed to process and verify the age and gender).

- On the Video analysis (iCAT) tab: Choose a camera, select **Add new definition**, and choose the **Face detection** type. (Please note that for each camera it is possible to define either an Object tracking region or a Face detection. If the Face detection option is grey and not available then please verify that no Object tracking region was previously defined for that camera.)
- Enter an **Identifier** for the face detection.
- Define the region where face detection will operate on the small camera view in the top-right corner.
- Uncheck the **Age and gender detection** checkbox.
- If necessary change the three grade sensitivity level (normal is a good default).
- Save the definition. At this point the detector is ready and will generate default face detection events.
- **Optional**: Add an event trigger definition to have more customization possibilities. A typical event trigger definition for face detection is: Polygon / Object is crossing field / Object center point.

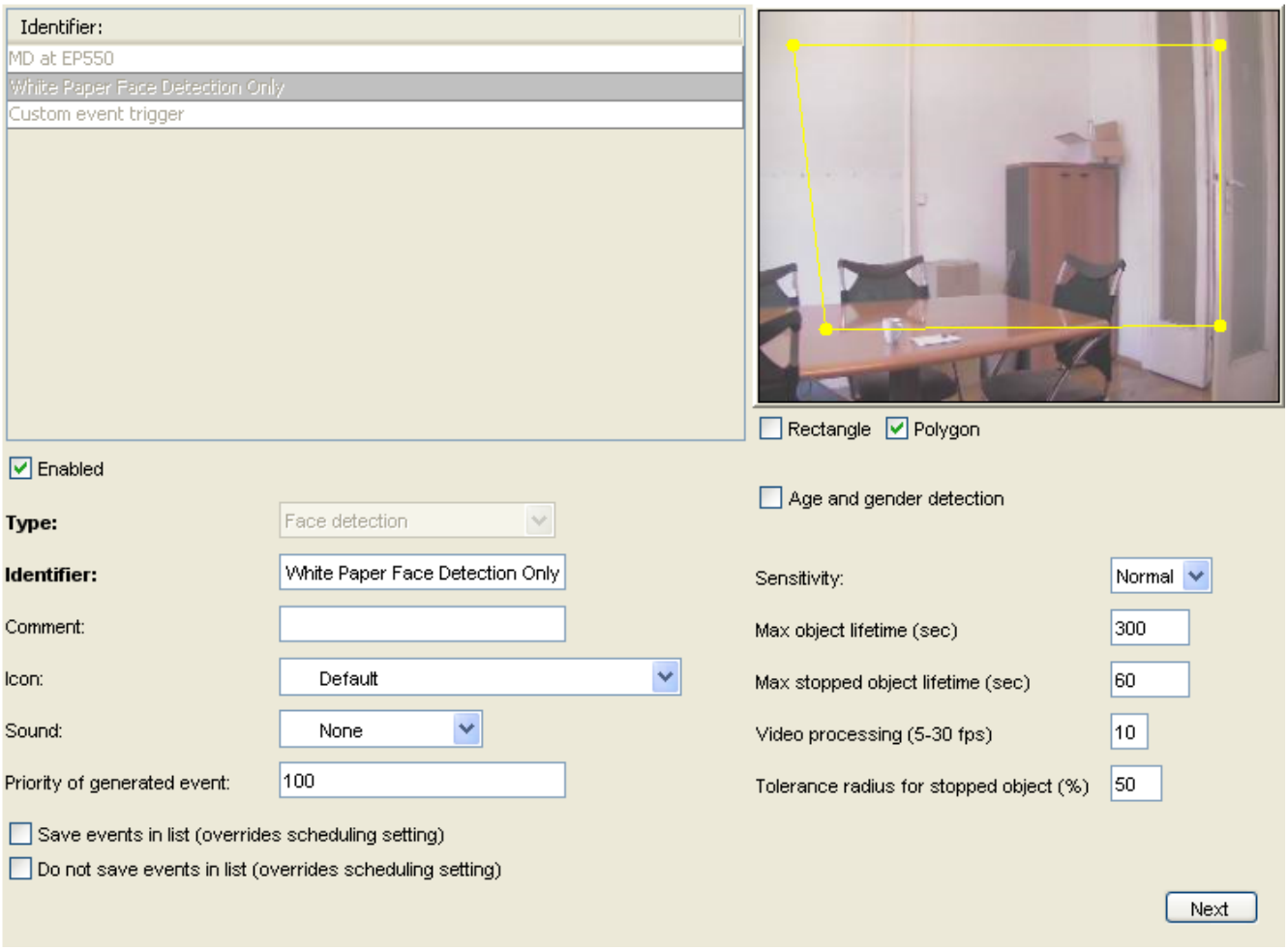

Figure 1: A face detection only setup with optional event triggers

1.3 Setting up age and gender detection

If age and gender information is needed, enable age and gender detection. In this operation mode, event generation is somewhat delayed (~1-1,5 sec) in order to capture stable detections.

- On the Video analysis (iCAT) tab: Choose a camera, select **Add new definition**, and choose the **Face detection** type. (Please note that for each camera it is possible to define either an Object tracking region or a Face detection. If the Face detection option is grey and not available then please verify that no Object tracking region was previously defined for that camera.)
- Enter an **Identifier** for the face detection.
- Define the region where face detection will operate on the small camera view in the top-right corner.
- Leave the **Age and gender detection** checkbox checked. Check or uncheck the **Display age groups** checkbox depending on the requirements.
- If necessary change the **Sensitivity** level (normal is a good default).
- Save the definition. At this point the detector is ready and will generate default age and gender detection events.
- **Optional**: Custom event triggers might be defined as well.

