Machine Learning and Credit Risk

KPMG Challenge 2021/2022

A Decision Tree Model for Predicting Defaults

Team 5

UNIVERSITÀ DEGLI STUDI DI NAPOLI
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Roadmap

01 **The Problem**

02 ML in Finance

03 The Model

04 Conclusions

01
The Problem

An introduction to Credit Risk

Credit Risk

Credit Risk can be defined as the likelihood of a loss, for a bank, resulting from the impossibility of a borrower to repay a loan.
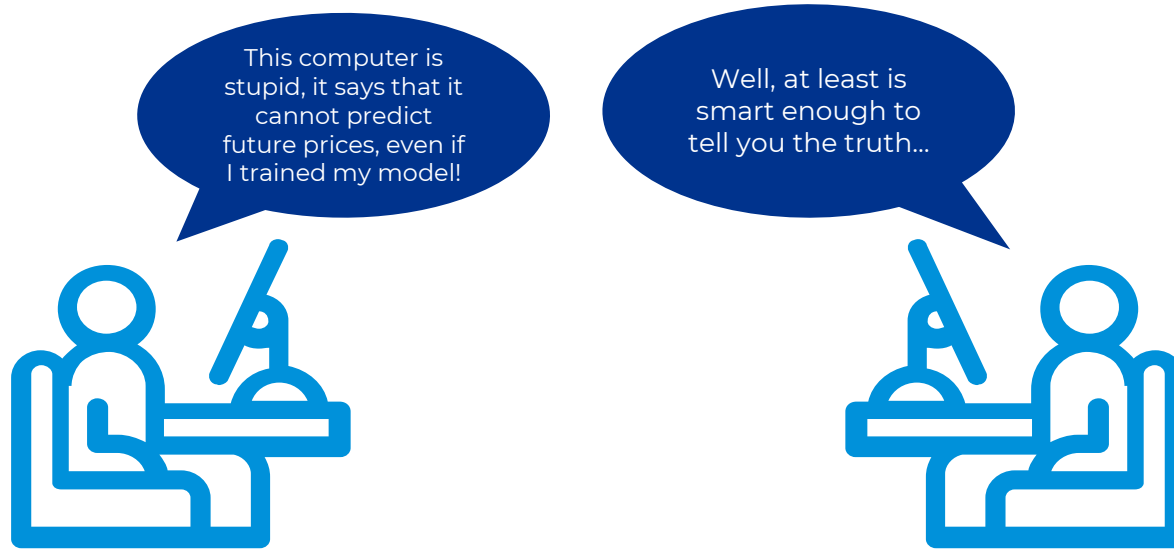
Not today. I do promise I will pay tomorrow. Maybe...

You have to pay your debt!

