Homework 1
RInS

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Date: 31. 3. 2021

Contents

Introduction

The document contains the evaluation of 3 face detectors, which was conducted on real life videos which contained a printed face on a wall.

The first detector used is a Haar cascade (source: https://towardsdatascience.com/face-detection-in-2-minutes-using-opencv-python-90f89d7c0f81), the second is a Hog detector from the library dlib provided in the labs of the course, and the third is a DNN from the library OpenCV.

These detectors were tested on the same footage with 3 different lighting conditions. The tests were conducted under 5 different camera angles (90°, 75°, 60°, 45°, 30°), where 90° means straight on.

In the following graphs F1 was used as a measure.

$$F1 = \frac{2 * TP}{2 * TP + FP + FN}$$

Where TP is the number of correctly detected faces, FN is the amount of not detected faces where there was one and FP are all falsely detected faces.
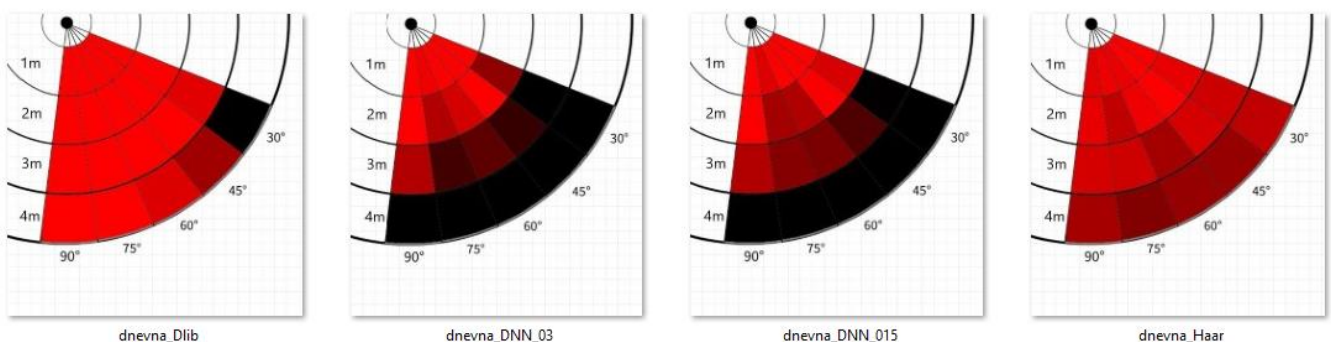
This is the scale used, where F1 score ranges from 1 (red) to 0 (black).
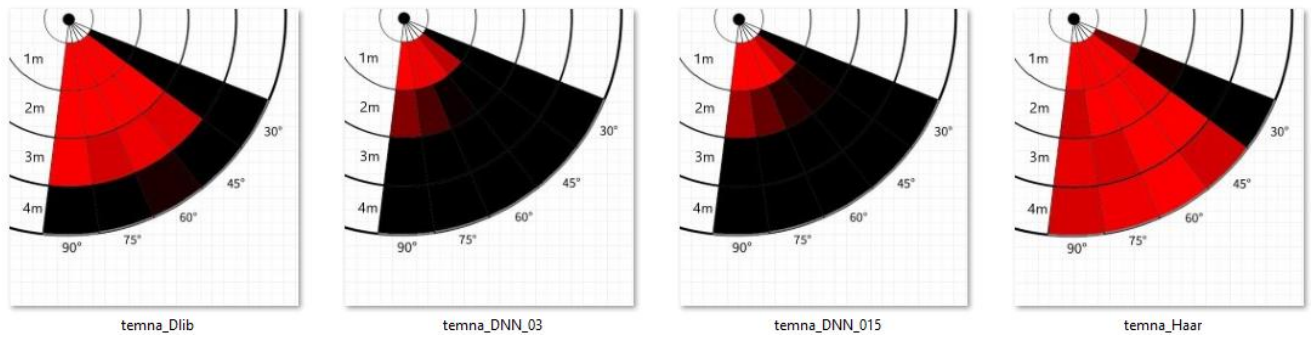
Grouped graphs

