CW2 : Object detection task

**Subtask1 :** **The Viola-Jones Object Detector**

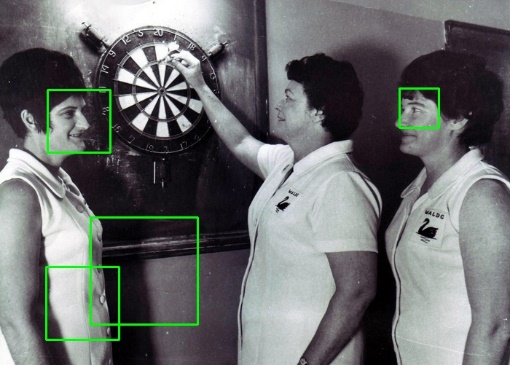
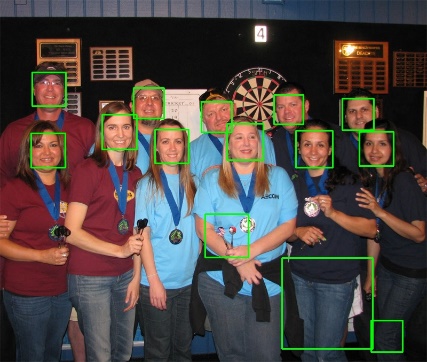


Figure 1 : face detectors of picture 4,5,13,14,15

These five pictures are detected using frontalface.xml.The TPRS of picture 5 and 15 are calculated by following:

TPR = TP/TP+FN Dart5 : TPR = 1; Dart15:TPR = 0.6667 The difficulty during calculating TPRs is it is hard to determine which is true positive. It is hard to decide if it is the positive one when a bound box is drawn around a part of face. And the reason why it is challenging for computer is that the colours of skin, facial expressions, light .etc, which have great impact on the accuracy of detection.

It is always possible to achieve a 100% TPR because the Viola-Jones face detector always can identify every part of the image such that every object is detected. But the accuracy may be low , eg, some non-facial parts also marked as face, which leads to high false positive rate(FPR). A better detector should have 100% TPR and low FPR.

There are several rules created in order to calculate F1 score: 1.A face only considered valid only if the mouth and eyes are visible and it must be a human face. 2.The bound box must circle out the eyes and the mouth fully and the size of box cannot be larger than 1.5x dimensions. F1 score can be calculated using formula: F1 = 2TP/(2TP+FN+FP) -> dart15 : F1 = 0.57; dart 5 : F1 = 0.88 We can also use ground truth to ensure true positive by calculating the overlap area between detected faces and setting ground truth.

**Subtask2 :** **Building & Testing your own Detector**