02
ML in Finance

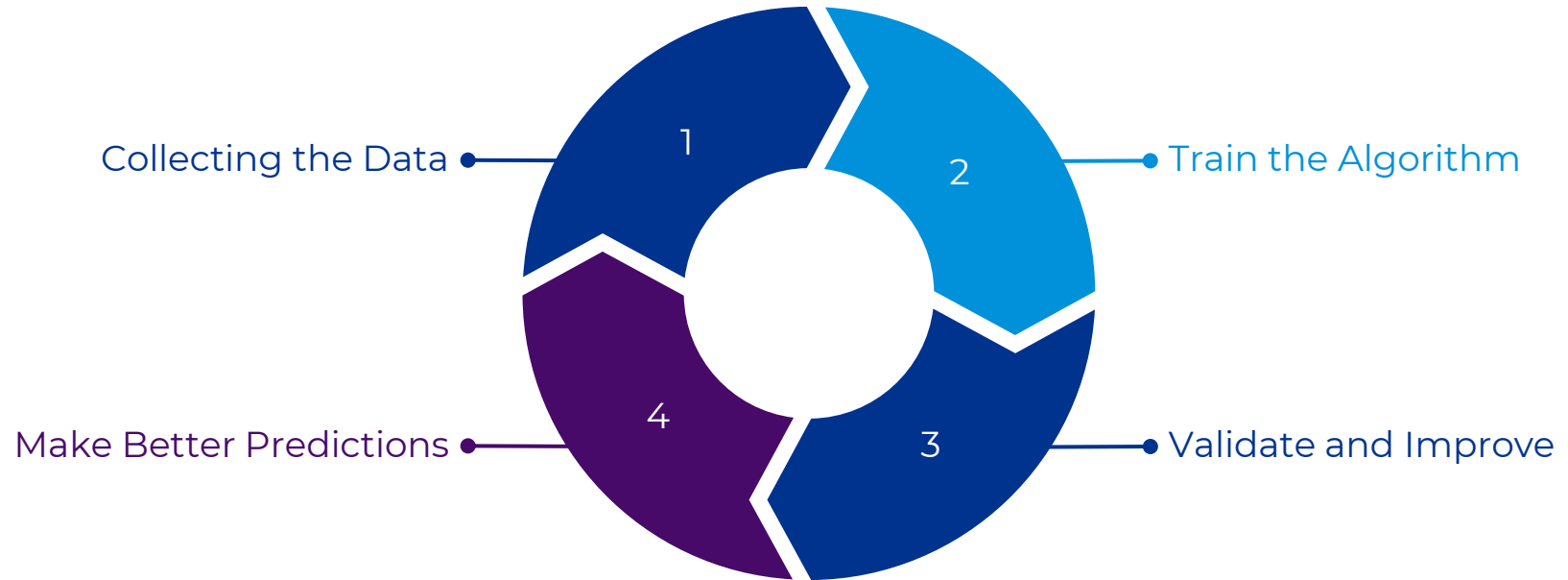How Machine Learning can be used to solve this problems?

What is Machine Learning?

Machine learning (**ML**) is the use of computer algorithms that can improve automatically through experience and by the use of data.

Machine Learning Lifecycle

Collecting the Data — 1

Train the Algorithm — 2

Validate and Improve — 3

Make Better Predictions — 4

How is it used in Finance?

- Credit and Individual Ratings
- Credit Risk Scoring
- Fraud Detection on Credit Cards

- Automatic Approval of Loans
- Fintech

- Algorithmic Trading/High Frequency Trading
- Portfolio Management

A Little Example

Can I open a Mortgage? I would like to buy a new House

Based on my experience, you will not be able to repay it. Sorry but we cannot accept the request.

- 22 Years Old
- Earns 1000€ per Month
- Rents a house
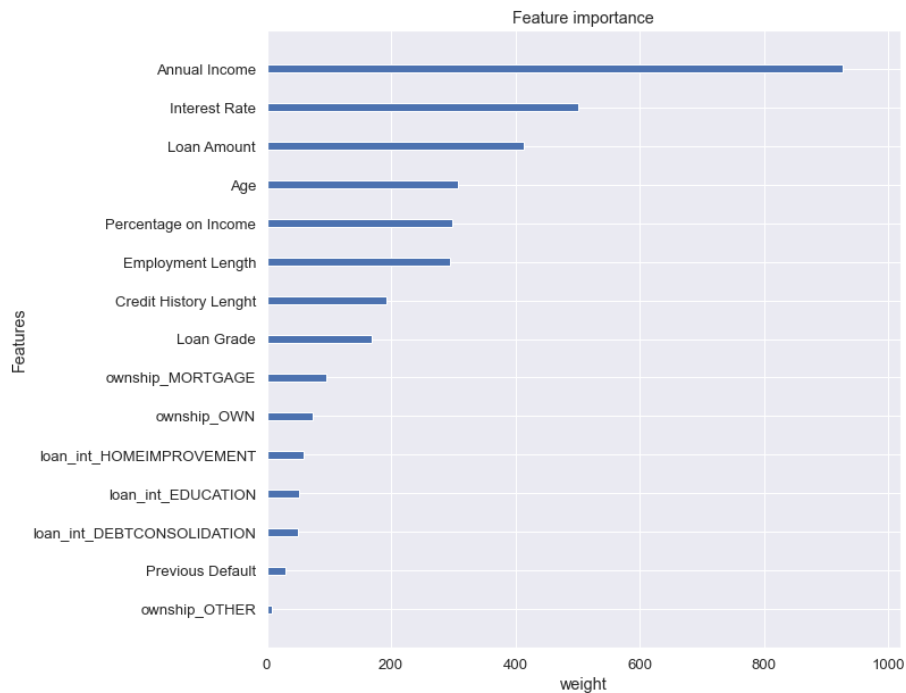- Recently bought a Car with a Loan

