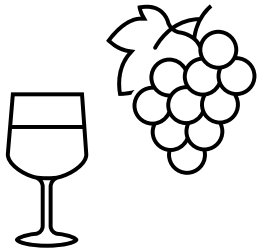
Data Mining – Team MINEHeim

Wine Prediction



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Agenda

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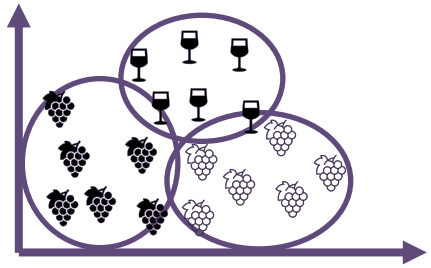
Research Problem

Data & Pre-Processing

Data Mining



Conclusion

Research Problem

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PROBLEM

How can you determine the quality of wine without actually drinking it?
What makes a great wine … actually great?

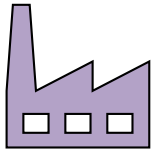
- Which factors/components influence the quality and taste?

GOAL

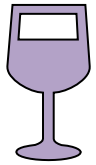
Objectively predict and classify the quality of wine based on its ingredients, components and features.

- e.g. sulphates, residual sugar, alcohol, pH-Value, type, …

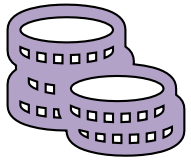
BUSINESS VALUE



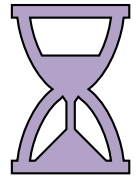
Wineries & Dealers



Old Wine



Reduce Costs



Save Time

Single Source of Truth

Data Structure

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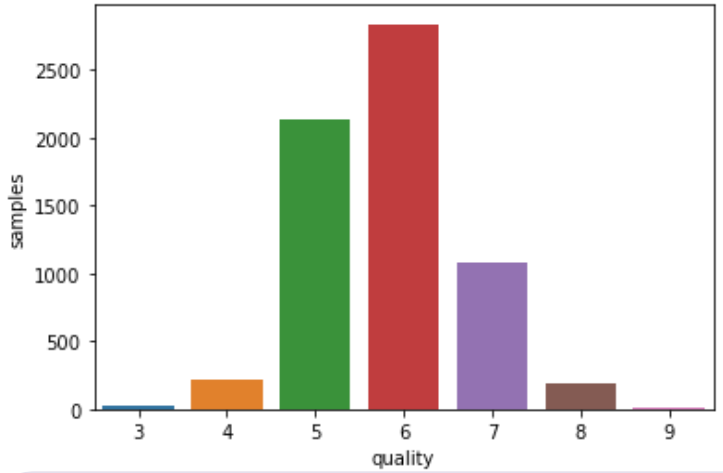
Data set related to red and white variants of Portuguese wine "Vinho Verde"

6497 samples, already gathered



13 features, mainly physiochemical properties e.g., pH-value, alcohol percentage etc.

Quality feature ranges from 0 to 10, assessed by wine tastings

Highly unbalanced data: lots of mediocre wines, few bad and excellent wines

Data & Pre-Processing

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Duplicate Deletion and Replacing Null-Values