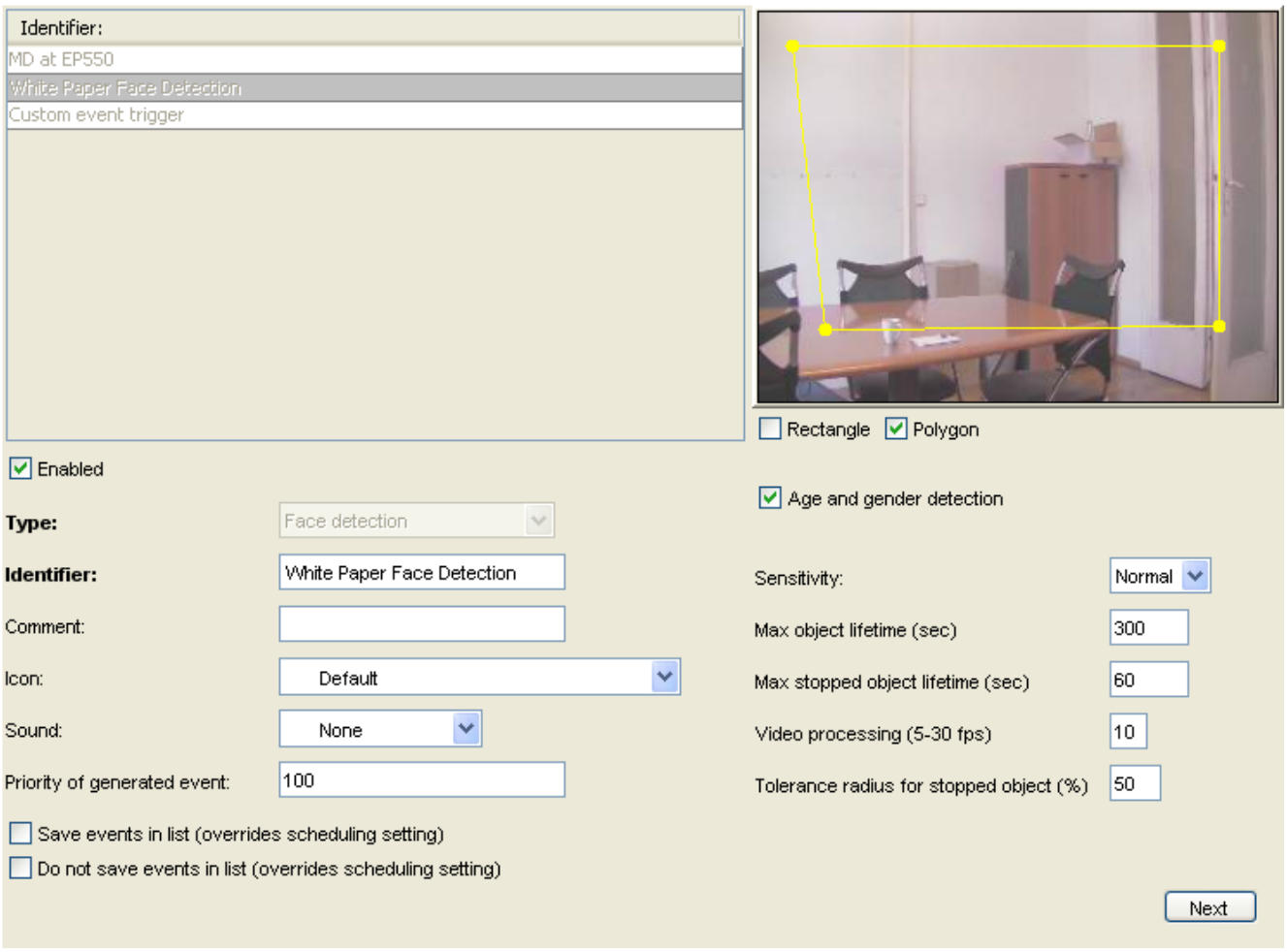

Figure 2: An age and gender detection setup with optional event triggers.

Besides being saved alongside the generated events the age and gender estimations are displayed in **Online Monitor** when **iCAT info display → Object markers** is switched on. If **iCAT info display → Object bounding boxes** is switched on a rectangle is drawn around detected faces. The color of this rectangle reflects the gender of the detected face: blue for male and red for female. If no age and gender

detection is enabled this bounding box is yellow. The estimation of the gender is more than 90% accuracy and the age estimation is accurate to within +/- 8 years.

