WIR BEGEISTERN UNSERE KUNDEN MIT
EMOTIONALEN FAHRERLEBNISSEN.

PRÄZISE - CHARAKTERSTARK - INNOVATIV

MACHINE LEARNING AS A EXAMPLE FOR OVERRIDE DETECTION
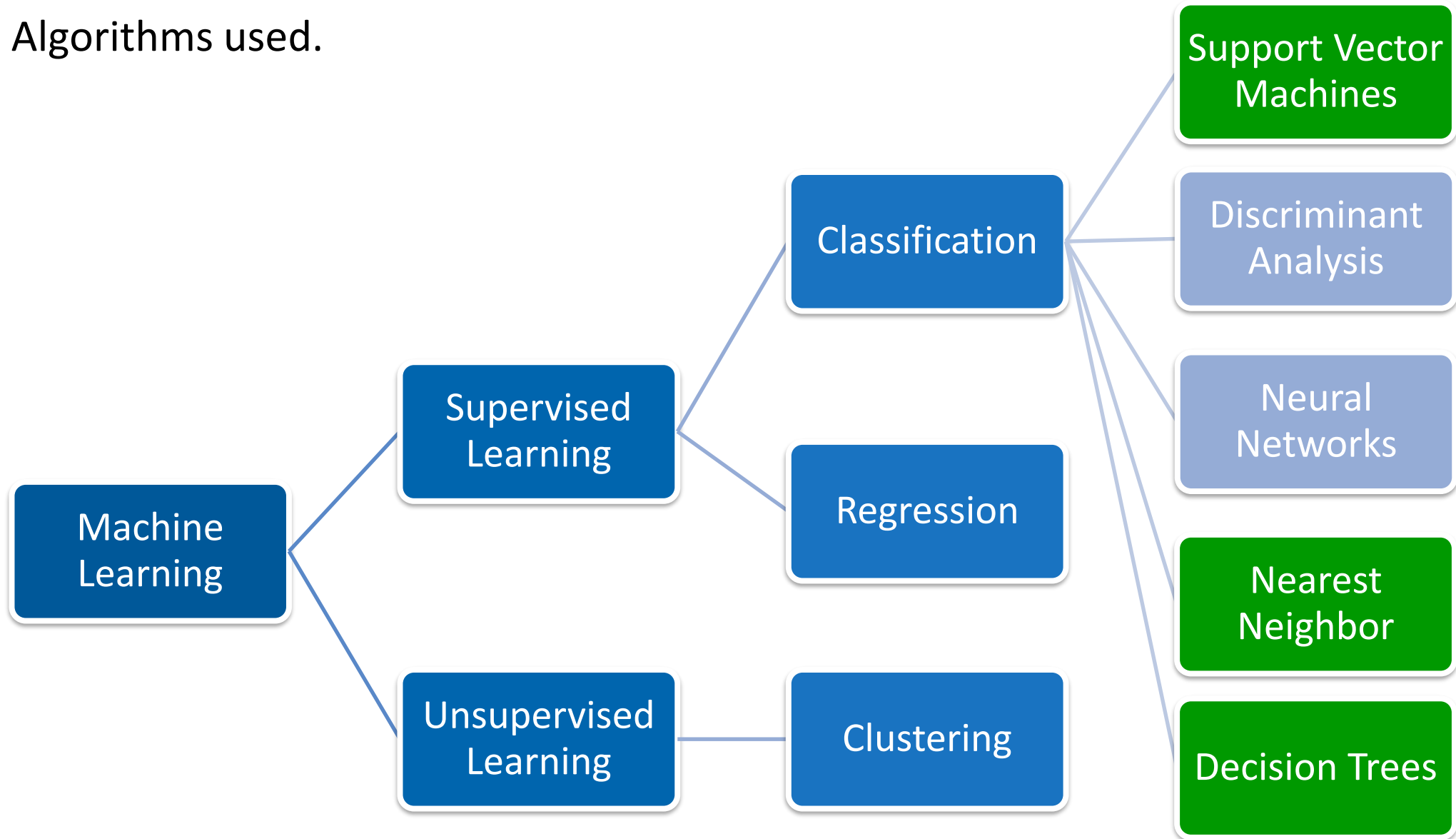
SUPERVISED MACHINE LEARNING WITH MATLAB.

MOTIVATION.

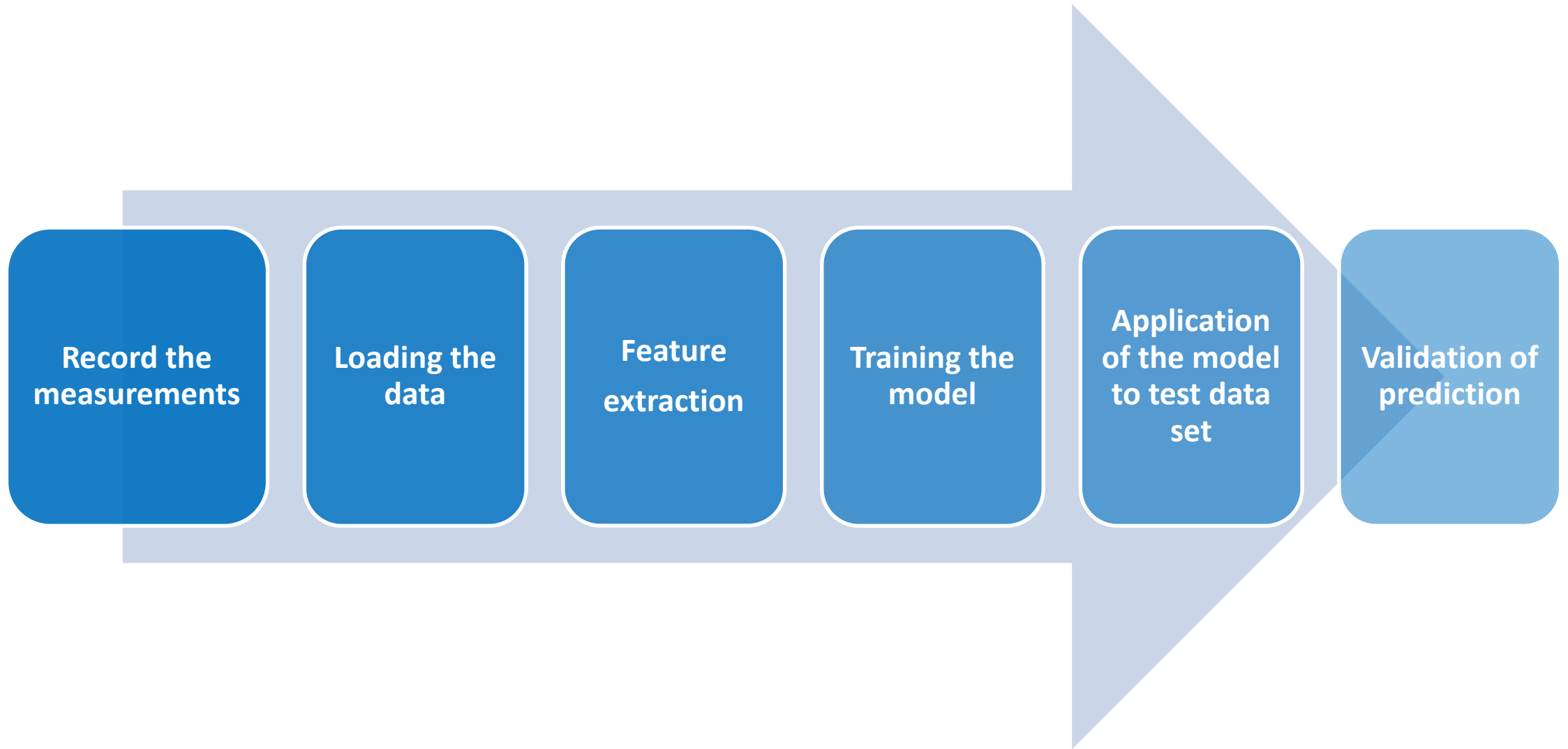Evaluation of the "Statistics and Machine Learning" Toolbox from MATLAB