- No duplicates
- 34 rows with missing values were deleted

Column Preprocessing

- Normalization of numerical values
- Encoding of categorical values

Outlier Deletion

- Deleting 57 outliers on the basis of a 90 % confidence interval

Data Separation and Splitting

- Separation of the feature and target variable
- Train and test split

Data Mining

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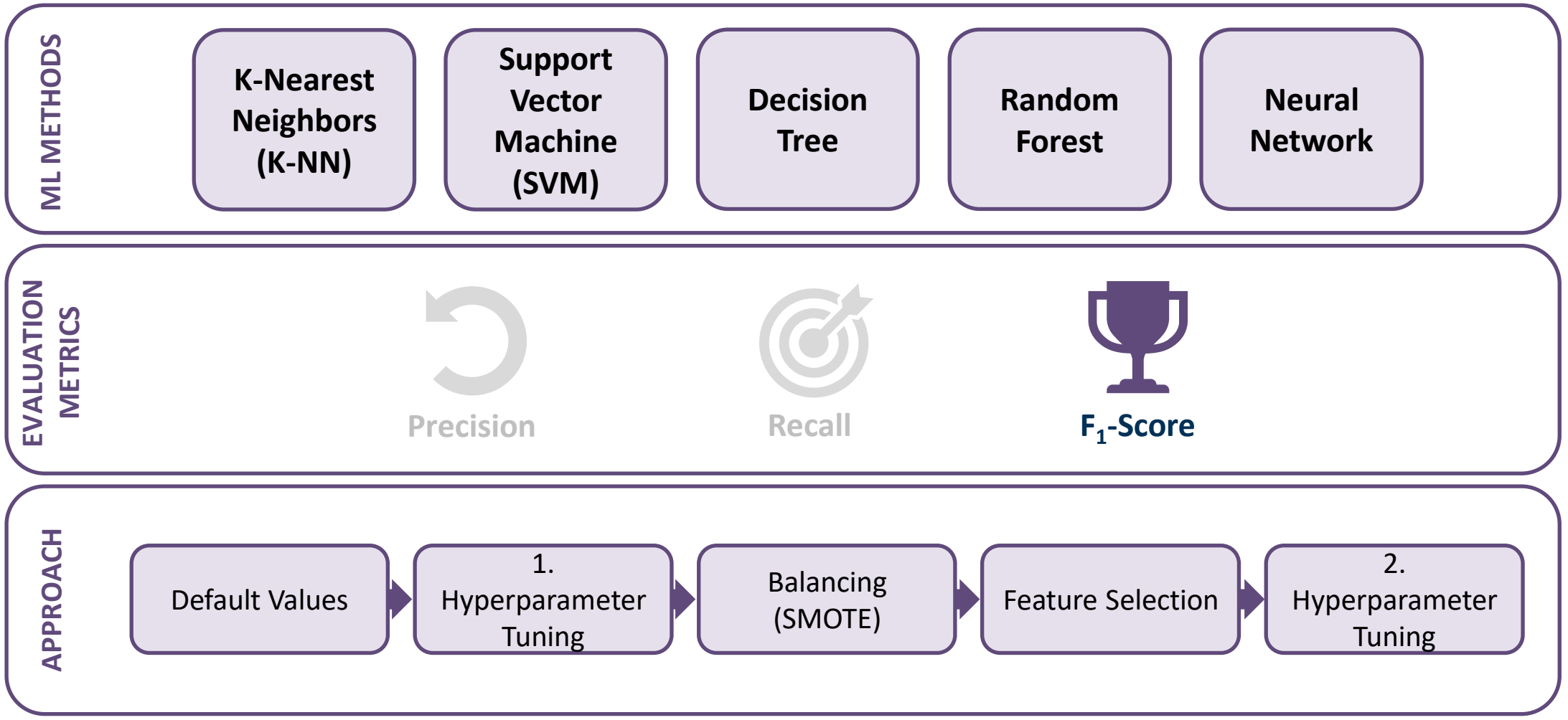

K-Nearest Neighbors (K-NN)

F_1-Score Overview

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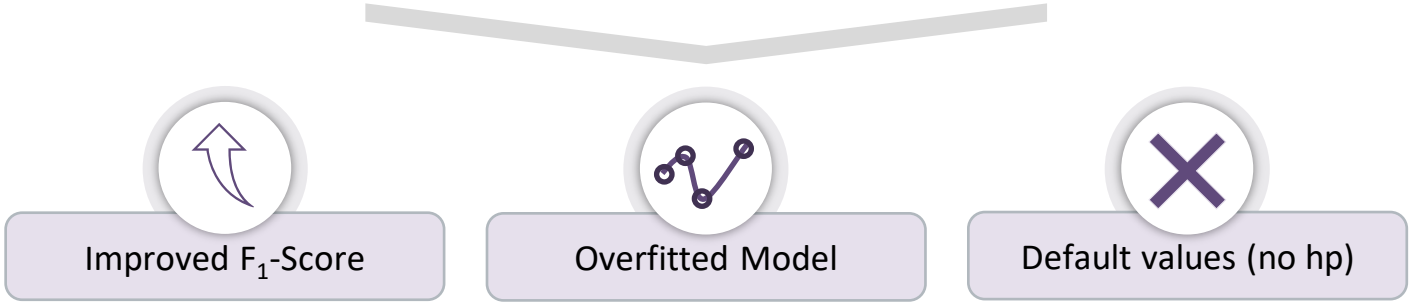
TRAIN	63.1 %	63.1 %	100 %	100 %	100 %
	Initial State	1. Hyperparameter Tuning	With Oversampling	With Feature Selection	2. Hyperparmeter Tuning
TEST	53.2 %	53.2 %	58.6 %	60 %	60 %
	Initial State	1. Hyperparameter Tuning	With Oversampling	With Feature Selection	2. Hyperparmeter Tuning



Support Vector Machine (SVM)

F_1-Score Overview

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	Initial State	1. Hyperparameter Tuning	With Oversampling	With Feature Selection	2. Hyperparmeter Tuning
TRAIN	38.4 %	72.0 %	88.5 %	86.4 %*	93.5 %
TEST	41.2 %	57.5 %	56.5 %	56.1 %*	57.6 %

* 2 models were evaluated, the better one is listed here. Performance decreased, therefore not included in next step.