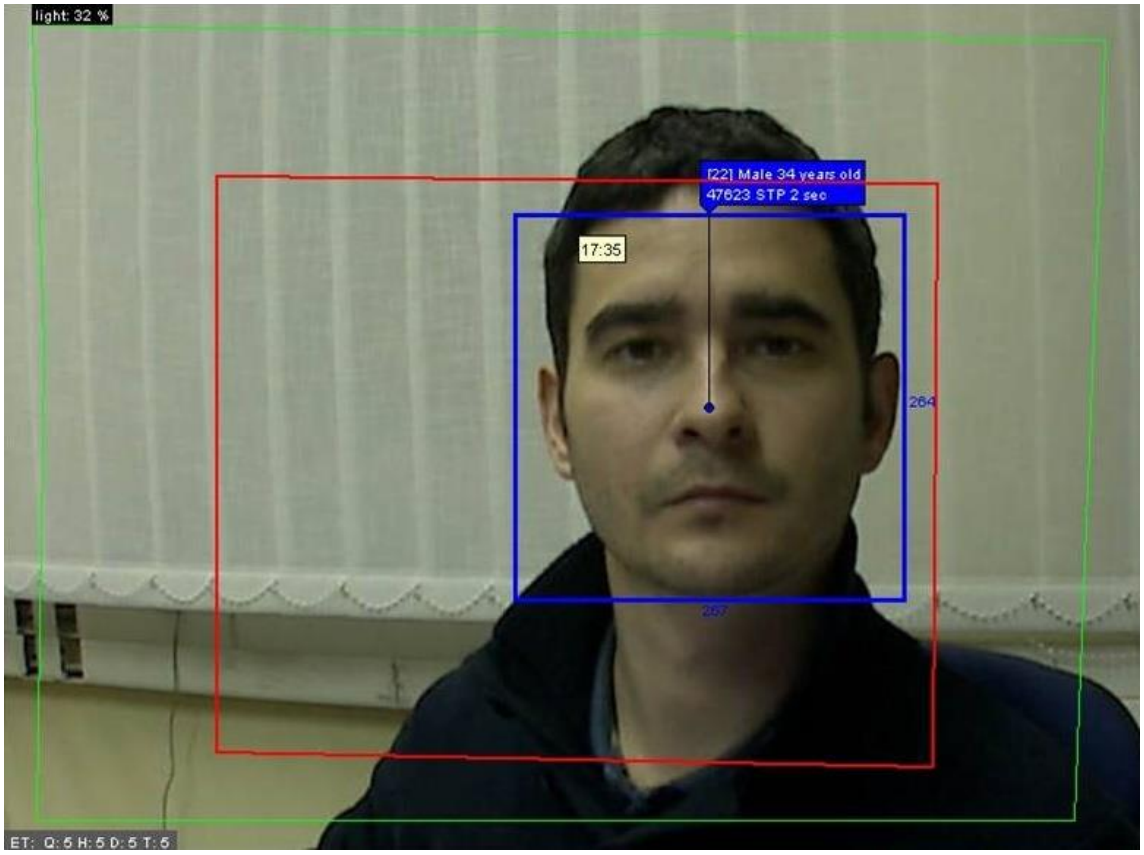

Figure 3: Information from an age and gender detection setup in the Online Monitor

The red rectangle visible in Figure 3 is the polygon of an event trigger. It is usually yellow but if an event is triggered it turns red for a few seconds.

Age groups

Detected age results are sorted into age groups whereby the default groups are: 0-10, 11-20, 21-30, 31-40, 41-50, 51-60, 61-100. These groups are then displayed in event details (e.g. the "age 21-30" text in Figure 5). Events in the same age groups are also collected and counted together in the statistics export. These age groups can also be customized. For more information please see the **AgeRangeConfig.SAMPLE.txt** file on the **Observer Customizer** page.

1.4 Face detection events

Different events are generated depending on whether the face detector was set up to operate with or without age and gender detection:

32079	31/08/2012 13:41:33		Face detected in field face on camera SIMUL:asztal [test66]
32082	31/08/2012 13:41:36		Face detected in field face on camera SIMUL:asztal [test66]
32087	31/08/2012 13:41:45		Face detected in field face on camera SIMUL:asztal [test66]
32094	31/08/2012 13:42:09		Face detected in field face on camera SIMUL:asztal [test66]

Figure 4: Face detection events without age and gender detection

32270	31/08/2012 13:46:37		Woman with age 11-20 detected in field face on camera SIMUL:asztal [test66]
32273	31/08/2012 13:46:37		Man with age 11-20 detected in field face on camera SIMUL:asztal [test66]
32276	31/08/2012 13:46:43		Man with age 31-40 detected in field face on camera SIMUL:asztal [test66]
32279	31/08/2012 13:46:45		Man with age 21-30 detected in field face on camera SIMUL:asztal [test66]

Figure 5: Face detection events with age and gender detection

A double-click on the generated event opens the event details view.