Large number of recorded vehicle measurements (unlabeled) available

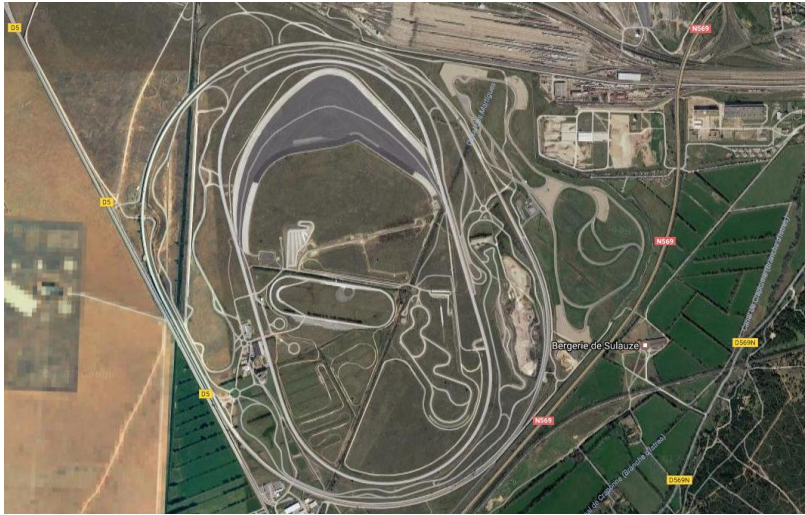# MACHINE LEARNING.

Algorithms used.

WORKFLOW.

Record the measurements	Loading the data	Feature extraction	Training the model	Application of the model to test data set	Validation of prediction

GENERATION OF THE MEASURED DATA. TRACK

Train a model

Training data set:

- Handling course Miramas

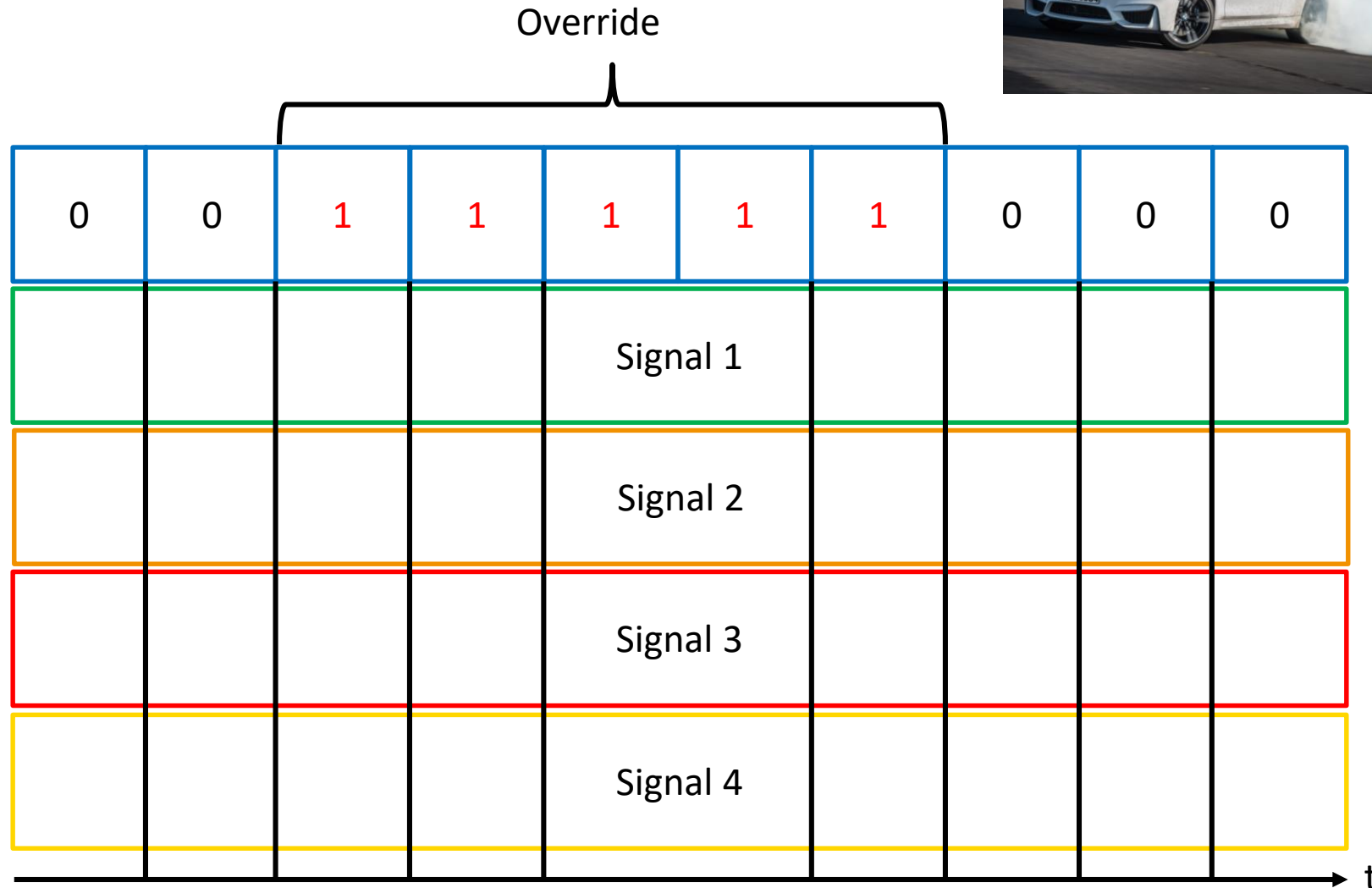- 259.000 data points

≙ 43 minutes

Test the trained model

Test data set:

- Handling course Aschheim

- 150.000 data points

≙ 25 minutes

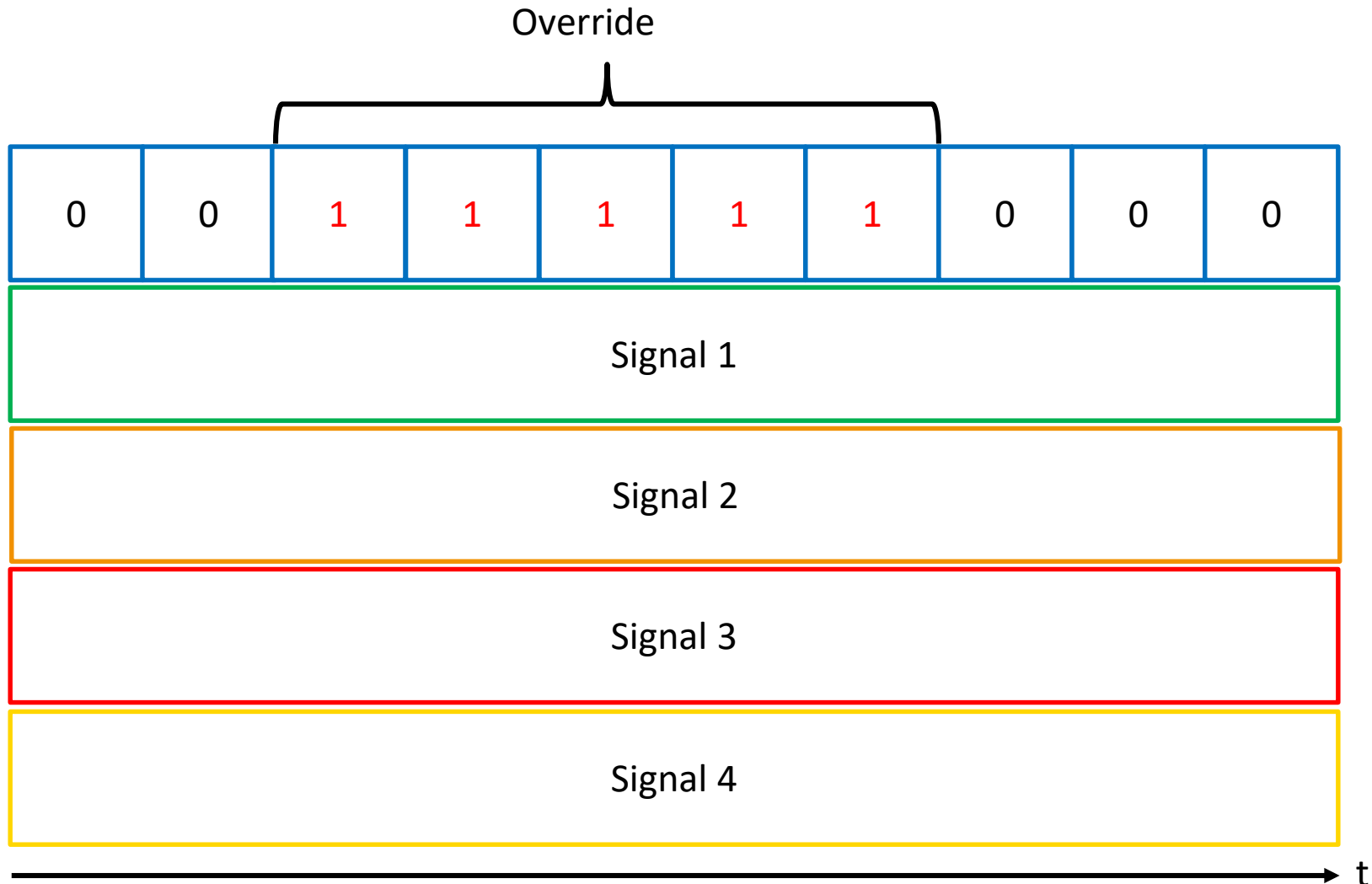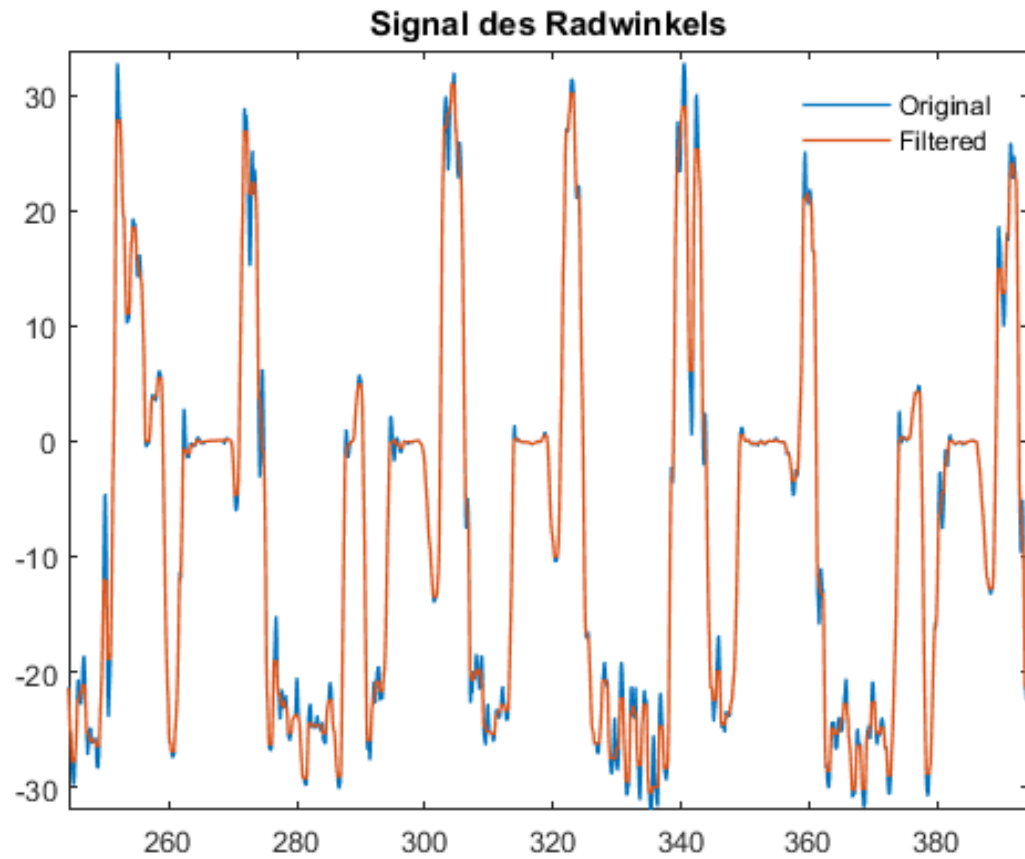# GENERATION OF THE MEASURED DATA.