03
The Model

Comparison Between Logistic Regression and Two State of Art ML Technique: Decision Tree and Neural Network
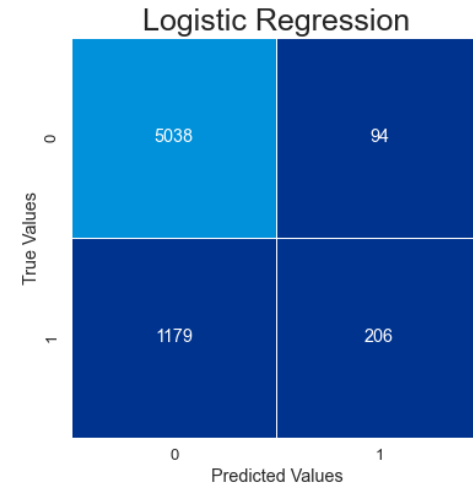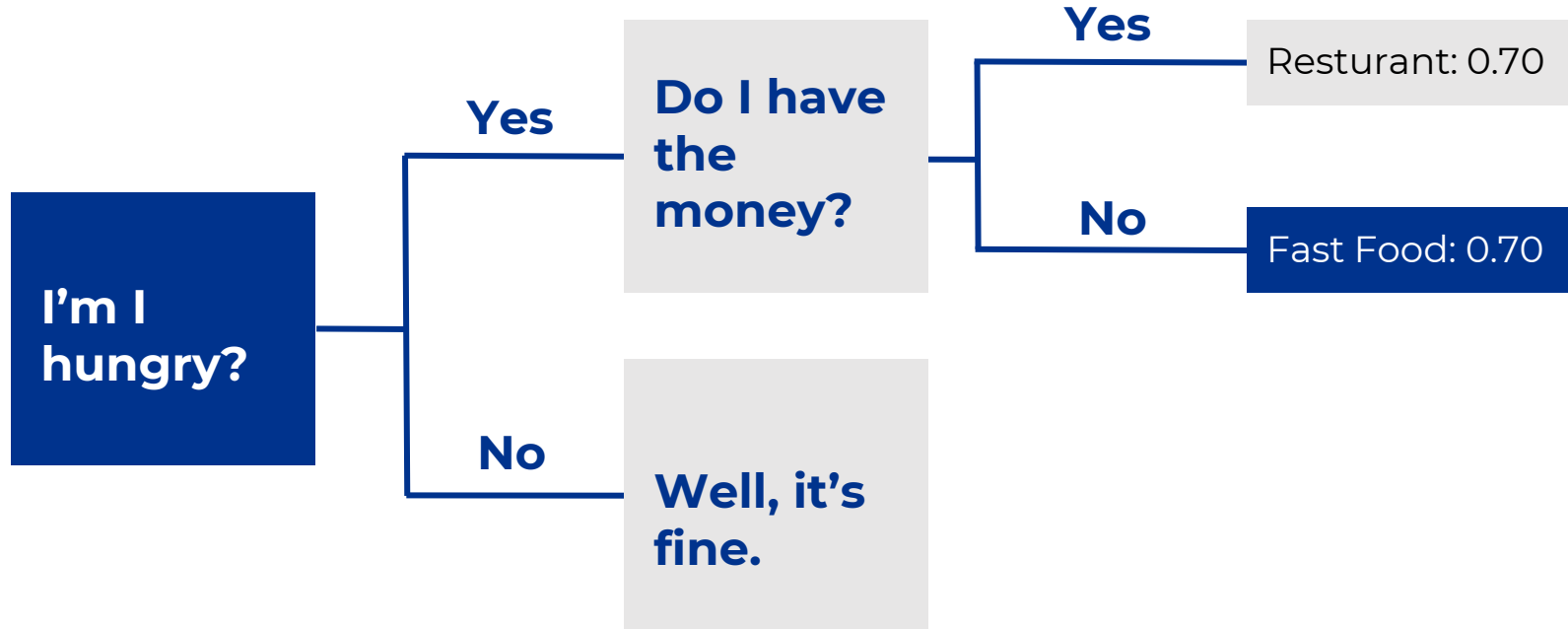
Coding is Cool