The DNN detector was tested for two different cut-off rates of confidence level: 0.3 and 0.15.
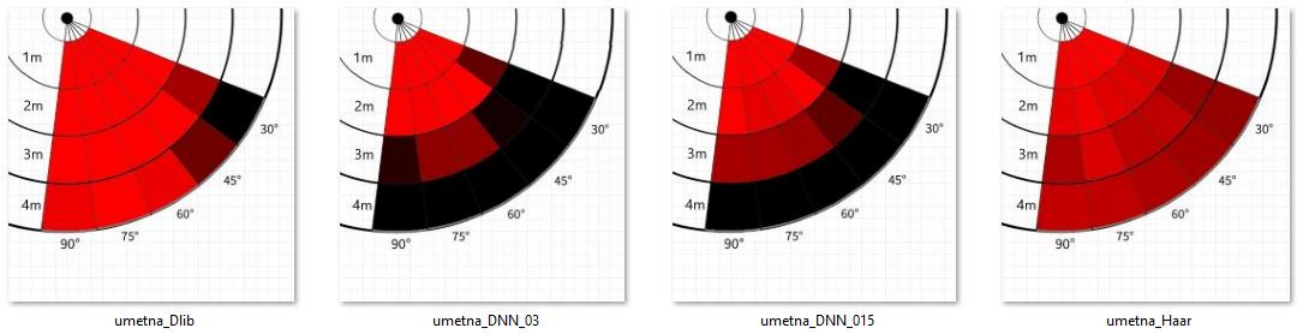
These graphs were grouped by lighting condition.

1. Natural daily light:

dnevna_Dlib   dnevna_DNN_03   dnevna_DNN_015   dnevna_Haar

2. Dimmed daily light in the evening:

| temna_Dlib | temna_DNN_03 | temna_DNN_015 | temna_Haar |

3. Artificial industrial light:

| umetna_Dlib | umetna_DNN_03 | umetna_DNN_015 | umetna_Haar |

From these graphs it is visible that Haar cascade and Hog from Dlib have the best detection rate. The data additionally shows that Haar has far more false positives than Hog.
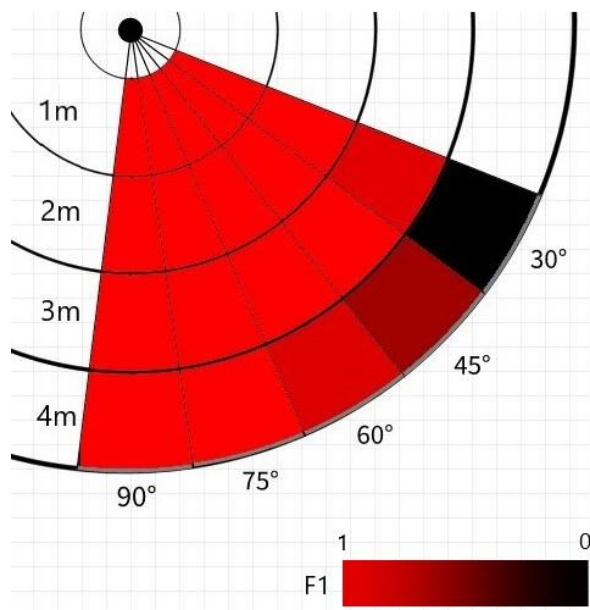
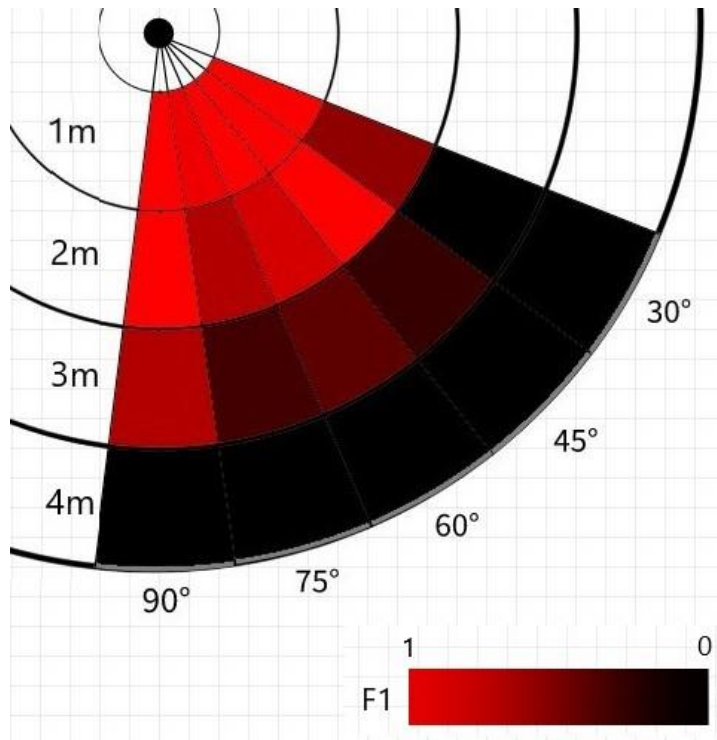# Individual graphs