Insert a trigger signal.

Override

0	0	1	1	1	1	1	0	0	0
				Signal 1					
				Signal 2					
				Signal 3					
				Signal 4					

t

GENERATION OF THE MEASURED DATA.

Insert a trigger signal.

Override

| 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |

Signal 1

Signal 2

Signal 3

Signal 4

t

FEATURE EXTRACTION.

Filter.

Signal des Radwinkels
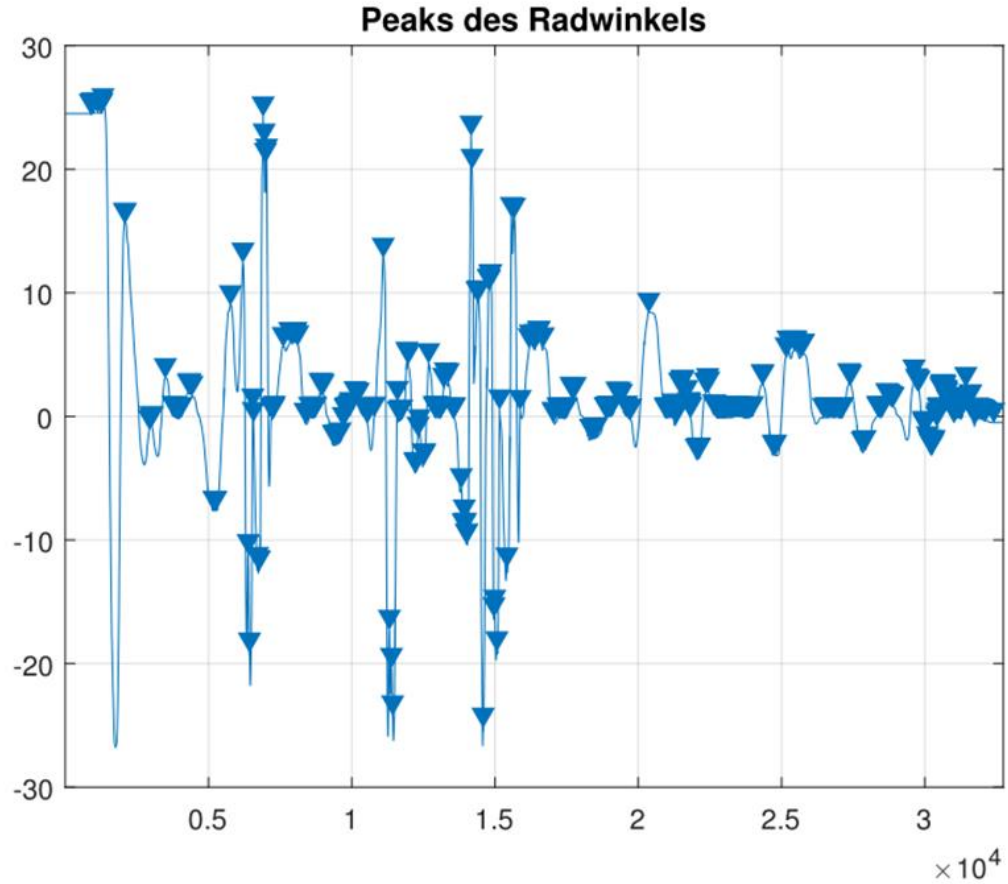
Suppress signal noise

Training and test data sets have to filter in the same way
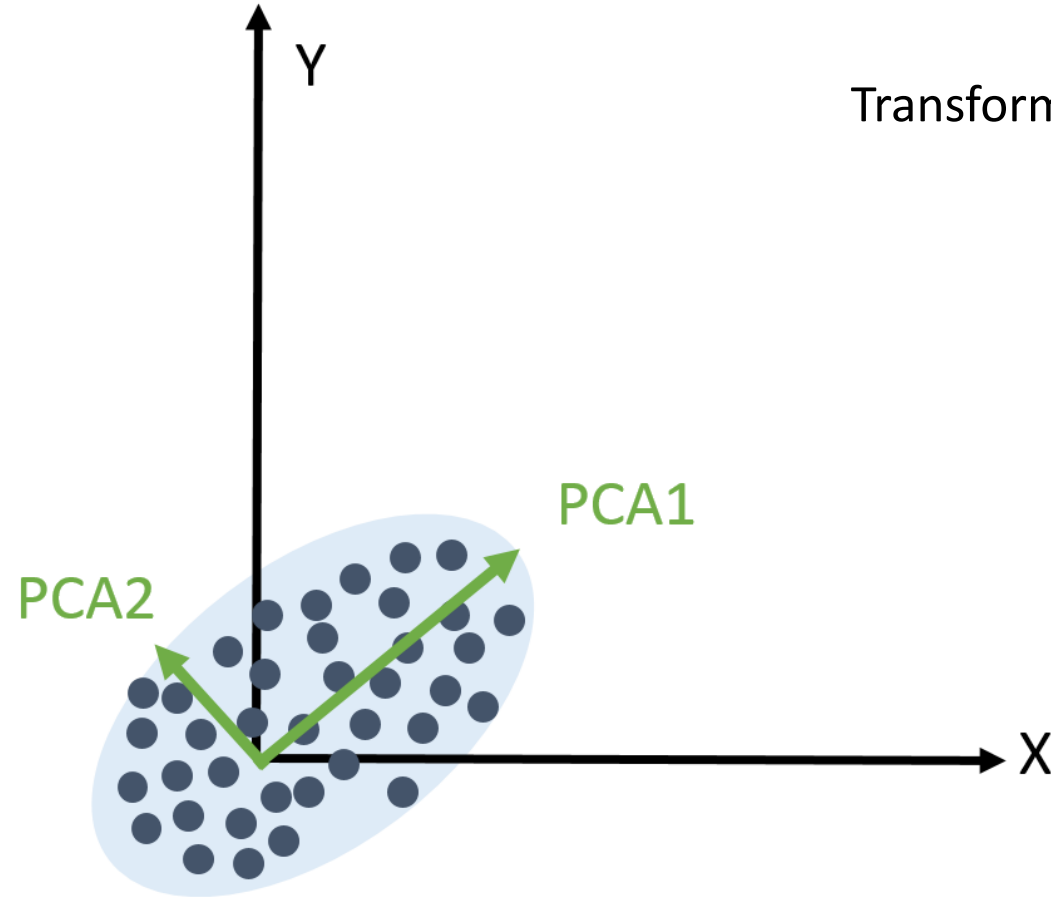
FEATURE EXTRACTION.