- Improved F_1-Score
- Overfit Tendency of Model
- No Feature Selection

Decision Tree

F_1-Score Overview

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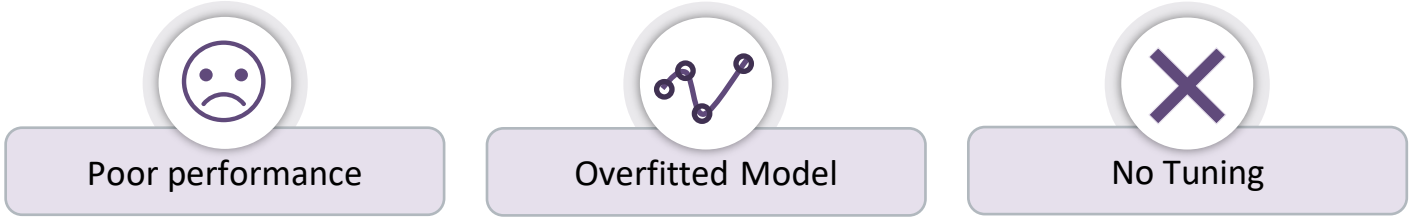
	Initial State	1. Hyperparameter Tuning	With Oversampling	With Feature Selection	2. Hyperparmeter Tuning
TRAIN	100 %	75.9%	100 %	100 %	85.8 %
TEST	58.7 %	53.8 %	55.7 %	57.5 %	51.8%



Random Forest

F_1-Score Overview

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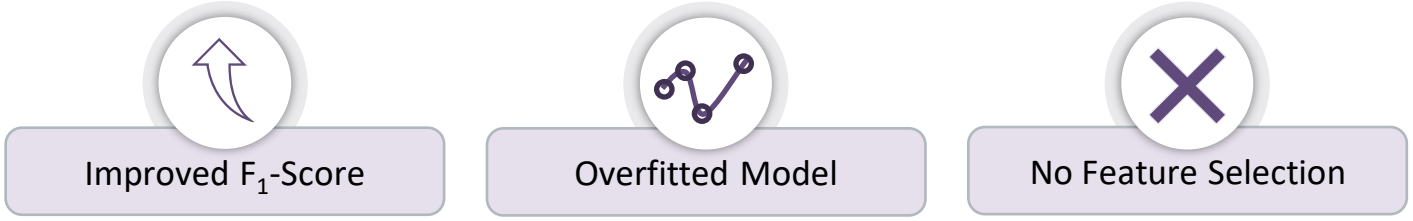
TRAIN	100 %	58.9 %	93.5 %	93.9 %	96.6 %
	Initial State	1. Hyperparameter Tuning	With Oversampling	With Feature Selection	2. Hyperparmeter Tuning
TEST	55 %	47.8 %	70.8 %	70.5 %	70.9 %
	Initial State	1. Hyperparameter Tuning	With Oversampling	With Feature Selection	2. Hyperparmeter Tuning



Neural Network

F_1-Score Overview

Legend

Batch	Layers
Epochs	Neurons

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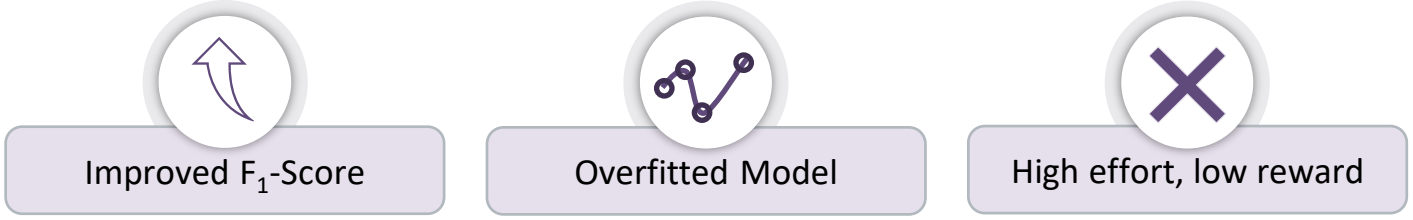
VALIDATION	38.3 %	72.8 %	76.8 %	80.9 %	84.6 %
	No Balancing				
	64 / 3	64 / 4	64 / 5	16 / 7	16 / 8
	30 / 100	30 / 300	30 / 400	40 / 1000	80 / 2048
TEST	41.4 %	51.9 %	49.9 %	55.7 %	56.6 %
	No Balancing				
	64 / 3	64 / 4	64 / 5	16 / 7	16 / 8
	30 / 100	30 / 300	30 / 400	40 / 1000	80 / 2048



Evaluation & Conclusion

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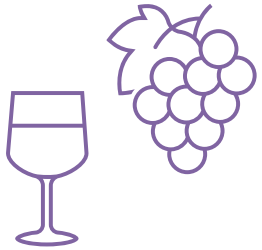
Business Use Case



Predict **wine quality** with the help of contents.

Results

KNN

as baseline did a reasonable job

Decision Tree

mediocre performance on its own

Random Forest

performed well as an aggregation of decision trees

SVM

also performed well as a classification algorithm

Neural Network

Efforts to create and were not rewarded with good predictions ➔ more resources, better experience needed

Overfitted Model

Random Forest

Other Features besides chemical characterisics might be important for the wine quality