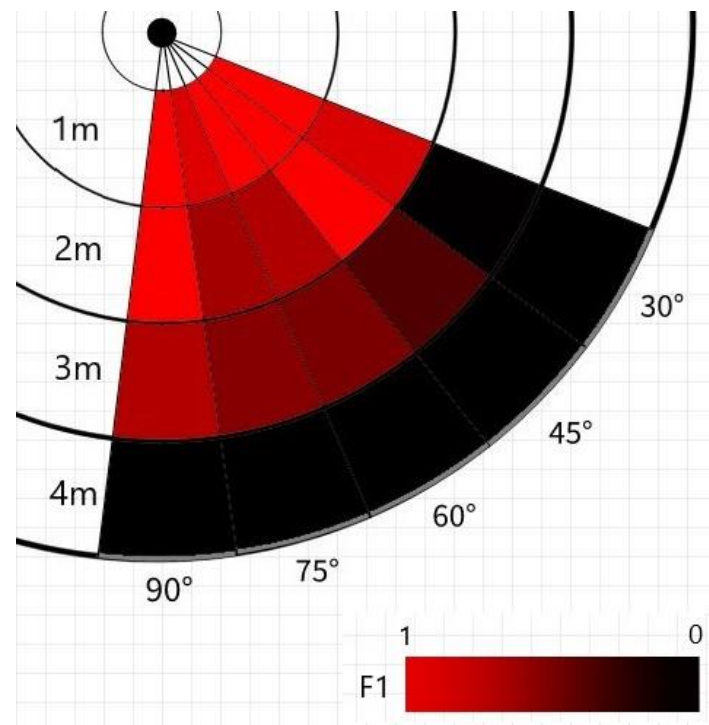*Figure 1 Hog dlib, natural daylight*

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Figure 2 DNN confidence level 0.3, natural daylight

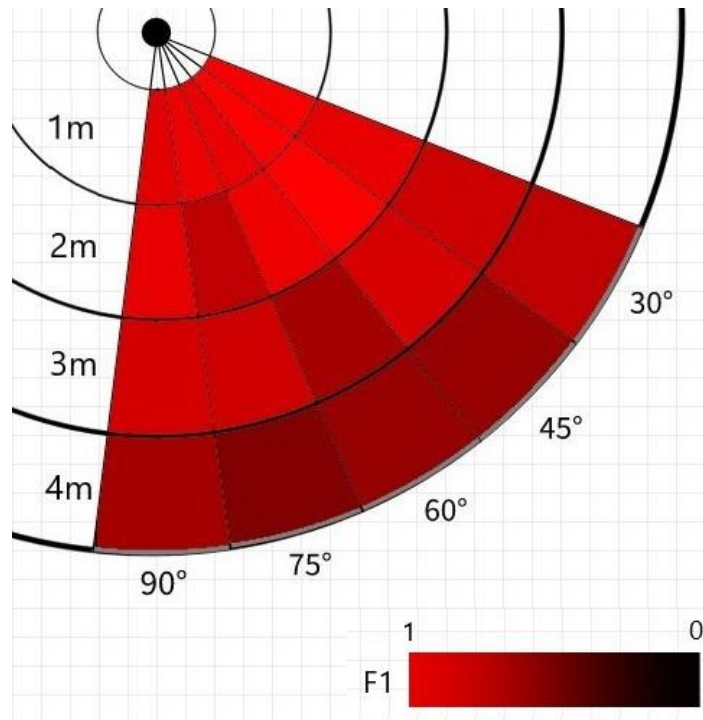*Figure 3 DNN confidence level 0.15, natural daylight*

