CIS432 - Predictive Analytics Using Python

Team Project #2

Decision Support System

MSBA2 - Team#16

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Background Information

- **Goal:**
  - Evaluates the risk of Home Equity Line of Credit (HELOC)
- **Methodology:**
  - A predictive model and a decision support system (DSS)
- **Data info:**
  - 23 features used to predict whether an observation is paid as negotiated flag (good / bad)

Contents

01 Data Handling & Cleaning

1 Data Handling & Cleaning

Handling special values

- Drop all observations with -9
- Fill the -7 & -8 cells with median
  - Why median?
  - distribution, range, outliers
    -> mean is biased

Spliting into training & testing sets

- X_train, y_train (80% of all obs)
- X_test, y_test (20% of all obs)
  - For cross validation

Pre-processing categorical values

- MaxDelq2PublicRecLast12M
- MaxDelqEver
  - get dummies
  - combine the columns that representing same category

Scaling the value of features

- Standard scaling (for all features)
  - Why scaling?
  - to avoid bias on prediction

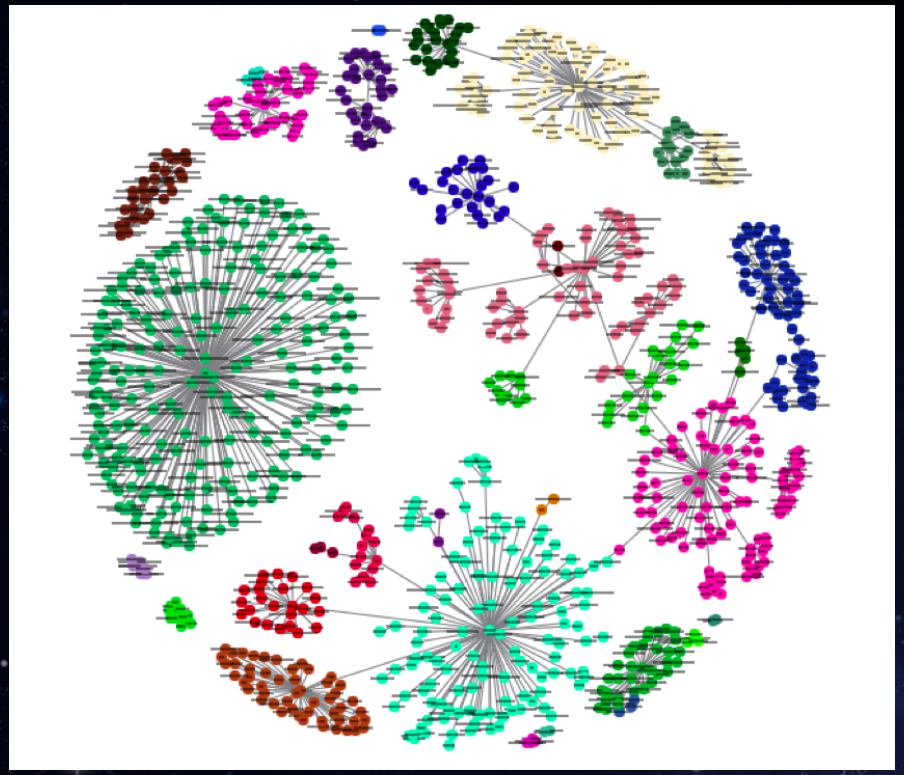
02

Modeling

- Models building
- Models evaluation
- Model selection

2 Modeling

Models Building - KNN



Search for parameters of the best KNN model using grid search, and get best parameters using training dataset:

- CV = 5, range: 1 – 23
- Best parameters:
  - n_neighbors: 22
  - Training accuracy = 0.7247

Apply to the testing dataset:

- KNN = 22
- Testing accuracy = 0.7192

2 Modeling

Models Building - SVM

Explore SVM using different kernels

- Linear
- Poly
- **rbf**

Search for parameters of the best SVM model with rbf kernel using grid search, and get best parameters using training dataset

- C: [0.1, 1, **10**, 100]
- gamma: [**0.001**, 0.01, 0.1]