Peak Analysis.

Peaks des Radwinkels

- Use the FindPeaks function

- Minimum distance between the peaks
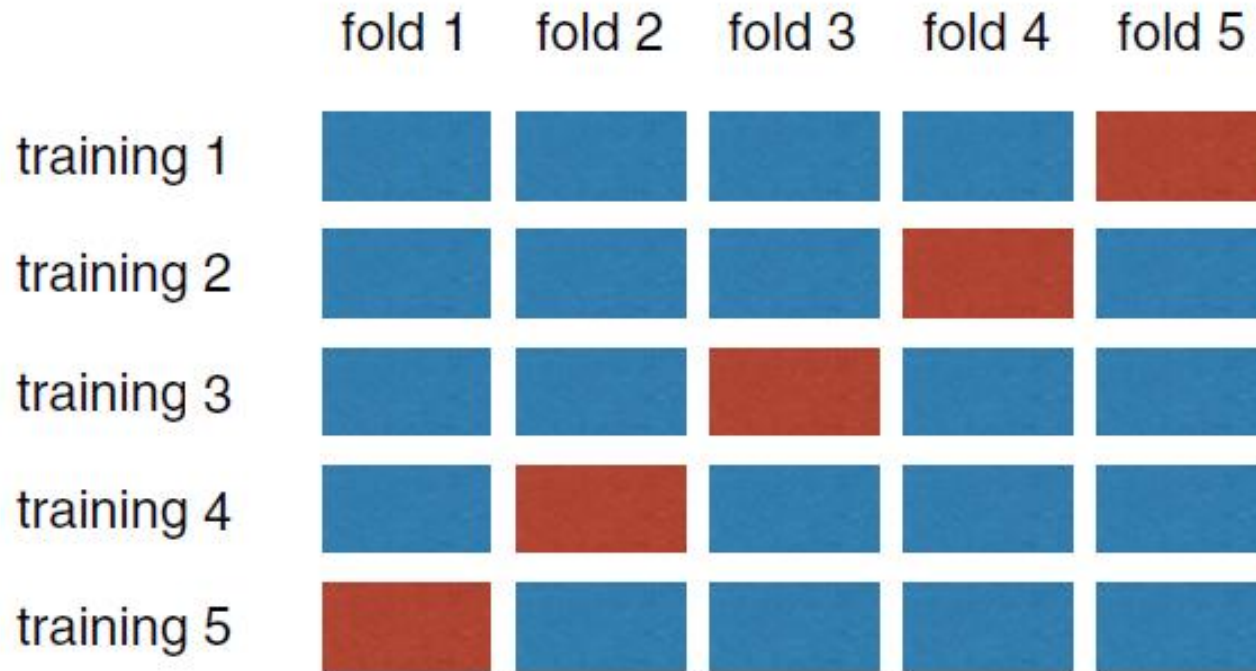
FEATURE EXTRACTION.

Principal Component Analysis (PCA).

Transformation in the directions of Principal Components

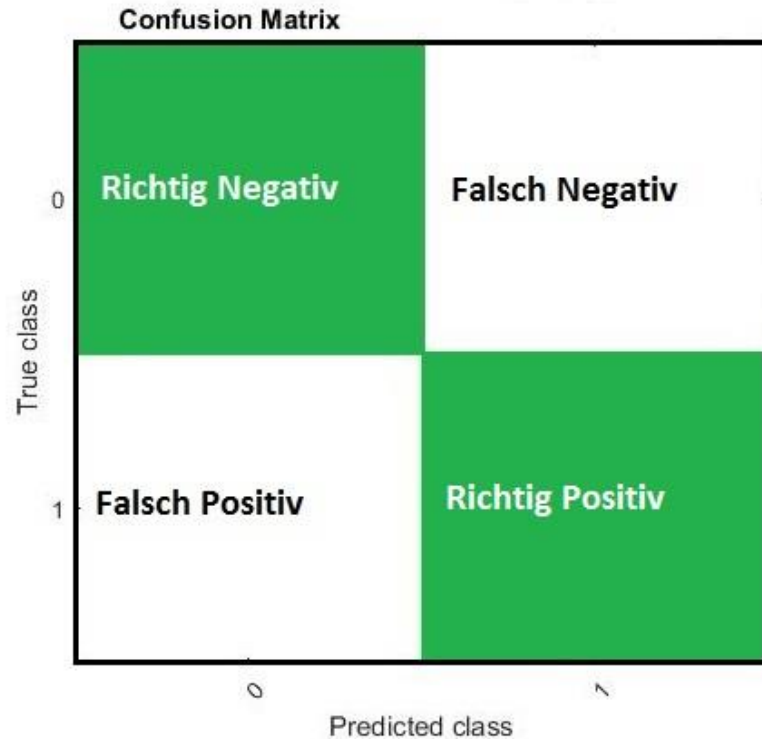# MODEL SELECTION.

K-Fold Crossvalidation.