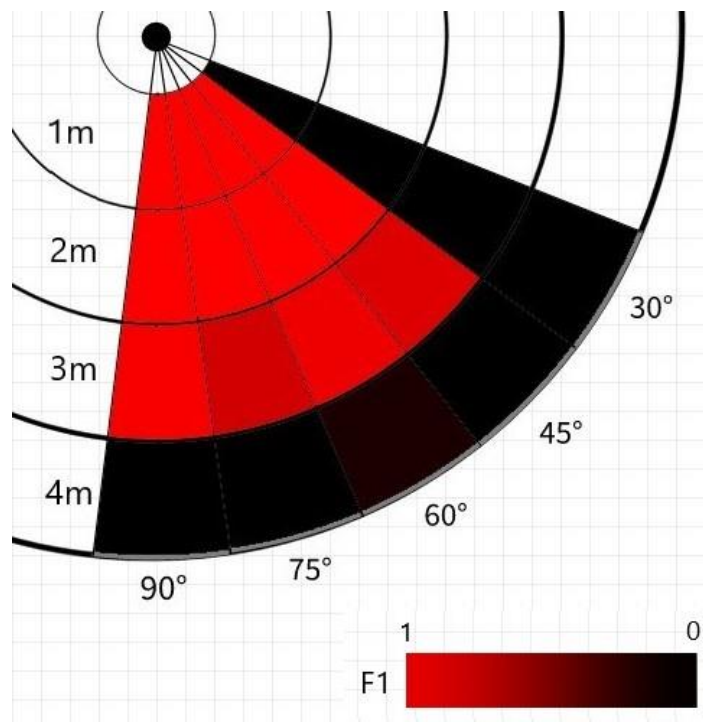*Figure 4 Haar cascade, natural daylight*
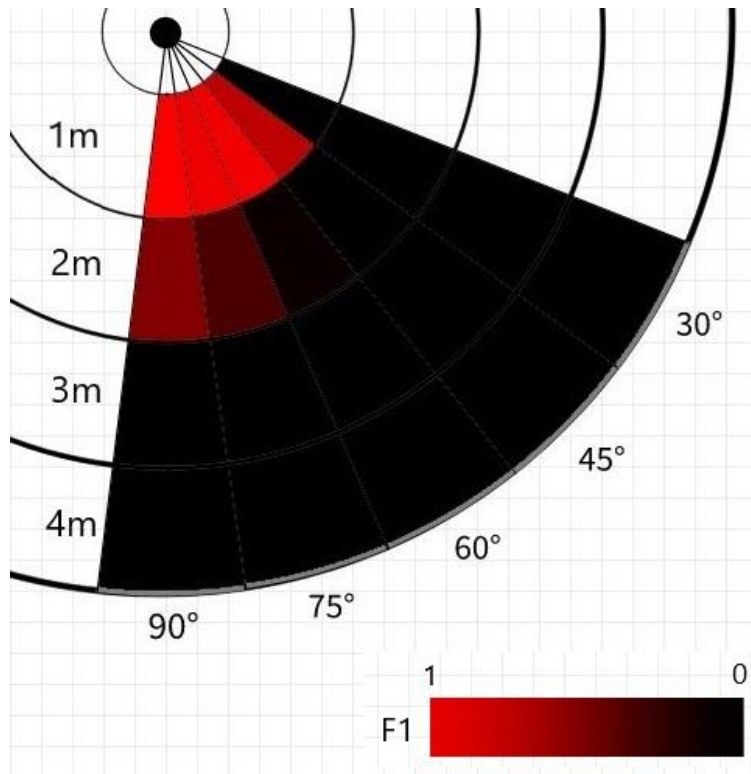

Figure 5 Hog dlib, evening light

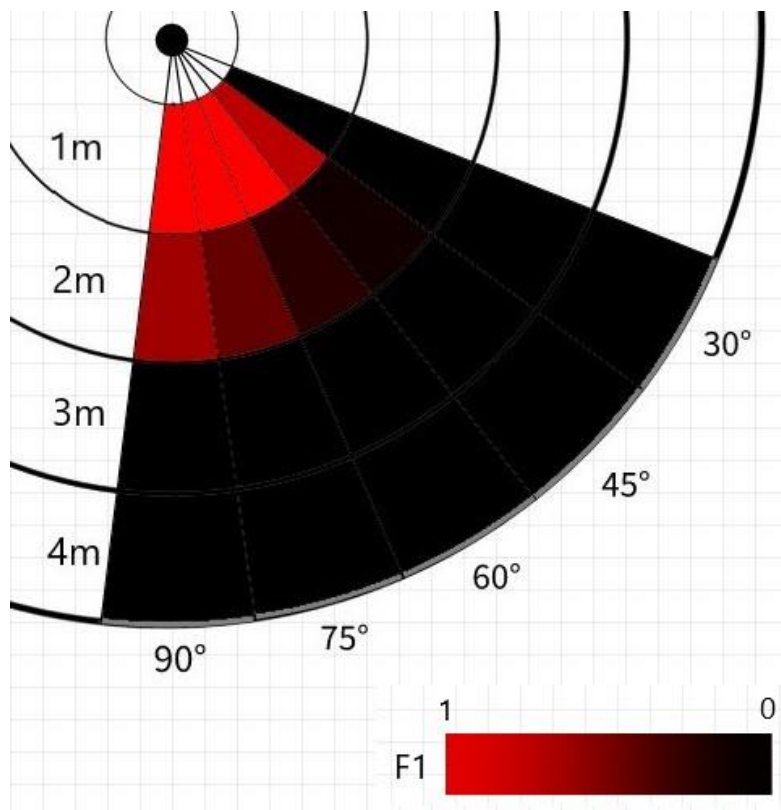*Figure 6 DNN confidence level 0.3, evening light*

