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Creating Business Value, Driven by Data Intelligence

CASE STUDY

Predictive modeling for future profitability at policy inception

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Predictive Modeling for Future Profitability at Policy Inception

Proof of Concept for Predicting Policy Profitability

CASE STUDY

Objective

Under the International Financial Reporting Standard (IFRS17), the Contractual Service Margin (CSM) is calculated at policy inception. This calculation serves as a measure of expected profitability, incorporating assumptions about future cash flows. The CSM is computed as the present value of net cash flows (inflows minus outflows) with an adjustment for risk.

- Demonstrate that a machine learning (ML) model can be accurately trained to predict the profitability of insurance policies at the inception stage.
- Evaluate the accuracy of various predictive models.
- Identify and explain the key drivers of policy profitability.

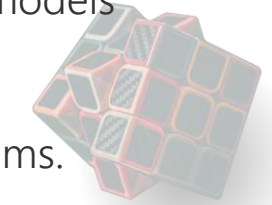
Tools & Technologies

- Python
- Tensorflow
- AWS Glue or Jupyter Notebook

Purpose of Model

The primary goal of the model is to predict policy profitability at key stages (quotation, pre-sale, or inception). The model aimed to provide early feedback to the business, enabling better decision-making.

- Client Targeting: Identifying profitable segments for marketing efforts.
- Business Forecasting: Setting early expectations for profitability at the inception stage.
- Broker Remuneration: Informing compensation models based on predicted profitability.
- Loyalty Programs: Input into client loyalty programs.



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Data Inputs

The model was trained using a comprehensive dataset that included contract-level information, such as:

- Unique Identifier for each contract
- Premium
- Cover
- Policy Term
- Commission
- Demographics: Age, Gender, Smoker Status, Occupation Class.
- Socio-Economic: Socio-Economic class, Income band.

Additionally, the model used actuarial modelling outputs that included the CSM at inception, both at the product and contract levels. The dataset was split into a training set for model development and a validation set to test model accuracy.

Methodology

A variety of statistical models were employed to assess their performance in predicting profitability:

- Linear Regression
- Decision Trees
- Random Forests
- Neural Networks
- Neural Networks with Boosting

Boosting techniques were specifically applied to the neural network model to enhance its predictive accuracy.

- **Linear Regression**: The linear regression model provided useful information for identifying which data dimensions were the most significant predictors of profitability.
- **Neural Network with Boosting**: This model showed exceptional performance, with validation results indicating up to **96%** accuracy in early profit predictions.

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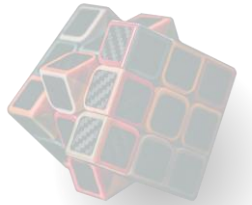
Governance

The implementation of this predictive model necessitates ongoing governance and ethical oversight:

- Model Retraining: It is recommended that the model be retrained quarterly, or at least annually, using the latest available data to maintain accuracy.
- Risk Assessment: The inherent risks of relying on expected future profits as a definitive measure must be carefully evaluated.
- Ethical Implications: The ethical and legal implications should be considered when using of the model's output for various business purposes, such as client targeting and broker remuneration.
- Accuracy Considerations: The model output is highly dependent on actuarial model output accuracy.

Outcomes

- The linear regression model provided insight on the most important policy and demographic drivers, e.g. premium, cover, term, age, gender, smoker status and occupation class.
- The predictive capabilities of the model support various business functions, including client targeting, broker remuneration, and profitability forecasting.
- The neural network model with boosting showed exceptional performance with 96% accuracy with early profitability predictions.
- The other models included decision trees, random forests and differently parameterised neural networks and provided useful inputs into the exercise.



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