Prediction of Company Bankruptcy

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Business use case: Banks

Statement of Problem	Client	Business Question
Banks will lose money if they lend to businesses that will face bankruptcy in the future	Banks are based in Taiwan	Are the companies that want to get loans from banks stable enough to be worth the risk?

The total loans taken from all banks in Taiwan in 2009 by corporate entities

$8,308,472,000

Probability of bankruptcy

3.23%

Loss per year – all banks

$268,363,646 annually

Loss per year – an average bank

$7,253,072 annually

Business impact for work

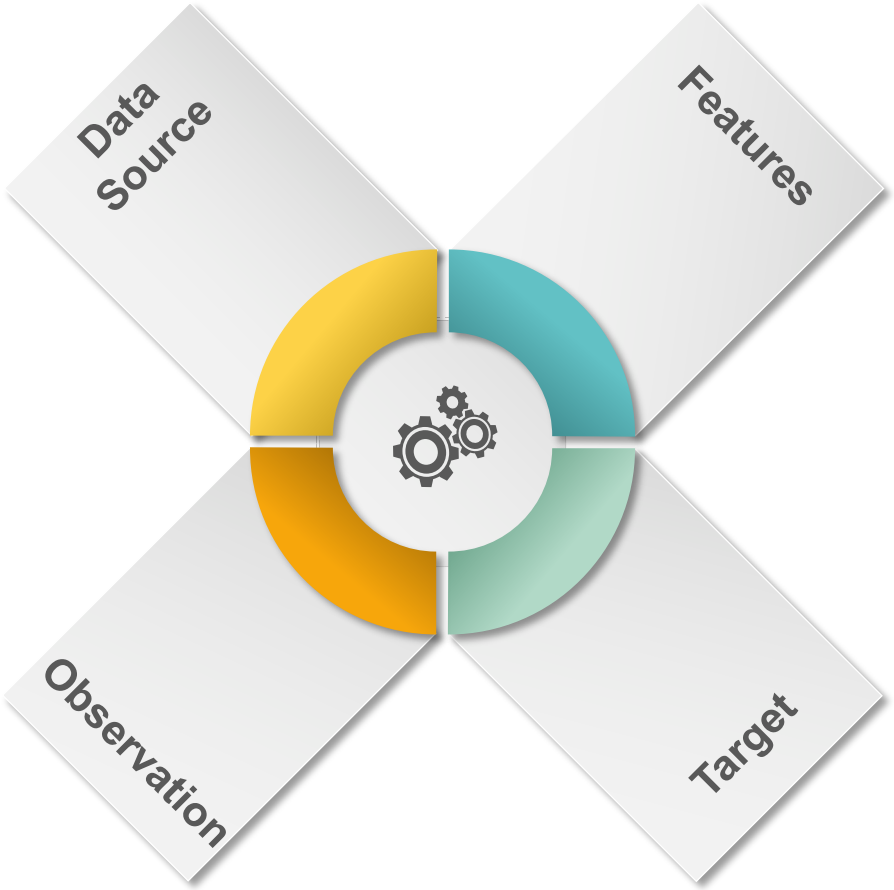
We reduce the total amount of loans given to all unstable companies by 1%

We would be saving $2,245,533/year

Data

Kaggle

The data was collected from the Taiwan Economic Journal for the years 1999 to 2009.



Rate of the financial statement

There are 96 features, 1 output feature and 95 input features. All the input features are expressed as a rate.

The number of observation

There are 6819 observations.

Bankrupt?

6599 companies are stable and 220 companies faced bankruptcy. The percentage of bankruptcy is 3.23%.

Prediction model

	Predicted stable company	Predicted unstable company
Actually Stable company	1085 TN	234 FP
Actually Unstable company	2 FN	42 TP

- **We don't want to incorrectly predict the companies that actually went bankrupt.**

- **Important Features**

There are 22 important features such as new income to total assets, debt ratio%, and current liability/equity.

Sensitivity:
89%

Base Model

Logistic Regression
Using 25 features

Sensitivity:
95%

Final Model

Catboost
Changed the threshold to 0.37

Business Actions

Business Question: **Are the companies stable that want to get loans from banks?**

- **Ask companies for their financial statement, and estimate probability of bankruptcy.**

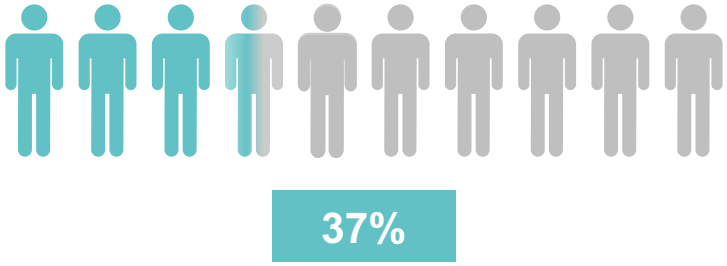
  If the probability is lower than 37%, we will loan for the companies.

- **For company with high probability, see if banks will be able to sell the loan to a bigger bank.**

  For small banks, after they provide a loan to customers, sometimes they sell the loan to a bigger bank because they prefer having money now instead of collecting interest for 30 years.

- **Monitor the metric to see if model's promising**

  Company bankruptcy does not happen often, so we can monitor the metric monthly.



Conclusions and Further Research

Conclusion

To find unstable companies, used classification modeling - catboost that resulted 95% correct for predicting the unstable companies.

Further Research

- Use Xgboost classification with 95 features
- Use SMOTE classification with 95 features

Conclusion

Banks can use this prediction model to prevent from giving loans to the companies that are expected to go bankrupt.

Further Research

- Use PCA for feature selection
- Use feature importance for feature selection

Limitation

Using the final model, only 15% is actually unstable companies when we predicted that the companies are unstable.

Further Research

- Use Catboost classification for feature selection, and then use PCA to prevent from overfitting. After that, use Catboost again to train a model with the PCA transformed data.

Thank you