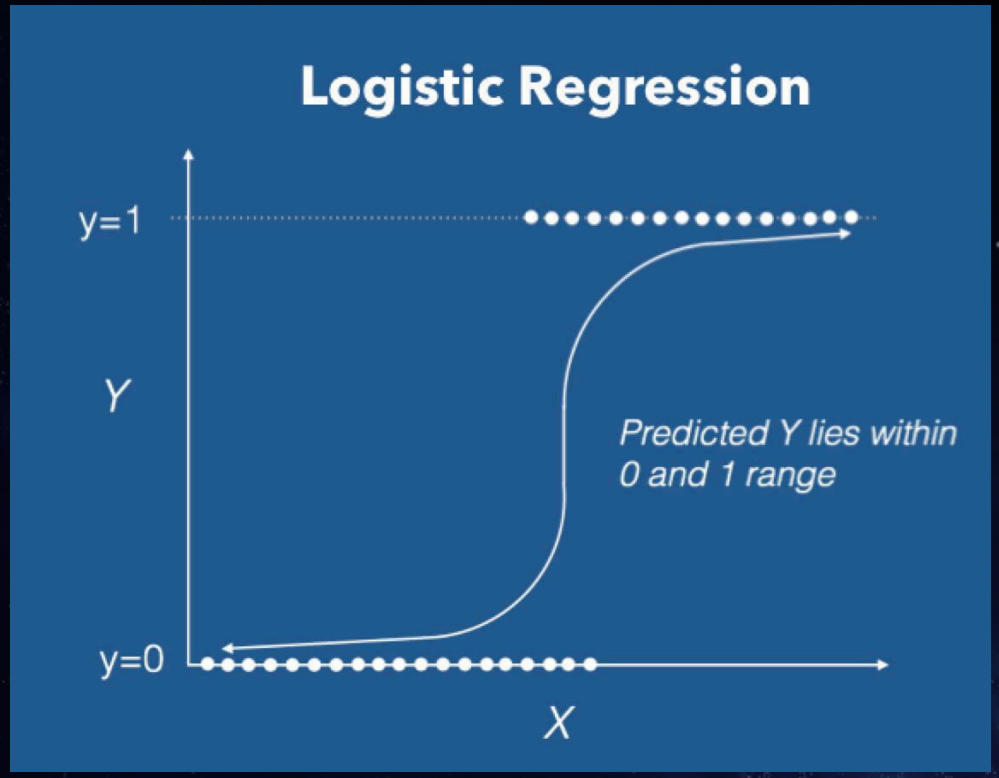
Apply the selected SVM model to testing dataset for validation

Testing accuracy

0.7344

2 Modeling

Models Building – Logistic Regression



Hyper-parameter

- C: np.logspace(-3, 3, 7)
- Penalty: ["l1", "l2"]

Best parameters

- C: 0.01
- Penalty: l2 (ridge)

Score

- 0.7182

1 Modeling

Models Building – Single Decision Tree

Hyper-parameter

Tree Depth: range(1, 6, 1)

Best parameter

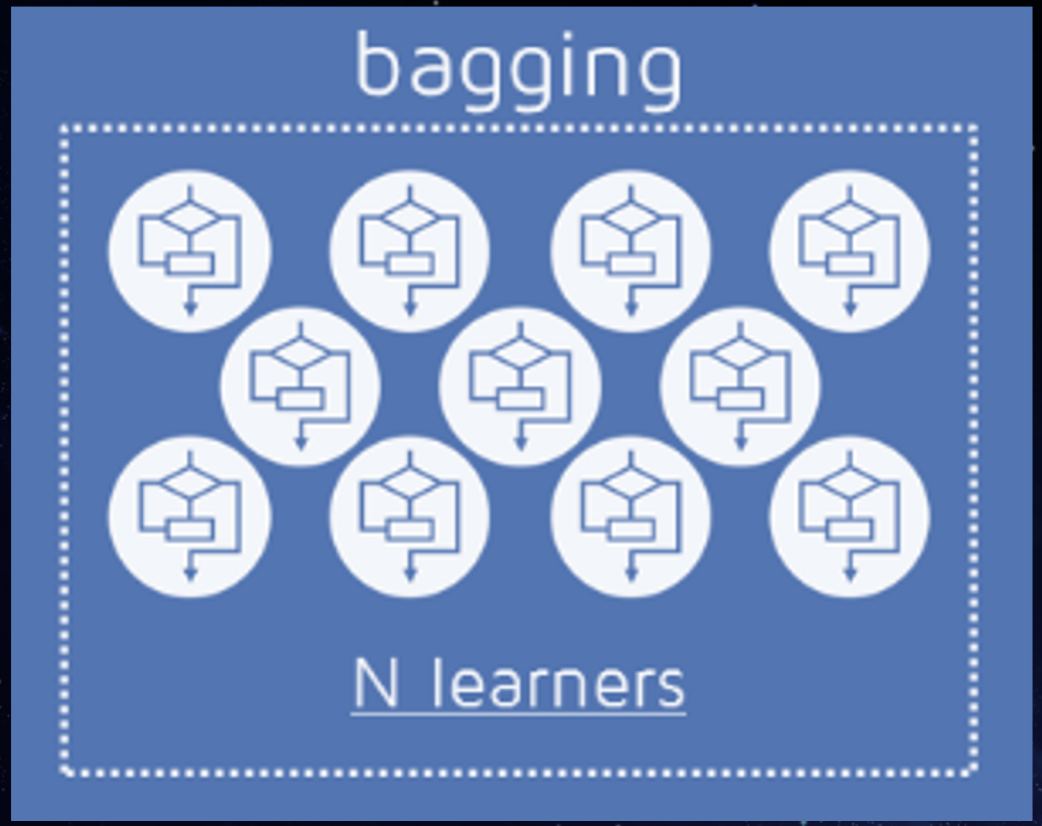
Tree Depth: 4

Score

0.7142

1 Modeling

Models Building – Bagging



Hyper-parameter

Tree Depth: range(1, 6, 1)

n_estimators: range(1, 40, 1)