Blue= Training data set
Red= Test data set

Results: Average error

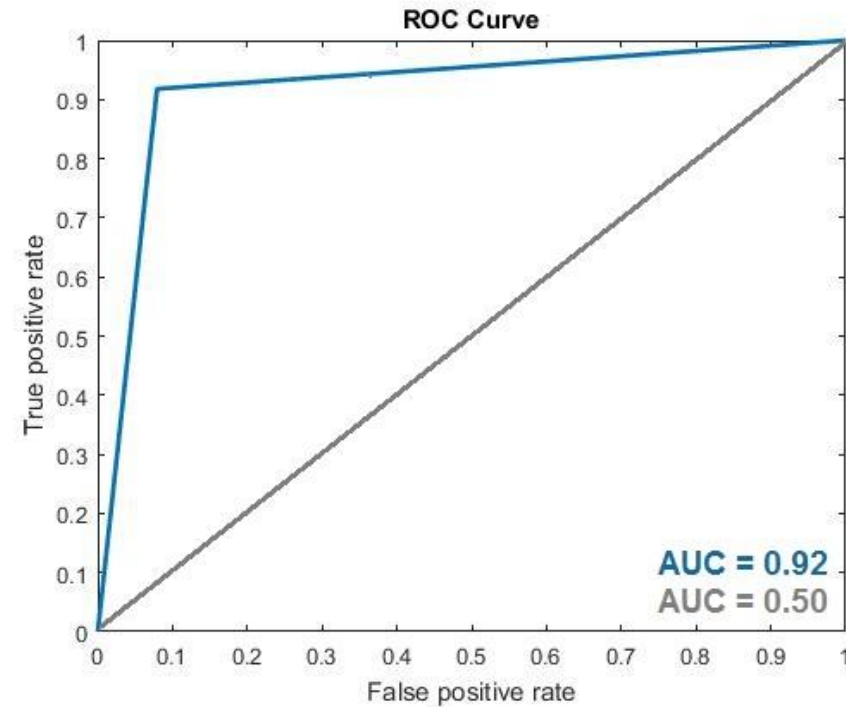Source: Machine Learning for Evolution Strategies, Kramer, 2016, S.39
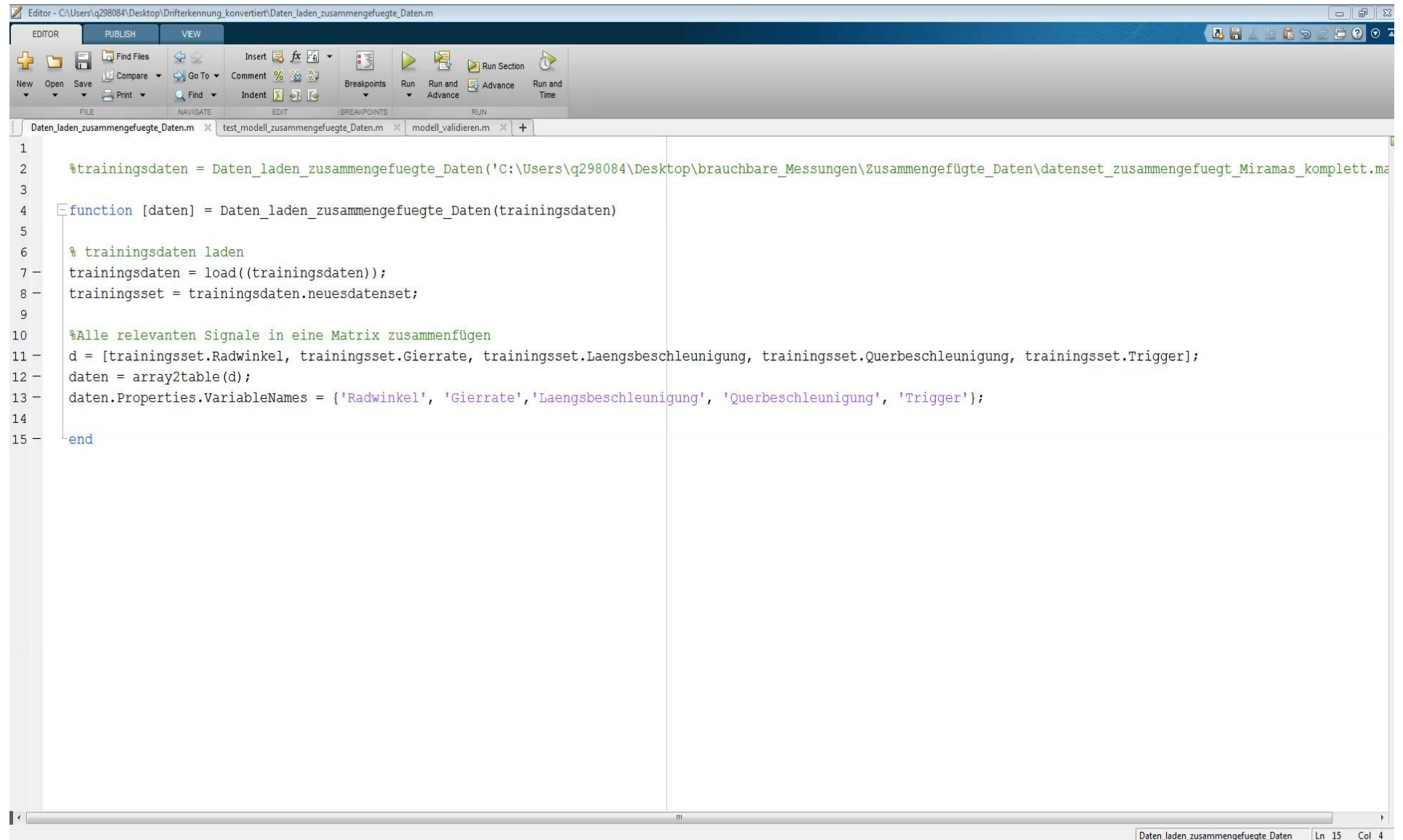
MODEL SELECTION.

confusion matrix.

Goal:
100 % on the green diagonal

Receiver-Operating-Characteristic-Curve.
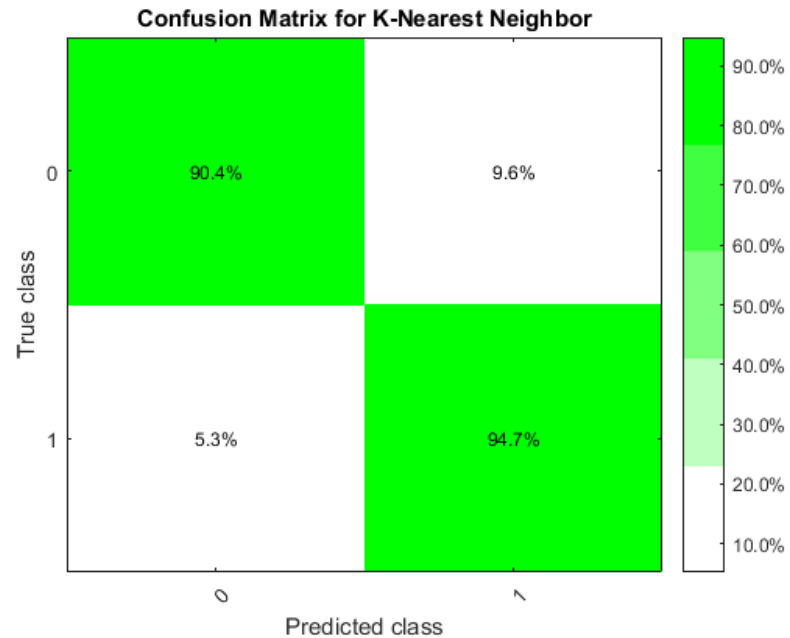

Goal :
AUC = 1

VIDEO: PROCEDURE.