Features and Model

Feature importance

$$Default = \begin{cases} 1 & if\ ind.\ Default \\ 0 & otherwise \end{cases}$$

Logistic Regression

	Precision	Recall	F1-Score	Support
0	0,81	0,98	0,89	5132
1	0,69	0,15	0,24	1385
Accuracy			0,80	6517
Macro AVG	0,75	0,57	0,57	6517
Weighted AVG	0,78	0,80	0,75	6517

scikit learn

Logistic Regression

What is a Decision Tree?

I'm I hungry?

Yes → Do I have the money?

Yes → Resturant: 0.70

No → Fast Food: 0.70

No → Well, it's fine.

Our Decision Tree Model
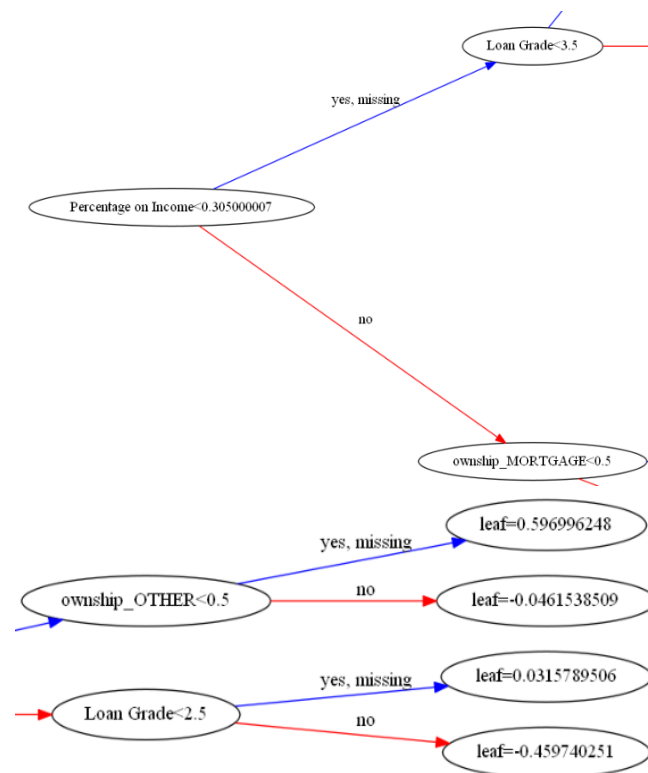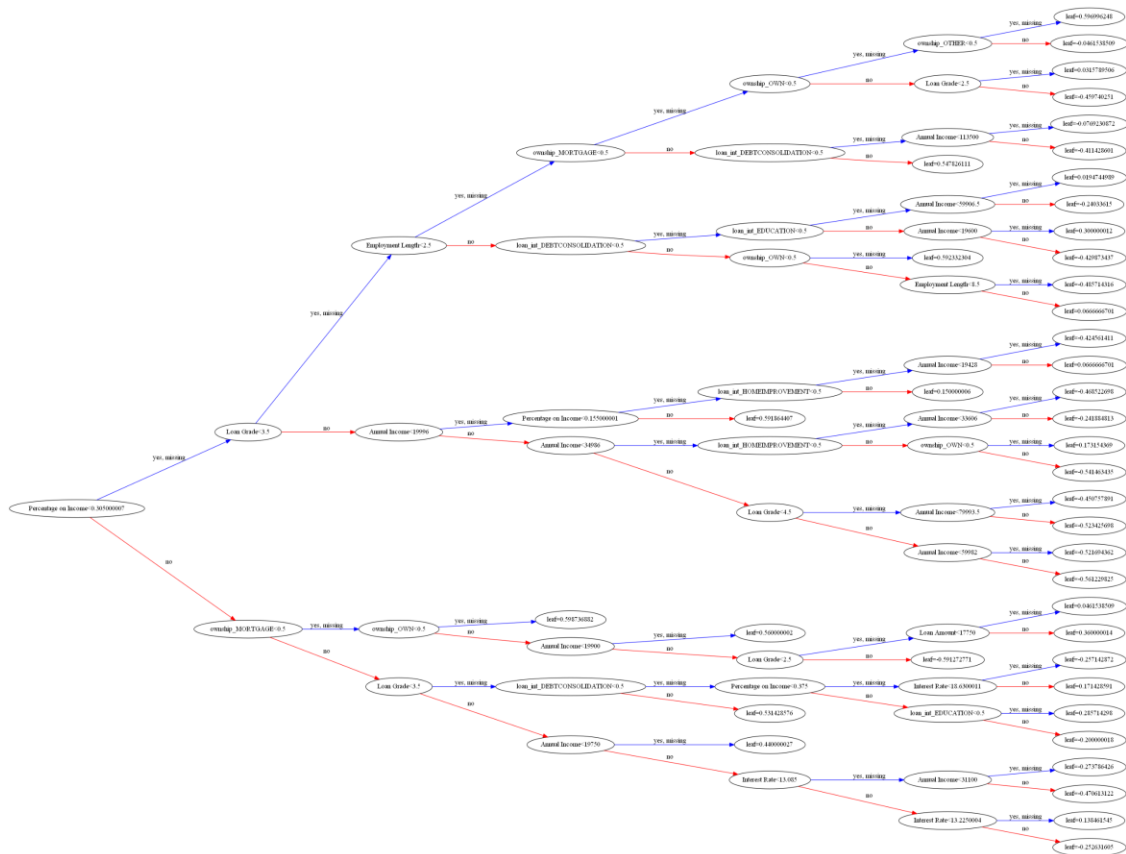
Boosting is Awesome