Best parameter

Tree Depth: 5

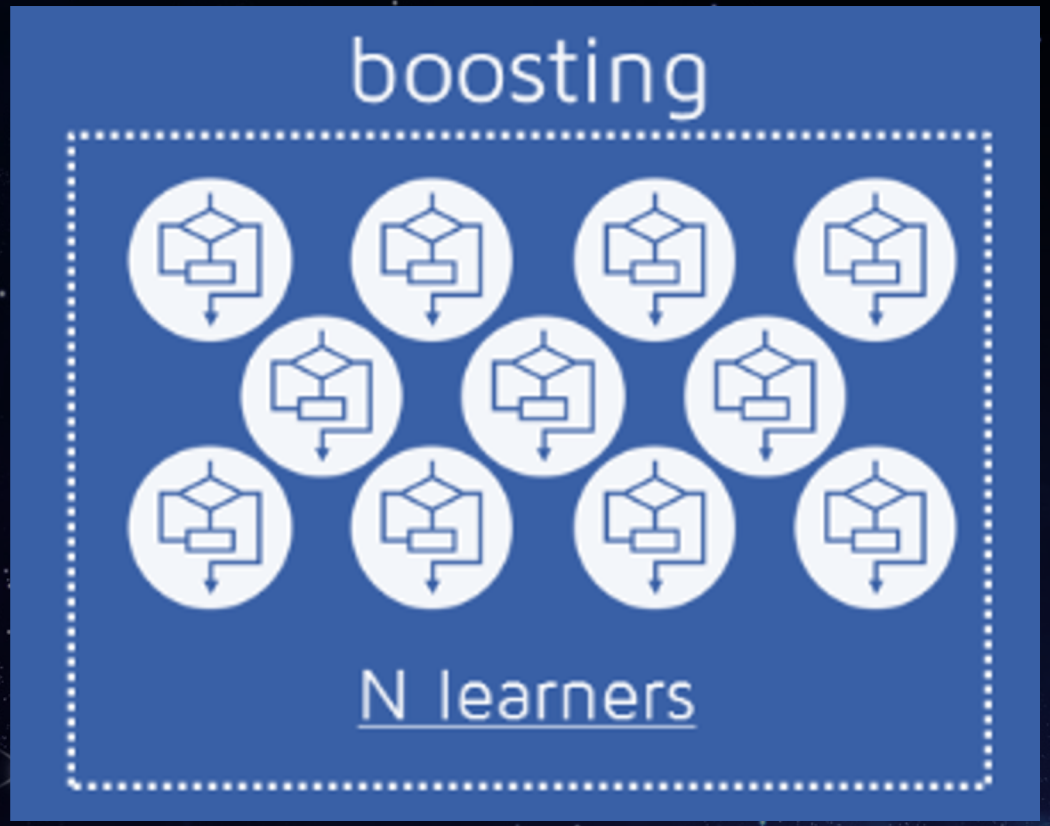
n_estimators: range: 33

Score

0.7272

1 Modeling

Models Building – Boosting



Hyper-parameter

n_estimators: [10, 20, 30, 40, 50]

Learning Rate: range(0,1, 1, 0.1)

Best parameter

Learning Rate: 0.9

n_estimators: range: 20

Score

0.7289

1 Modeling

Models Building – Random Forest

Hyper-parameter

Tree Depth: range(1, 6, 1)

n_estimators: range(1, 40, 1)

Best parameter

Tree Depth: 5

n_estimators: range: 38

Score

0.739782

2 Modeling

Models Evaluation & Selection

Main reference standard

- Accuracy (0 – 1)
- Simplicity & Interpretability

Results

- The best model: **random forest**
- The highest score: **0.74**

	model_names	model_score
0	Logistic regression	0.718196
1	KNN	0.719209
2	SVM	0.734415
3	Single decision tree	0.714227
4	Bagging	0.727207
5	Boosting	0.734915
6	Random forest	0.739783

03 Interactive Interface Demo

3 Interface

Clients Choices

- General glance of the model dataset
- Selection of individual records
- Choices of algorithm

Credit Risk Performance Model

Show dataframe

Choose a row of information in the dataset (0~10458):

5

which algorithm ?

