An Application of AI to Credit Risk Modelling in the Auto Loan Industry

Group Members:

Moruf Bamigboye
Maxwell Djoumessi Kana
Hon Ching Yeung
Sébastien Palma

Presentation Highlights

- Business Context
- Understanding Credit Risk Modelling
- Credit Risk Modelling
- Data Preparation
- AI Technology : Logistic Regression
- Predicting Auto Loan Defaults
- Conclusions

Business Context

- An auto financing company that has always relied on credit risk expert in predicting loan defaults will now like to leverage on AI technology to better and quickly predict loan defaults as it plans to massively increase its market share.
- It will also like to know the main determinant of defaults in order to better manage its risks.
- A database of customers' loans containing loan information, loanee information and credit bureau data and history is provided.

Understanding Credit Risk Modelling

Some Terminologies:

- Credit Risk is the possibility or risk that the borrower will not fully repay the loan. Calculated as the difference between the risk of lending a customer money and the risk of buying a government bond
- The likelihood that a customer will default on a loan is the probability of default (PD)
- The expected loss from a loan is the PD * Loss Severity * Exposure at Default

Credit Risk Modelling

- The loss severity which is calculated as 1-recovery rate is determined by the how much the company is able to recovery if a customer defaults and this will be dependent on a host of factors.
- We will focus on using AI to predict the probability of defaults given the data available

Data Preparation

- 40 features such as Date.of.Birth, asset_cost, and State_ID
- 233 154 rows
- Convert the date column to datetime data type
- Fill up missing values
- Divide into test and train datasets
- Drop unnecessary columns

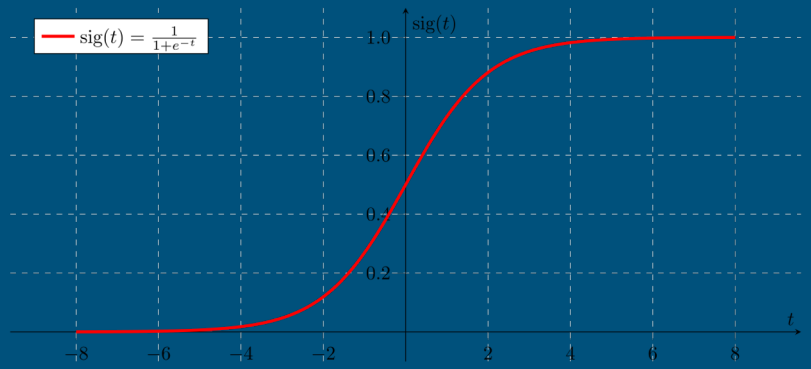
```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 186523 entries, 50119 to 71787
Data columns (total 40 columns):
 #   Column                          Non-Null Count   Dtype
---  ------                          --------------   -----
 0   UniqueID                        186523 non-null  int64
 1   disbursed_amount                186523 non-null  int64
 2   asset_cost                      186523 non-null  int64
 3   ltv                             186523 non-null  float64
 4   branch_id                       186523 non-null  int64
 5   supplier_id                     186523 non-null  int64
 6   manufacturer_id                 186523 non-null  int64
 7   Current_pincode_ID              186523 non-null  int64
 8   Date.of.Birth                   186523 non-null  int64
 9   Employment.Type                 180349 non-null  object
 10  DisbursalDate                   186523 non-null  object
 11  State_ID                        186523 non-null  int64
 12  Employee_code_ID                186523 non-null  int64
 13  MobileNo_Avl_Flag               186523 non-null  int64
 14  Aadhar_flag                     186523 non-null  int64
 15  PAN_flag                        186523 non-null  int64
 16  VoterID_flag                    186523 non-null  int64
 17  Driving_flag                    186523 non-null  int64
 18  Passport_flag                   186523 non-null  int64
 19  PERFORM_CNS.SCORE               186523 non-null  int64
 20  PERFORM_CNS.SCORE.DESCRIPTION   186523 non-null  object
 21  PRI.NO.OF.ACCTS                 186523 non-null  int64
 22  PRI.ACTIVE.ACCTS                186523 non-null  int64
 23  PRI.OVERDUE.ACCTS               186523 non-null  int64
 24  PRI.CURRENT.BALANCE             186523 non-null  int64
 25  PRI.SANCTIONED.AMOUNT           186523 non-null  int64
```

AI Technology: Logistic Regression

- As our target features is dichotomous (default/non default) and we are also interested in knowing the probability of default predicted by our model, we chose to apply a logistic regression model to our use case.
- The prediction of the probability of defaults can be used in calculating expected loss from our loan receivable (a reporting requirement from regulators) as well as in determining if a customer will default on its auto loan on the due date.

AI Technology: Logistic Regression

- Regression analysis to conduct when the dependent variable is dichotomous (binary)
- Describe data and to explain the relationship between one dependent binary variable and one or more independent variables
- Developed and popularized primarily by Joseph Berkson, beginning in Berkson (1944)



Prediction of Auto Loan Defaults

Our Model

- The predict_proba() method of our logistic regression is able to predict probability of defaults which can be used for expected loss computation and loan status reclassification
- To determine an appropriate threshold for loan default status classification we consider that It's important for our model to be able to predict true loan defaults than true non default loans as risk management actions will be based on default predictions
- We determine the optimal loan default threshold (0.211915) using the largest J statistics

Prediction of Auto Loan Defaults

Validation

The recall for defaults is 0.66 meaning 66% of our actual loan defaults were predicted correctly.

	precision	recall	f1-score	support
Non-Default	0.84	0.49	0.62	36585
Default	0.26	0.66	0.37	10046
accuracy			0.52	46631
macro avg	0.55	0.57	0.49	46631
weighted avg	0.71	0.52	0.56	46631

17817

Prediction of Auto Loan Defaults

- Estimated default probability of some entries:

No Default Probability	Default Probability
0.7054146	0.2945854
0.81272068	0.18727932

- Confusion matrix

17817	18768
3451	0

Conclusion

The model is able to identify loans that will be in default on the loans due date, hence Credit risk department can target risk management actions on this loans thereby reducing the expected loss from this loans that would have adverse impacted our profits.