24% Increase of Precision in Predicting the **Default** with Gradient Boosting applied to Decision Tree.

	Precision	Recall	F1-Score	Support
0	0,93	0,99	0,96	5132
1	0,93	0,73	0,82	1385
Accuracy			0,93	6517
Macro AVG	0,93	0,86	0,89	6517
Weighted AVG	0,93	0,93	0,93	6517

dmlc
XGBoost

XGB Decision Tree

True Values / Predicted Values

	0	1
0	5060	72
1	370	1015
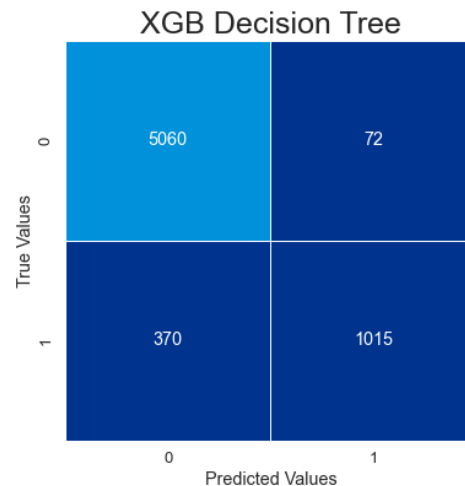
** The model has been trained and evaluated on the same Train/Test dataset

