

# MACHINE LEARNING

# Postgraduate Course Project

# "Machine Learning Applications for Face Detection"

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# Machine Learning on Face Detection

## Goals

- Detect faces in into the wild images
- Avoid fake face detection created by noisy image areas
- Create a generative model that has the maximum ratio between real and fake detections

## Means

- Filters detecting human face parts
- Training sets of images with faces
- Data analysis for human face modeling
- Machine Learning methods for classification and regression

# Machine Learning on Face Detection

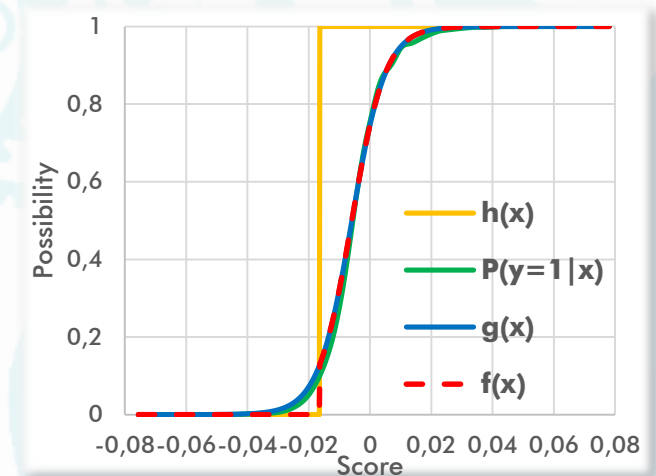
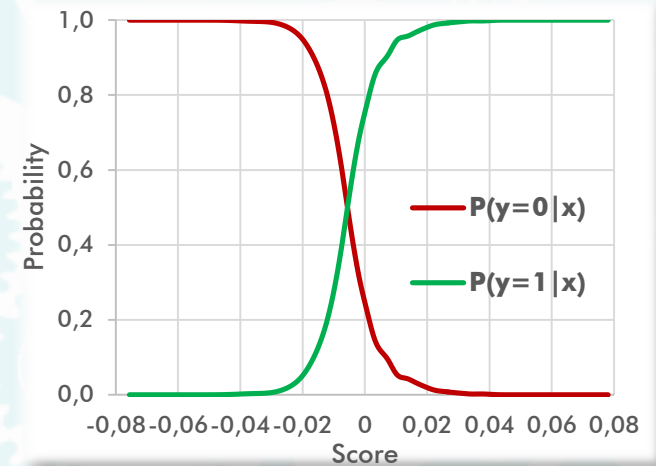
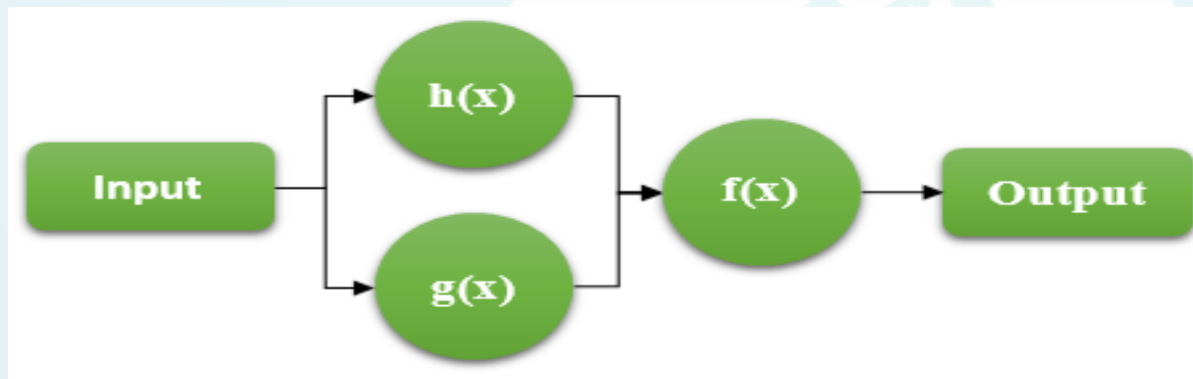
## Solutions

- Neural Net (2 kernel functions) for classification and certainty prediction of landmark detection using linear regression (return the possibility of an input to be a landmark)
- Data Analysis and SVM/K-Nearest Neighbor for landmark combination and face parts detection (analysis of the distances between the landmarks that are parts of a human face part (eyes, jaws, mouth, nose, eyebrows))
- Linear regression for choosing  $W$  vector on face predictive function using face parts as variables (use large  $w_i$  values for more critical parts in order to have more better detection performance)
- Linear regression for classification function using the certainty variable (A function that returns the possibility of a detection to be a human face)