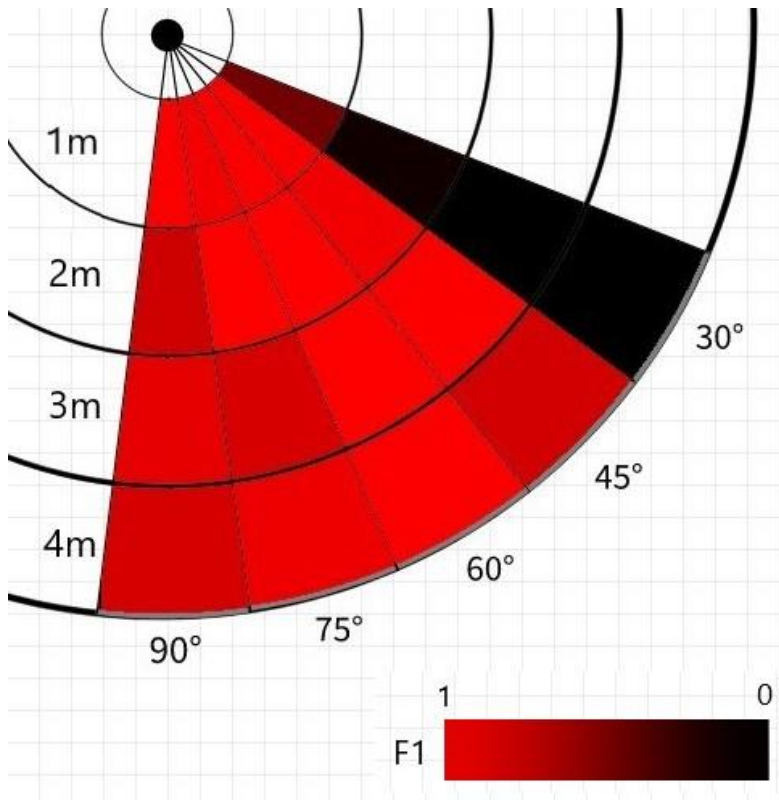*Figure 7 DNN confidence level 0.15, evening light*
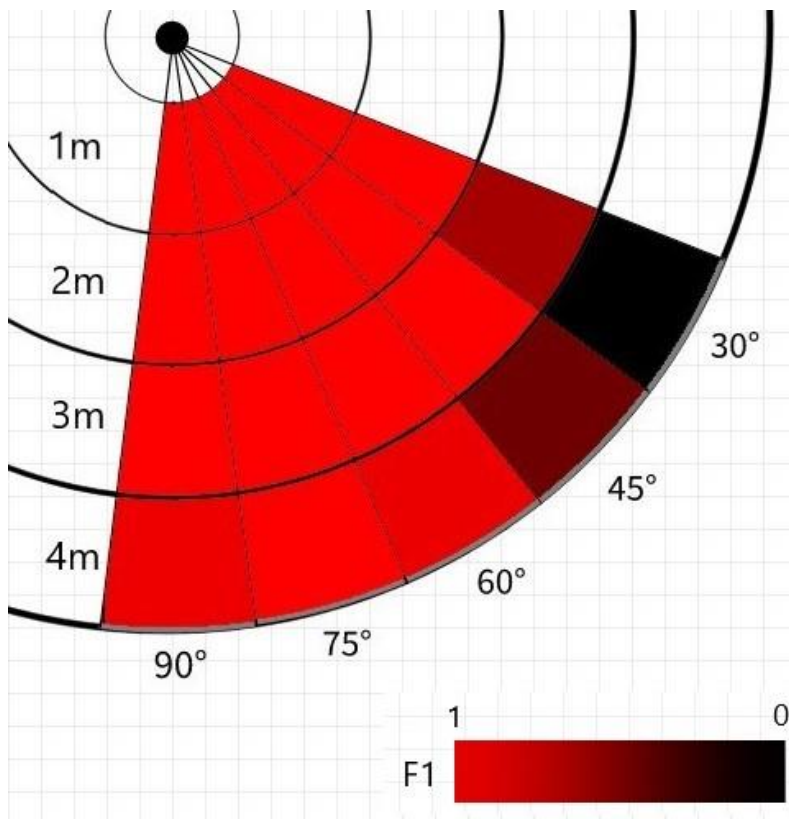
Figure 8 Haar cascade, evening light
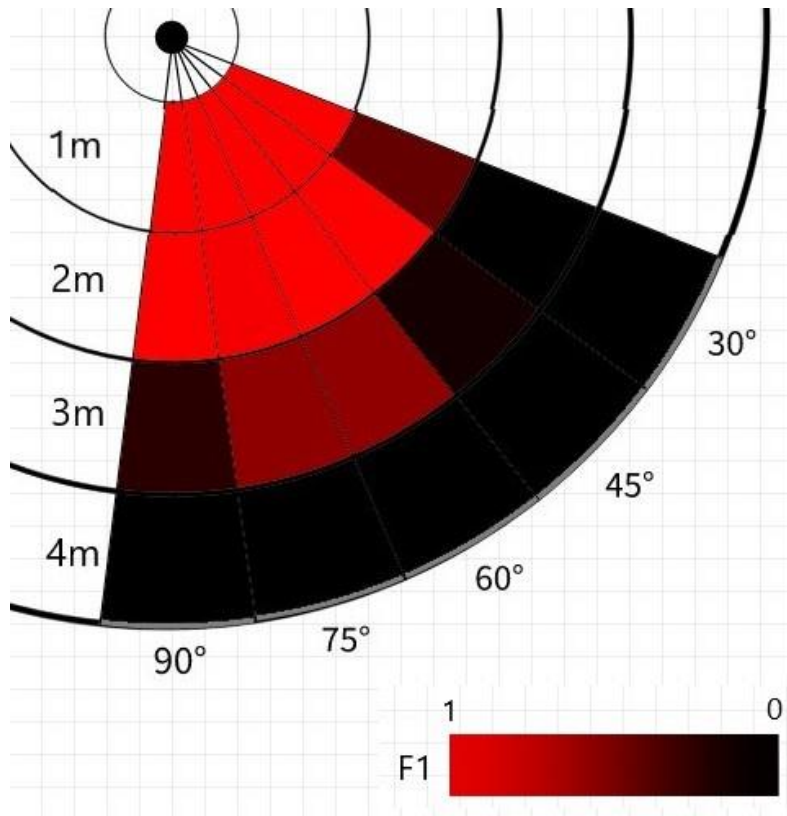

