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# Face recognition

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## DIGITAL SIGNAL PROCESSING PROJECT

UNIVERSITY OF APPLIED SCIENCES VORARLBERG  
MASTER IN MECHATRONICS

SUBMITTED TO

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# 1. Problem description

## 1.1 Overview

According to the article ZHAO et al. (2003) face recognition can be segmented into three key steps, shown in figure 1.



Figure 1: Face Recognition Progress

**Face Detection** is responsible for a rough normalization (like face tracking) and use for this task different approaches (see figure 2).

**Face Extraction** generates a more accurate normalization (like human emotions). The different approaches to get this emotions are shown in figure 3. Face detection and face extraction approaches can use the same feature-based-method (like informations out of color, Motion, ... see figure ) so they can perform simultaneous.

**Face Recognition** is the last step to identify/verify a picture. For a verification/identification several methods (see figure 4) are available.



Figure 2: Face Detection divided into approaches.



Figure 3: Face Extraction divided into approaches.



Figure 4: Face Recognition divided into approaches.

## 1.2 Face Detection

The most interest part from our point of view was the Face detection. To find an approach which we can study, implement and test we made further researches in this segment. The article Hjelmas (2001) gives a good overview of the topic face detection. The figure 5 (out of Hjelmas (2001)) represents the different approaches to detect faces in a picture.

The most interesting approach for us was *Face detection based on color likelihood* approach (in figure 5 marked as *Color*).

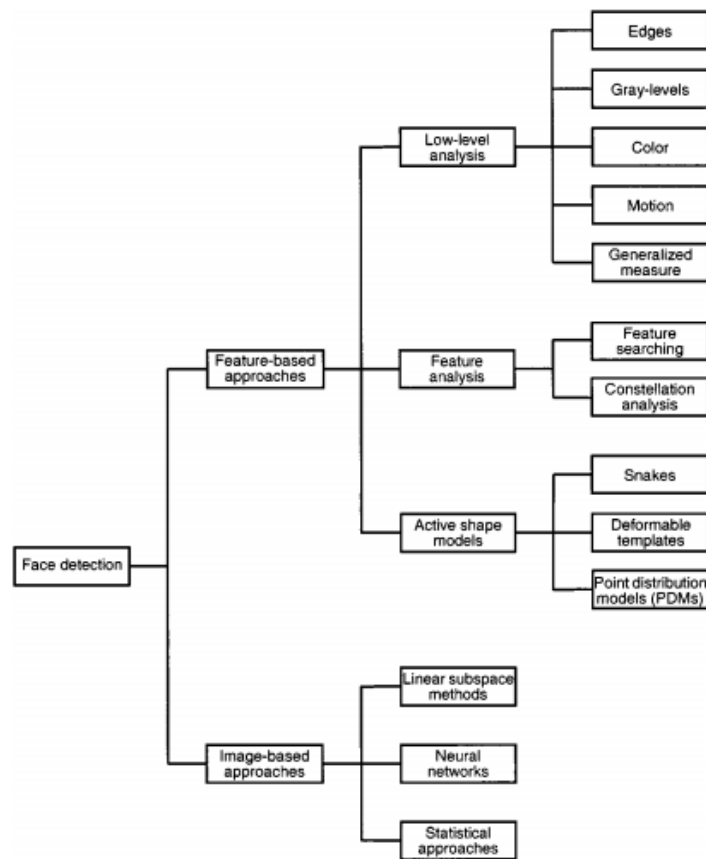


Figure 5: Face Detection divided into approaches (more detailed).

## 2. Literature Analysis

The literature analysis began with the topic selection (see chapter 1). The supervisor told us that the initial chosen topic *Face Detection* is too big to treat within one semester, so the first literature research was done to find a specific topic to handle.

The second literature research was done to find information about the chosen topic.

### 2.1 Approach

All interesting literature which were found and marked as interesting (by scanning the abstract) were saved in a list on the Ilias project space. This articles were read in a more detail afterwards.

The structure of the table (see figure 6) make additional sorting (by exporting/copying into an EXCEL) possible and the implementation on ILIAS makes it possible to get access easily to the actual table.

Literature Research (LR)				
ID	Date	Topic	Source	comment
1	22.10.2016	general	olav: face recognition database	<a href="#">ScienceDirect - On internal representations in face recognition systems</a> analysis of face recognition systems; mentioned databases: FERET and <a href="#">Face database info MIT</a>
2	27.10.2016	general	google: face recognition overview	<a href="#">Face Recognition: A Literature Survey</a> nice overview about face recognition (split into Detection, extraction and Recognition) -> Useful to search a more detailed topic.
3	27.10.2016	Face detection	olav: face detection	<a href="#">ScienceDirect - Computer Vision and Image Understanding - Face Detection: A Survey</a> Good overview about different approaches to detect faces
4	27.10.2016	Face detection - color	olav: face detection	<a href="#">ScienceDirect - Pattern Recognition - Face detection based on skin color likelihood</a> Face detection based on color likelihood - approach of: Face detection -> Feature-based approaches -> low level analysis -> color

Figure 6: Literature research table - 30.10.2016.

All literatures which were mentioned in this document are also listed in the bibliography.

## **2.2 Literature analysis of the topic face detection based on color likelihood**

documentation why articles have been selected or rejected. All used sources must be mentioned here



# Bibliography

Hjelmas, E. (2001). Face detection: A survey. *Computer Vision and Image Understanding*, 83(3):236–247.

ZHAO, W., CHELLAPPA, R., P.J.Phillips, and Rosenfeld, A. (2003). Face recognition: A literature survey. *ACM Computing Surveys*, 35(4):339–458.