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Lectures on Image Processing

Chapter 8B
Face Detection

Einige Bildbeispiele gem. UrhG §52a nicht enthalten

8B. Face Detection

- Face detection: Is there any face in the image?
- Face recognition: Is a face identical to a specific person?
- Face identification: Which does this face belong to out of a given number of faces?

8B. Face Detection

Different Methods:

- Rapid object detection using a boosted cascade of simple features, Viola, Paul and Jones, Michael, 2001
- Eigenfaces for face recognition (not treated in this chapter)

8B. Face Detection

Because of the large variety of faces many „weak“ conditions have to be fulfilled to detect a face within an image.

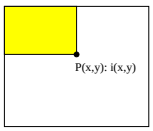
Conditions may be developed from shades of grey within a face.

Area of eyes is darker than the forehead,
eyes are darker than the nose in between,
… and many other conditions.

For fast calculation of grey level areas integral images are used.

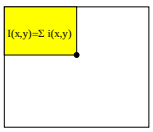
All face images are taken from free accessible images of the internet and may be used only for exercises of this chapter.

8B. Face Detection, Integral Image



Integral Image 01

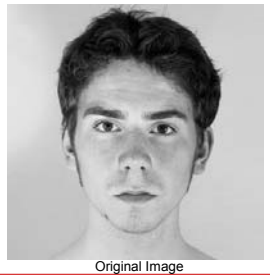
i(x,y): grey value at position P(x,y)



Integral Image 02

I(x,y): sum of all grey values P(0,0) → P(x,y)

8B. Face Detection, Integral Image



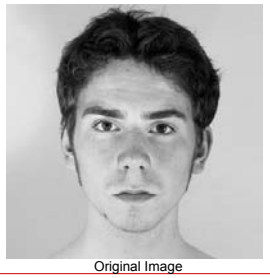
Original Image

How will the integral image look like?

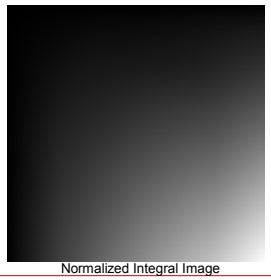
Take a sheet of paper and make a sketch of the integral image.

Normalized Integral Image

8B. Face Detection, Integral Image



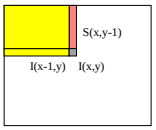
Original Image



Normalized Integral Image

8B. Face Detection, Calculation

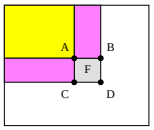
How to calculate the integral image



Integral Image 03

I(x,y)=I(x-1,y)+S(x,y-1)+i(x,y)

How to calculate the mean grey value of any square



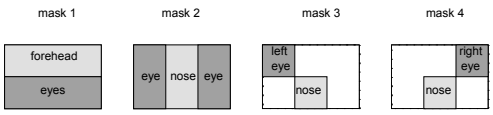
Integral Image 04

F = D –C – B + A

Calculation time is independent of area size

8B. Face Detection, Some Feature Types

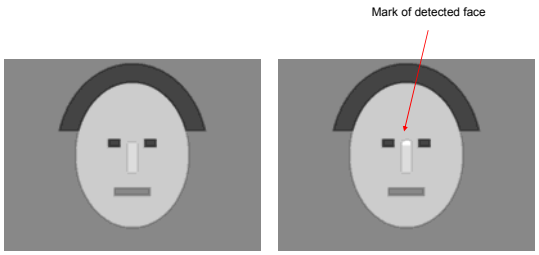
Scan image with following masks



Integral Image Masks.dsf

If conditions are met, face might be detected

8B. Face Detection, Analysis of Synthetic Image



Analysis using four masks

8B. Face Detection, Analysis of Natural Image

Analysis by mask 1 and mask 2

Analysis by mask 3 and mask 4

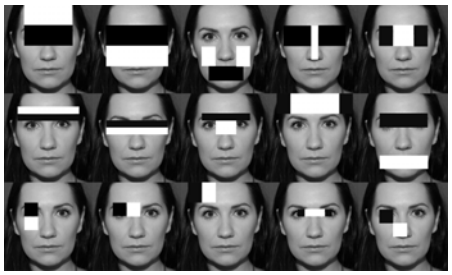
8B. Face Detection, Analysis

Coincidence of masks 1 to 4

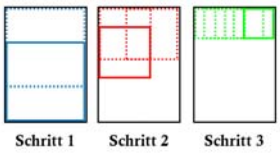
8B. Face Detection, Results (only four features used)

All faces from internet

Source: A. Sommer, HS-RM, WS 2016/17



Source: A. Sommer, HS-RM, WS 2016/17



Review of Chapter 8B

- Meaning of face detection / recognition / identification
- What is the meaning of integral image
- How to calculate the integral image
- How to calculate the mean grey value of any square
- Useful masks for face detection
- How many „weak“ conditions may detect a face