Figure 9 Hog dlib, artificial light

Figure 10 DNN confidence level 0.3, artificial light
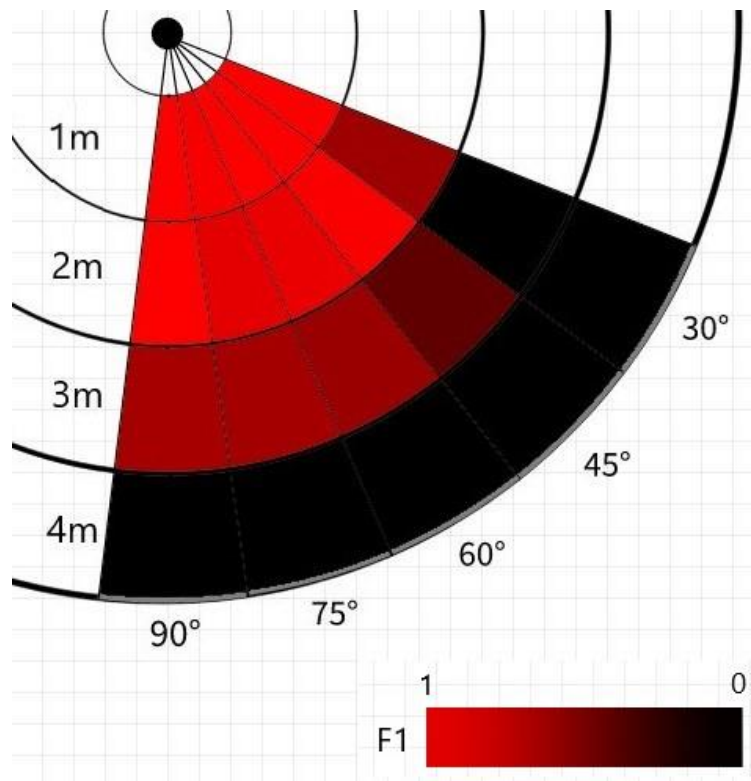

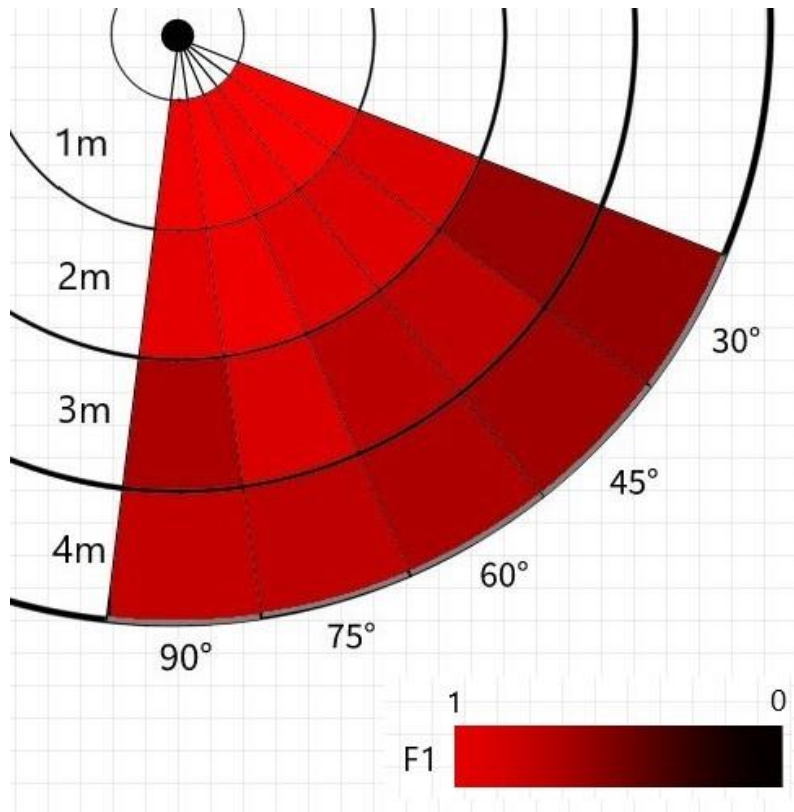*Figure 11 DNN confidence light, artificial light*