# Machine Learning on Face Detection

## Neural Network

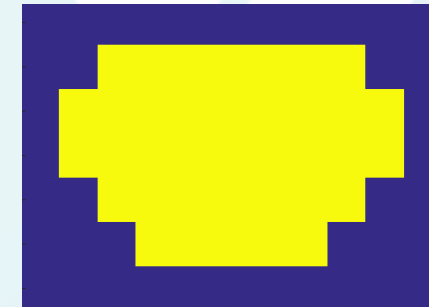
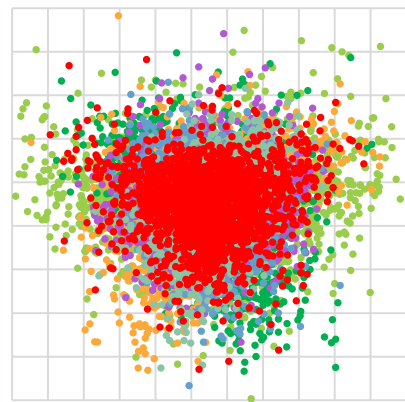
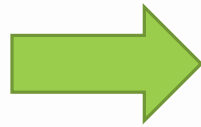
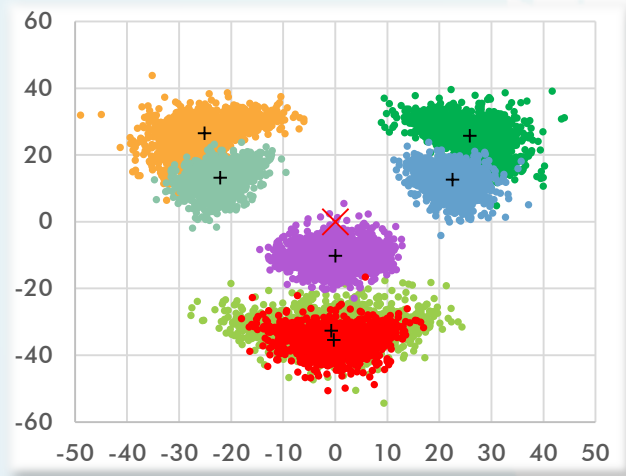
- Regression for possibility prediction
- One hidden neural for minimum value
- One hidden neural for possibility prediction



# Machine Learning on Face Detection

## Data Analysis – SVM/K-Nearest

- Analyze parts locality relations
- Add parts responses to detect face
- Create filters for combining them

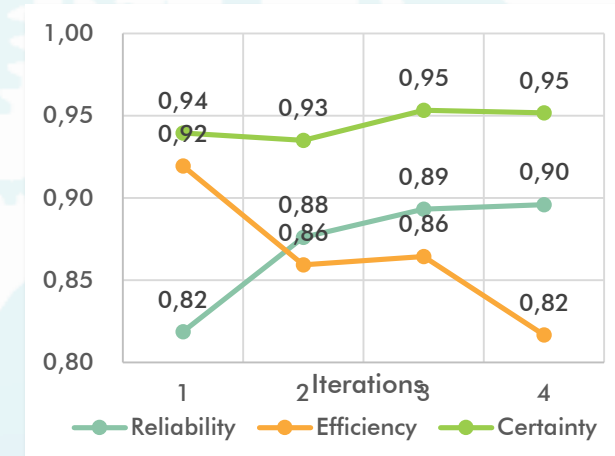
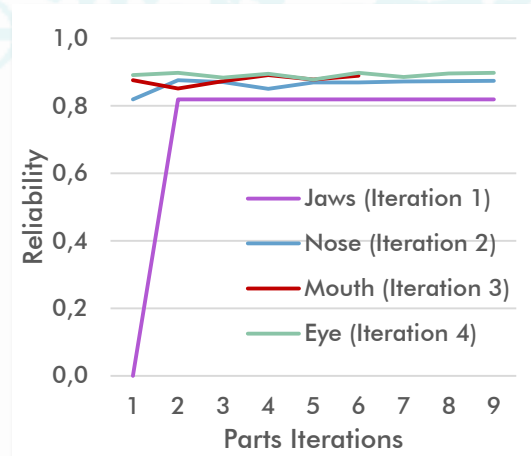
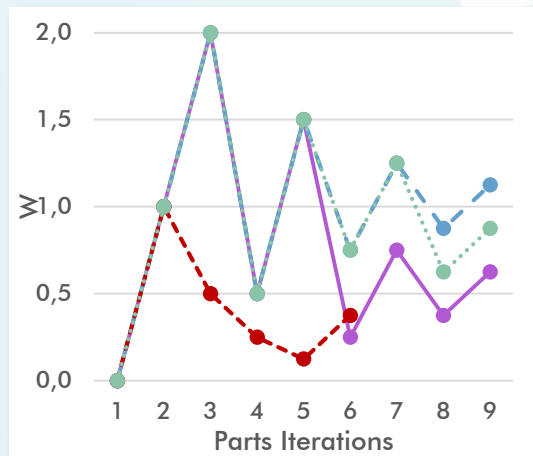