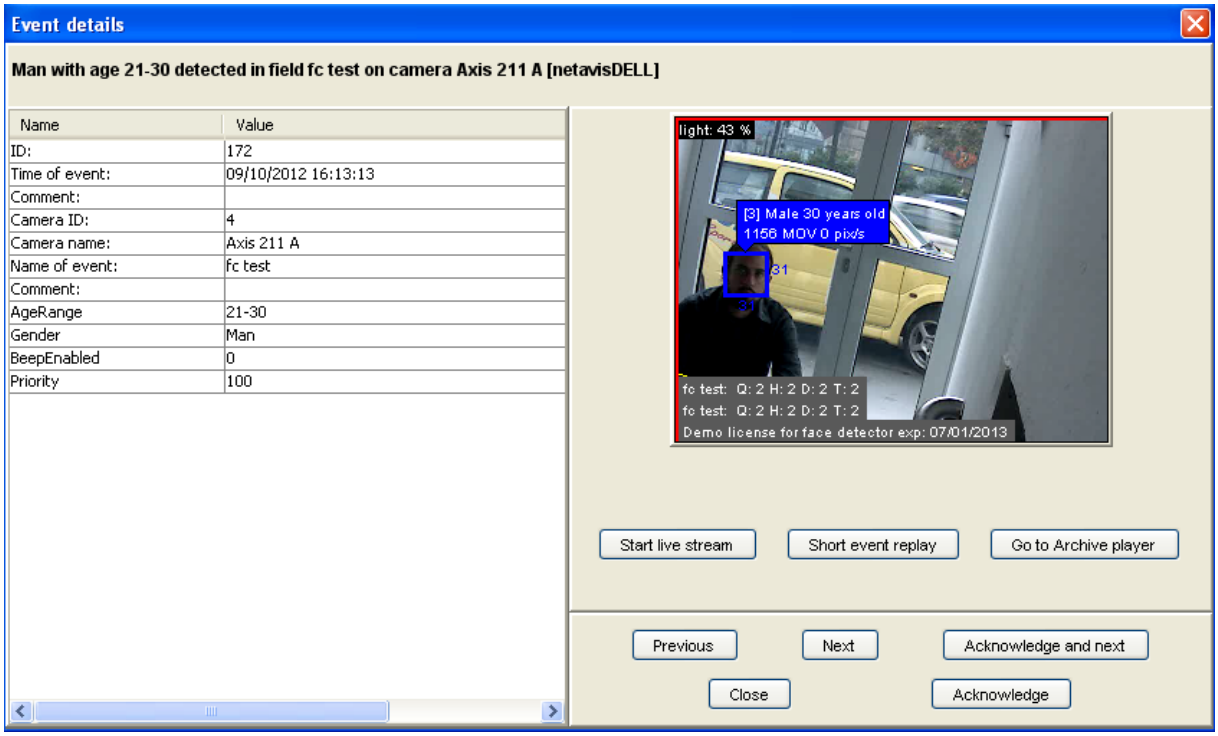

Figure 6: Details view of a face detection event

These events are automatically generated without event trigger definitions, though optional custom event triggers can also be defined. Such custom event triggers allow for geometric constraints to be added to a face detector. More specifically it is possible to define several different areas in the image and trigger events with different conditions (filters, other event trigger settings) for each of them.

An example scenario is a camera that is watching two doors. A different event trigger polygon can be defined for both doors to obtain events which are in some way different for each door. Both types of generated events are face detection events but they differ in their “field name” parameter (which is the name of the event trigger definition, for example “Door1” and “Door2”). It is then possible to find events for a specific door by filtering for the field name. Similarly in the statistics export there are also separate columns for each door.

For custom event triggers the polygon option is recommended as the usefulness of a tripwire is limited if a camera is looking at the faces frontally. In such a setup there is often no definite trajectory of the faces which can cross a tripwire.

Summary: (1) Check the camera and installation considerations. (2) Create a new Face detection definition. (3) Decide and configure whether a face detection only or age and gender detection mode is needed. If necessary configure custom age groups. (4) Create custom event triggers to add additional flexibility and constraints to a face detector setup.

2 Possible Applications

There is a broad spectrum of applications for face detection. Some common scenarios are:

- **Retail & Marketing**: Statistics about the age and gender of customers provide value in retail and marketing applications. This information can be combined with other iCAT functionality such as visual statistics (heat maps), tripwires, etc.
- **People Counting** using faces instead of iCAT tripwires. Either people counting only (without age and gender detection) or people counting with age and gender detection is possible.
- **Face detection as a trigger**: For example in a bank doors are only opened (using I/O contacts) if a face is detected – thus the door does not open for masked persons.
- **Event-based recording** if faces are detected.

3 Licensing

Face detector licensing is different from the standard Netavis licensing process. Its steps are:

1. During the server installation a customer key file is generated. Its name is **FaceDetectorCustomerKey.c2v** and it is available for download on the **Observer Customizer** page. After installation a trial version of the detector is available for one camera and for a period of 3 months.
2. The customer key should be downloaded and sent to Netavis to generate a license file.
3. To activate a license file upload it to the server on the Customizer page and restart the server.
4. If a license with different parameters as the preceding active license is necessary send the customer key again to Netavis along with the different license parameters. Then activate the license key as in step 3.
5. Activated licenses are backed up during the system backup. After a big upgrade these licenses will also be reactivated when the system backup is restored.
6. Note: Some hardware modifications of the server machine might require a renewal of the license.

Figure 7: The face detector customer key on the Customizer download page

4 Additional resources

- Netavis Observer User Manual:

  Netavis Observer – Help – User Manual

  http://Netavis.net – Support - Documentation