Figure 12 Haar cascade, artificial light

Additionally, the detectors were tested on shaky footage with a lot of motion blur (only at 90-degree angle and artificial lighting).
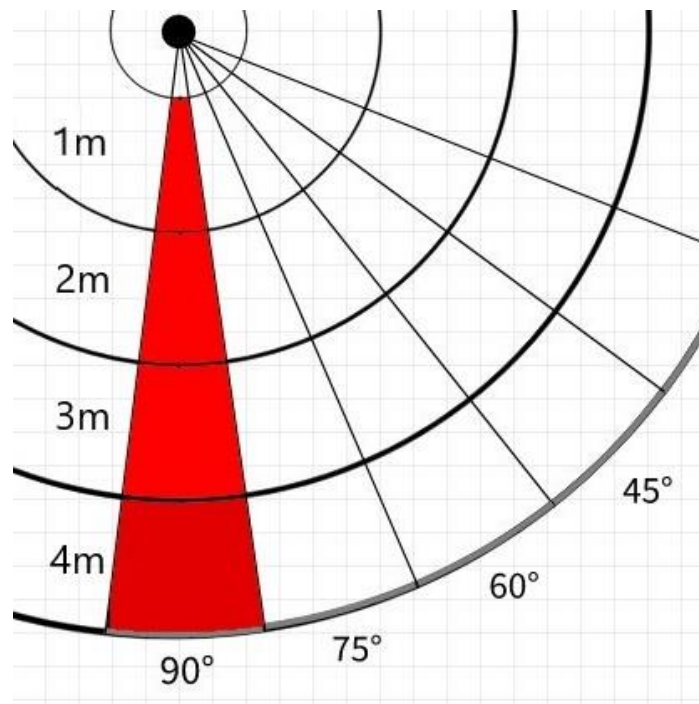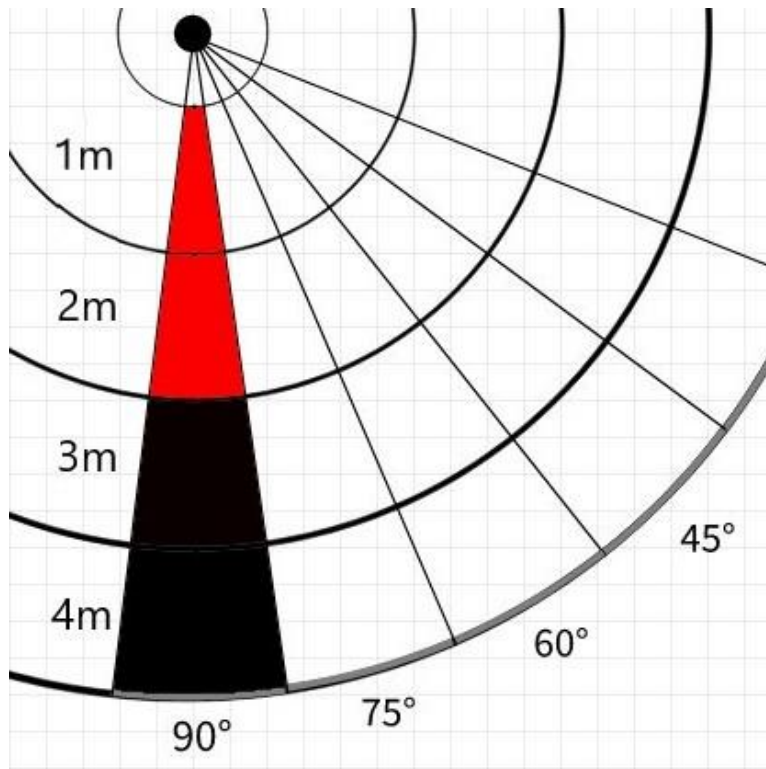