# Machine Learning on Face Detection

## Face Detection Function

- Face Detection function  $f(\text{face}) = \sum_{i=1}^7 w_i \times f(x_i)$
- Regression for finding the most critical parts (define W)

Regression Results	
Face Parts	W Values
Jaws	4,625
Eyebrow (L)	0
Eyebrow (R)	0
Nose	2,625
Eye (L)	0,375
Eye (R)	0
Mouth	4,125

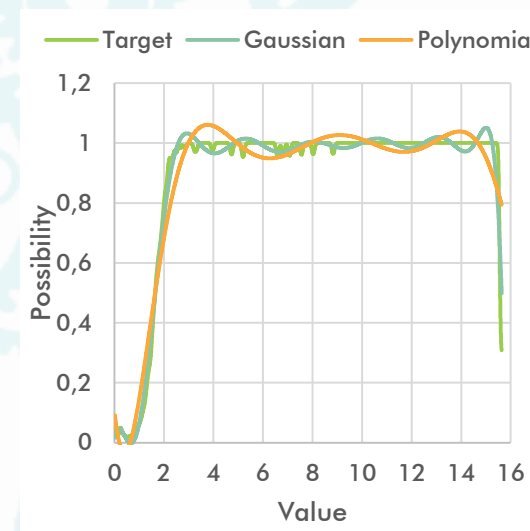
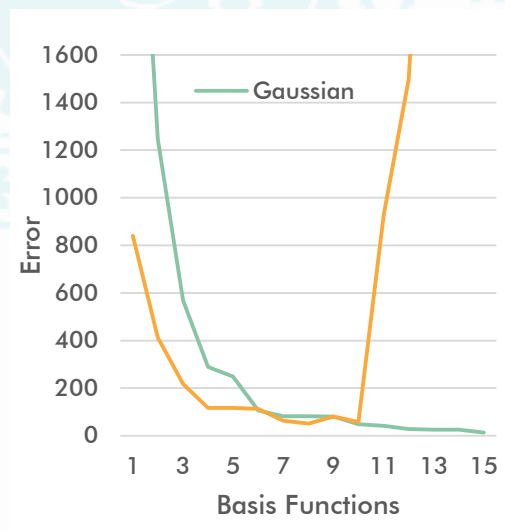
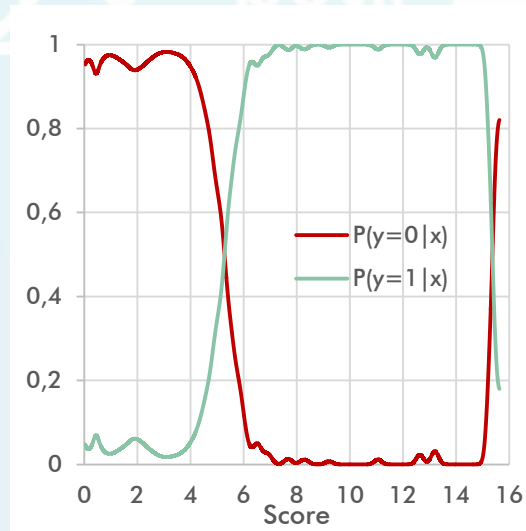




# Machine Learning on Face Detection

## Face Detection Classification/Prediction

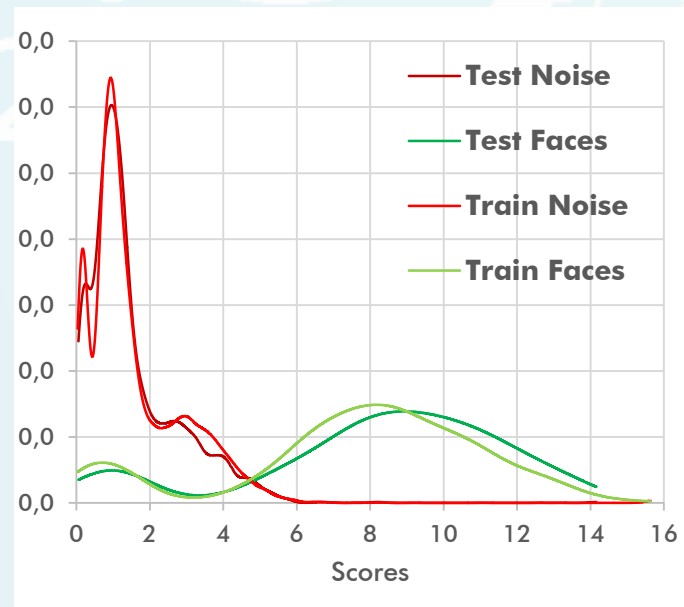
- Create a function that predict the possibility of face existence according to the algorithm result



# Machine Learning on Face Detection

## Test Results

- Finally use a testing set of image to verify our model



Testing results		
Indexes	Test	Training
Reliability	0,9022	0,8959
Detection Efficiency	0,8450	0,8168
Certainty	0,9484	0,9518