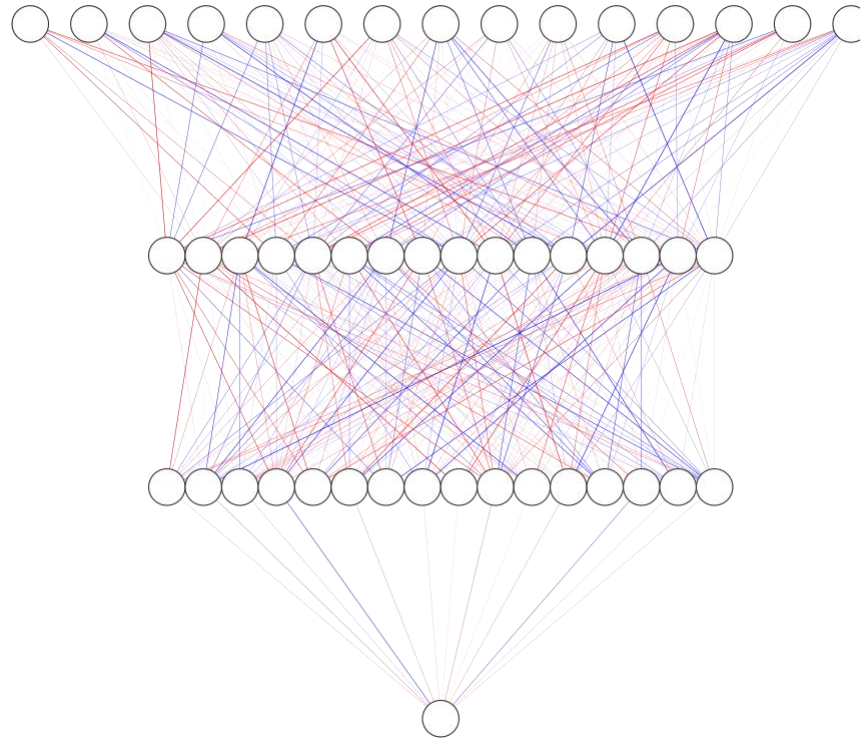# Our Neural Network Model

Input Layer

15 Features

Hidden Layers

112 Neurons

Output Layer
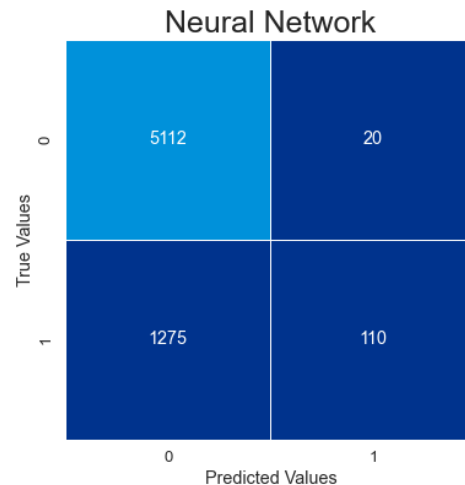
**Sigmoid Activation
In the Output Layer**

Neural Network Performance

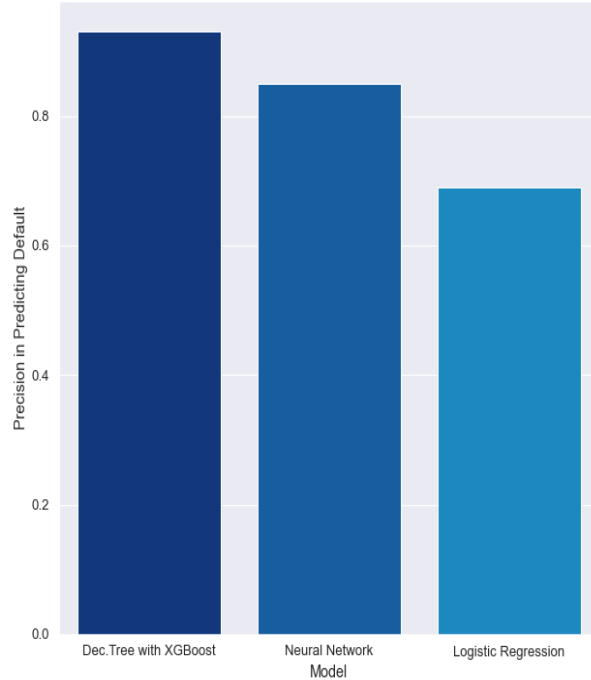**16% Increase** of Precision in Predicting the **Default**