RESULTS.

confusion matrix: K-Nearest Neighbor & PCA Feature Extraktion

Confusion Matrix for K-Nearest Neighbor

	Predicted 0	Predicted 1
True class 0	90.4%	9.6%
True class 1	5.3%	94.7%

```
Performance of model :
                Predicted 0        Predicted 1
   Actual 0     90.35% (82943)      9.65% (8856)
   Actual 1      5.26% (3162)      94.74% (57004)
```


ROC Curve
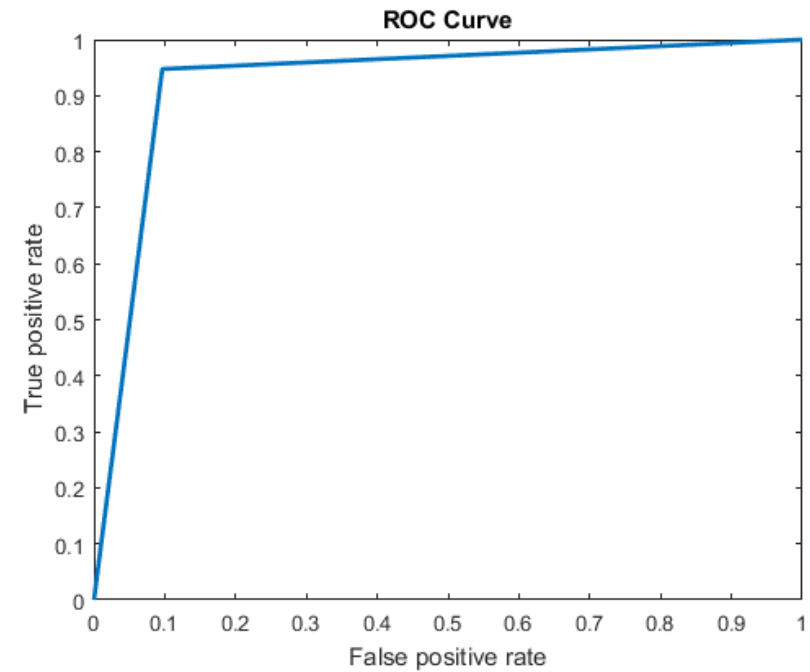
RESULTS.

confusion matrix: Support Vector Machine

Confusion Matrix for SVM

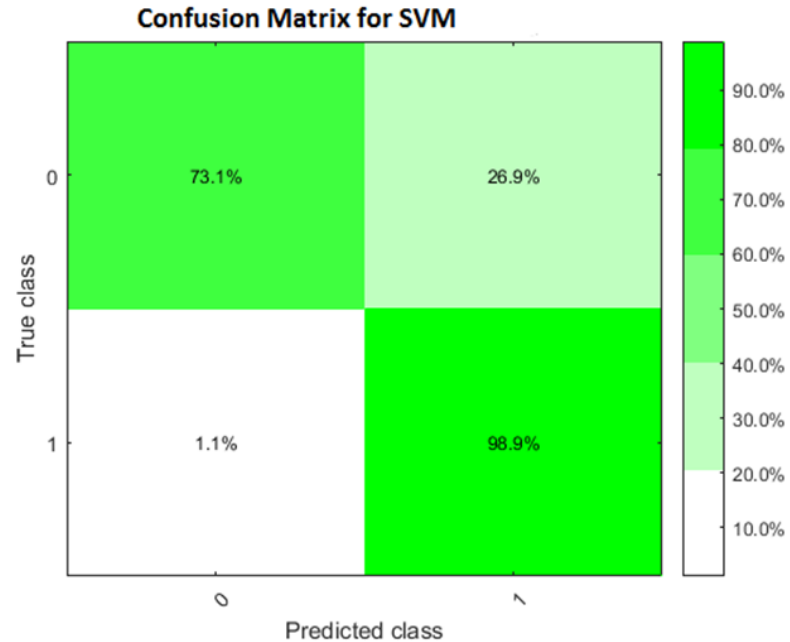|	Predicted 0	Predicted 1
True class 0	73.1%	26.9%
True class 1	1.1%	98.9%

```
Performance of model :
                Predicted 0        Predicted 1
    Actual 0    73.07% (67078)     26.93% (24721)
    Actual 1     1.08% (650)       98.92% (59516)
```
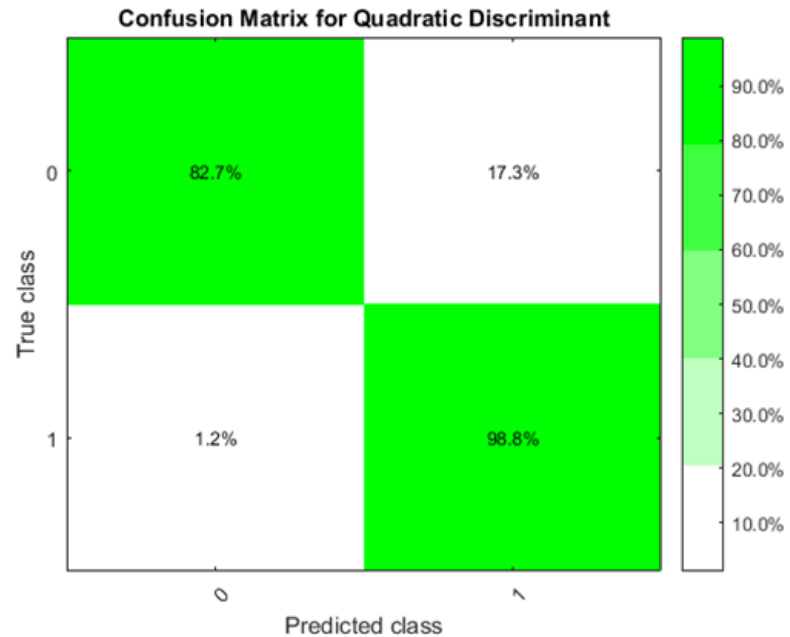

ROC Curve
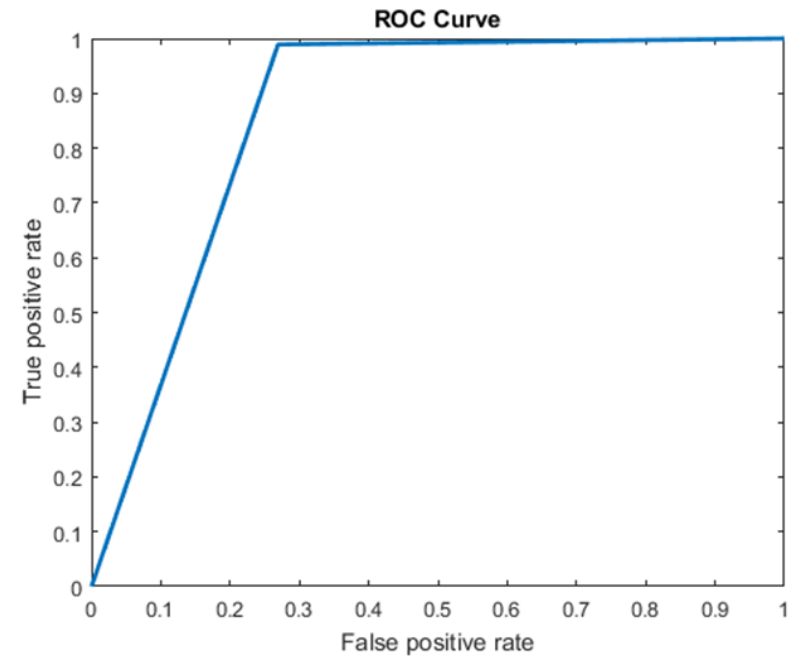
RESULTS.