Figure 13 Hog dlib, shaky footage
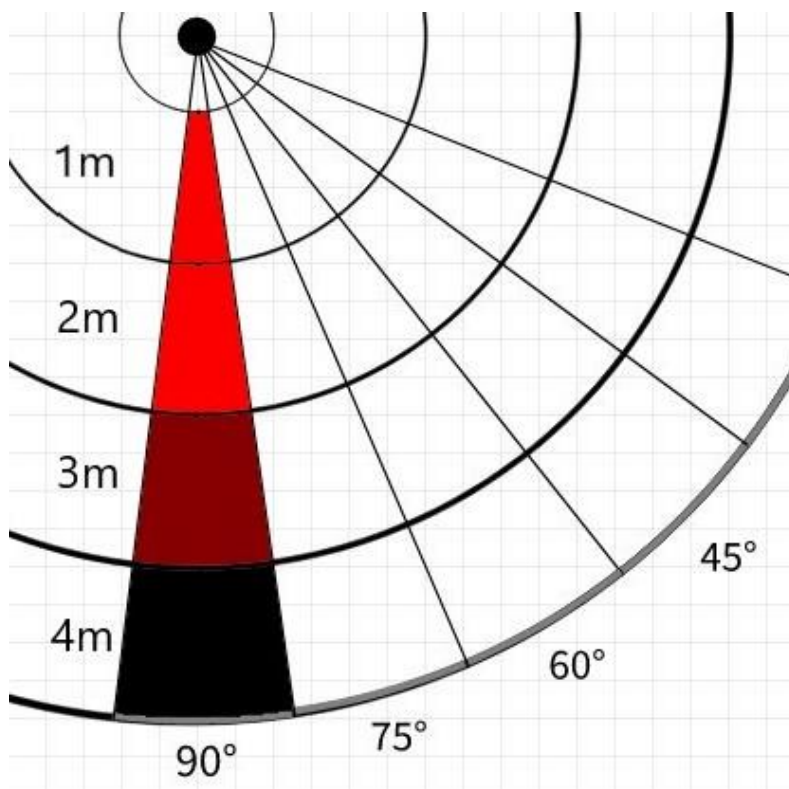
Figure 14 DNN confidence level 0.3, shaky footage

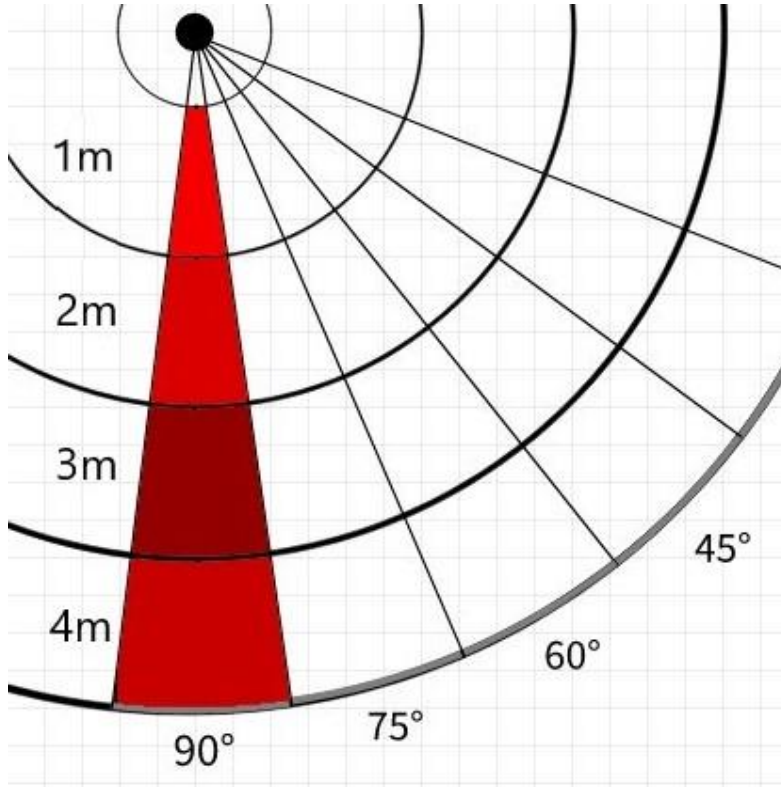*Figure 15 DNN confidence level 0.15, shaky footage*

Figure 16 Haar cascade, shaky footage

Raw data and additional calculations

The raw data can be found in the added files: *results_dlib.csv, results_dnn_03.csv, results_dnn_015.csv, results_haar.csv.*

The data also contains the calculations for recall and precision.

$$recall = \frac{TP}{P}$$

$$precision = \frac{TP}{TP + FP}$$