Logistic regression

Logistic regression

KNN

SVM

Tree-based models

Boosting

RF

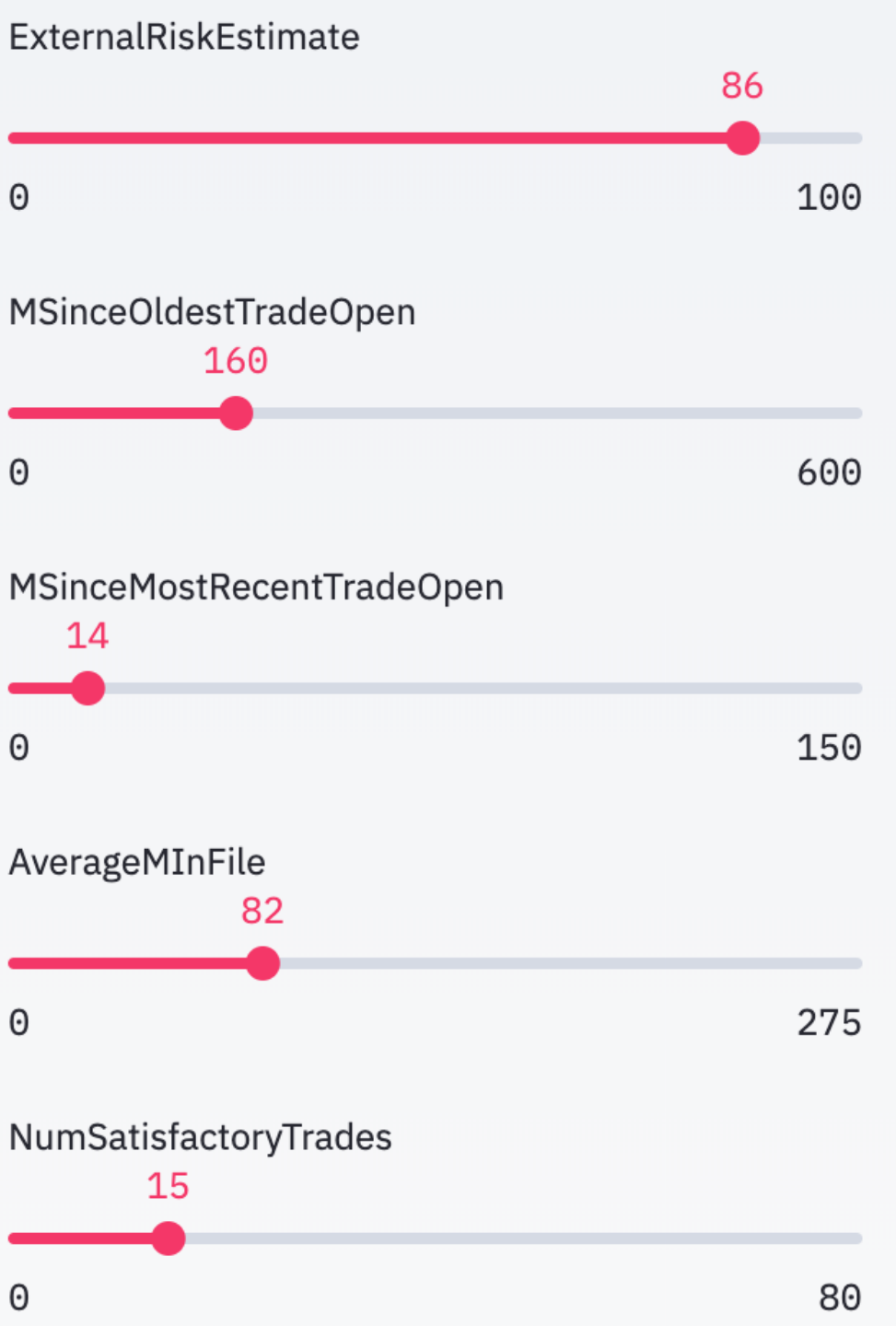
3 Interface

Inputs

Side bar:

variable of choice

Total 36 variables to modify personal inputs for prediction computation.



3 Interface

Outputs

- **prediction:**
  - The prediction outcome of credit performance based on the input data.
- **Accuracy:**
  - The accuracy of selected prediction method compare with the actual result.

Prediction: Good

Accuracy: 0.47237709072478457

Confusion Matrix:

	0	1
0	0	1041
1	0	932

04 Conclusion & Discussion

4 Conclusion & Discussion

Importance of data handling & cleaning

Importance of hyper-parameter selection

Importance of model evaluations & selections (considering the interpretability and overfitting)

Limitation 1:
Computing time

Limitation 2:
User friendly interface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EPS 10
ABSTRACT GRAPHIC
vector Illustration

THANK YOU