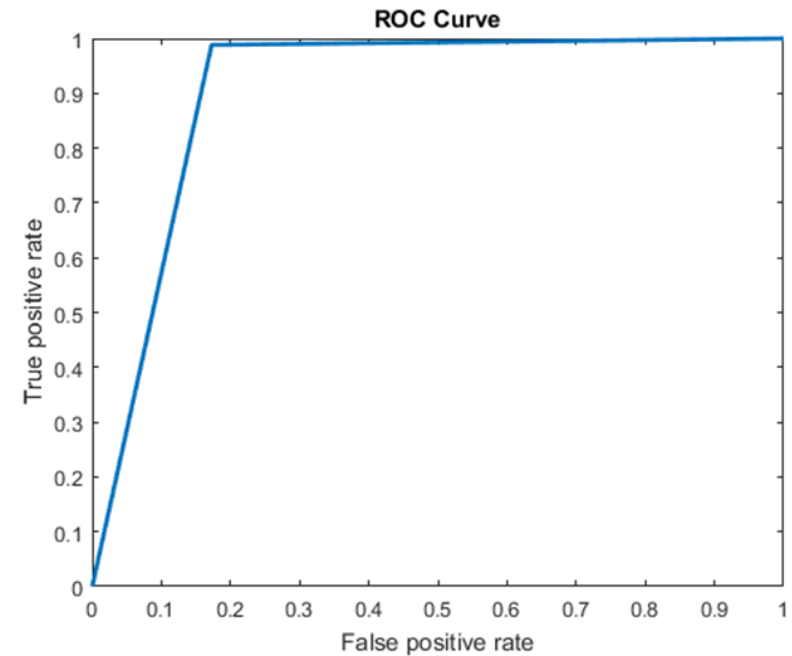## confusion matrix: Quadratic Discriminant analysis model

Confusion Matrix for Quadratic Discriminant


```
Performance of model :
                Predicted 0          Predicted 1
    Actual 0    82.73% (75946)       17.27% (15853)
    Actual 1     1.17% (701)         98.83% (59465)
```
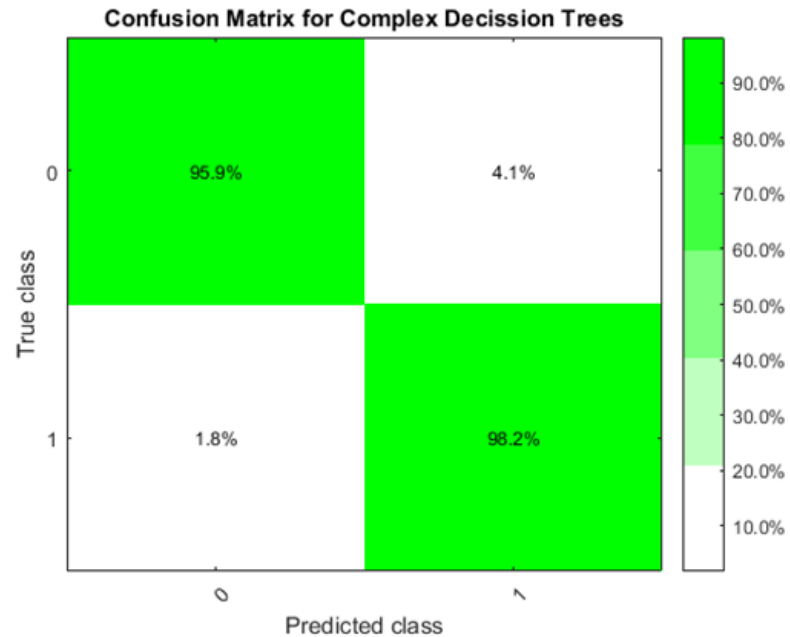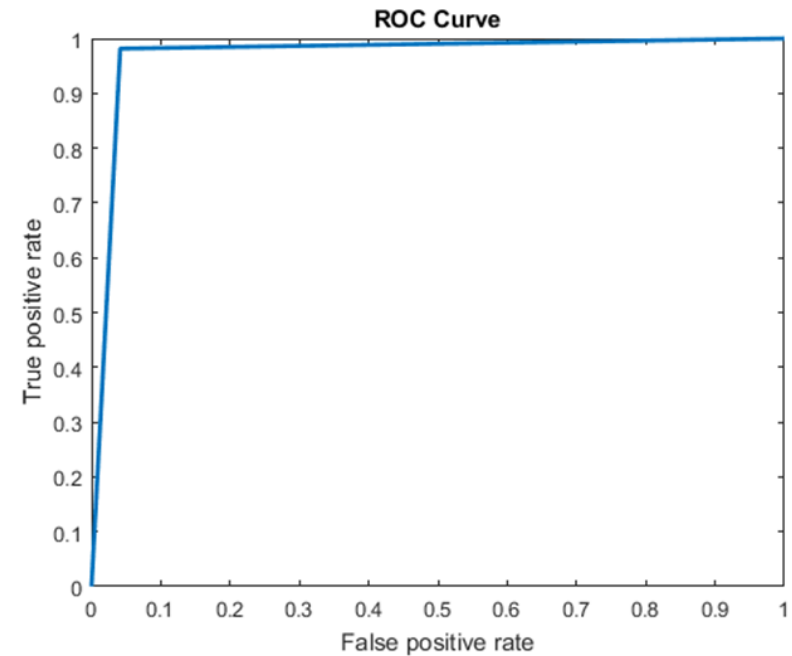
ROC Curve

RESULTS.

confusion matrix: Complex Decision Trees

Confusion Matrix for Complex Decission Trees

	Predicted 0	Predicted 1
True class 0	95.9%	4.1%
True class 1	1.8%	98.2%

```
Performance of model :
                 Predicted 0        Predicted 1
   Actual 0      95.86% (87996)      4.14% (3803)
   Actual 1       1.84% (1109)      98.16% (59057)
```


ROC Curve

SUMMARY.

Learning must always be carried out from the beginning of the measurements, no adaptive learning

Generate C code from the learned algorithm possible

Fast results with little previous knowledge