K Keras

	Precision	Recall	F1-Score	Support
0	0,80	1	0,89	5132
1	0,85	0,08	0,15	1385
Accuracy			0,80	6517
Macro AVG	0,82	0,54	0,52	6517
Weighted AVG	0,81	0,80	0,73	6517

** The model has been trained and evaluated on the same Train/Test dataset
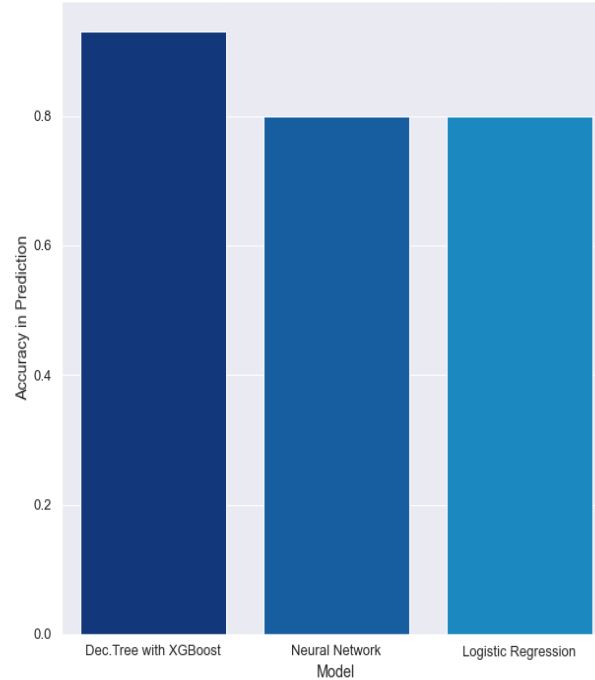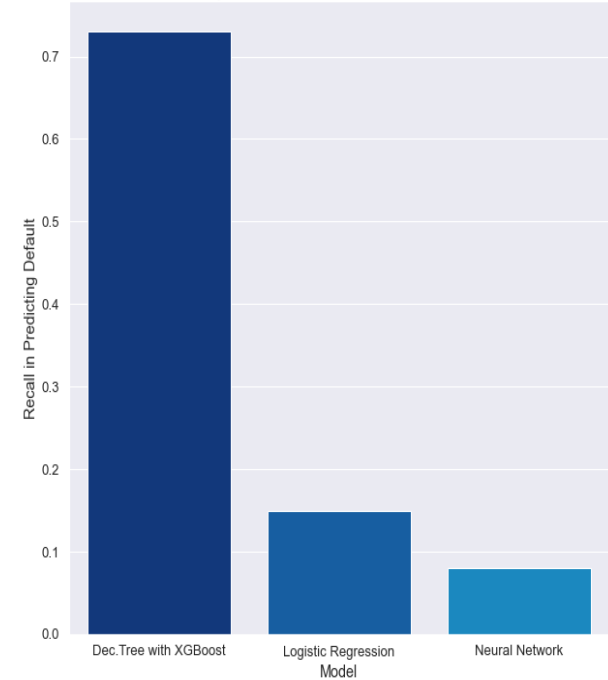
Neural Network

Final Comparison

04
Conclusions

To sum up.

From the Problem to the Solution

Problem → **Machine Learning** → **Solution**

Problem
- Credit Risk
- Predicting

Machine Learning
- Wide use in Financial Industry
- Better Prediction Performance

Solution
- Logistic Regression
- Decision Tree with XGBoost
- Neural Network

SWOT Analysis of the Model

Strengths

- High Performance
- Easy to Implement
- Easy to Interpret

Weaknesses

- Little Features Number
- Numerical Instability

Opportunities

- HyperParameter Tuning
- Better Model Specification

Threats

- Overfitting
- Errors in Prediction

Thank You for your Attention

Feel free to ask any question.

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«Computers are able to see, hear and learn. Welcome to the future.»

- Dave Waters