SOA Predictive Analytics Seminar – South Korea

30 Aug. 2019 | Seoul, South Korea

Session 3

Medical underwriting triage: An end-to-end machine learning case study

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Medical underwriting triage

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30 August 2019

SOCIETY OF ACTUARIES

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Business background

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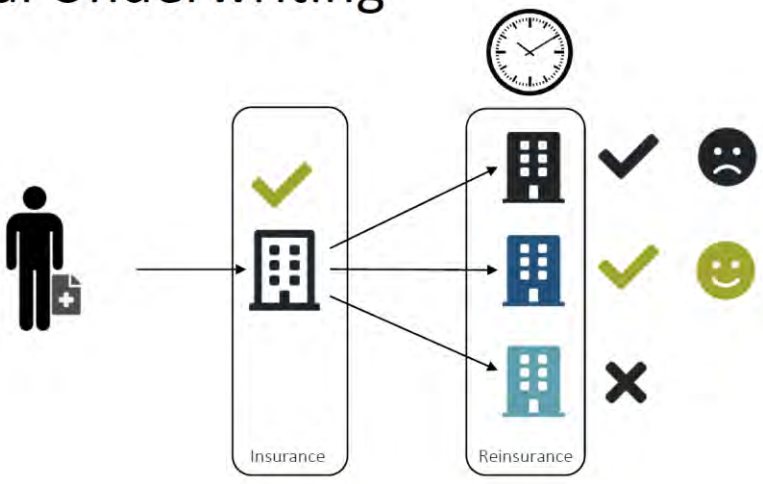
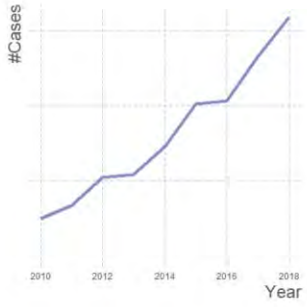
Medical Underwriting



Improvement potential

- Accept / decline
- Resource efficiency
- Response times
- Declined cases



Modelling

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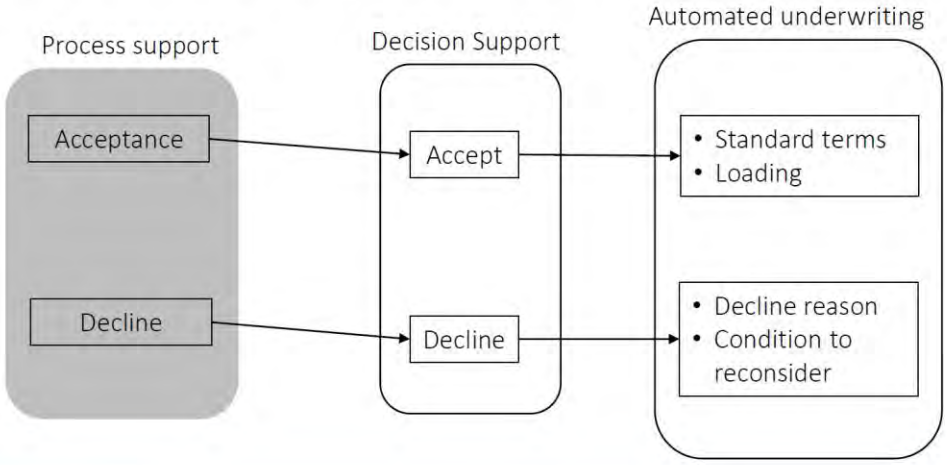
Levels of sophistication

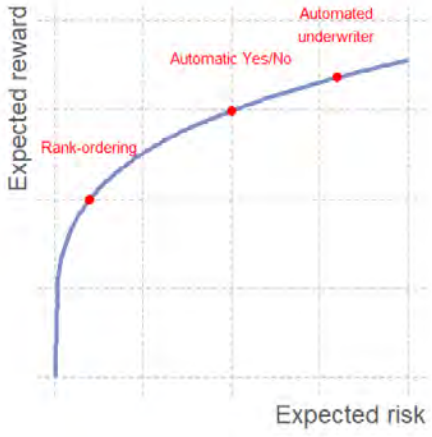


Modelling

Risks

- Taking in bad cases can be very expensive
- Loss of good business
- Relationship with clients (primary insurer)
- Reputational risk

- **Ethical**: very important decision for applicant



Modelling

Target

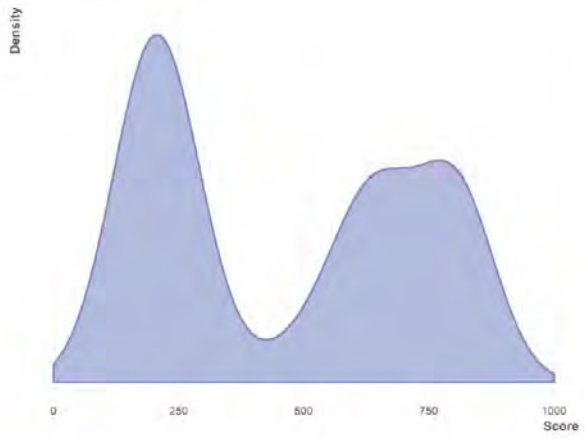
Prediction

- Acceptance probability
- The goal is not to use this to actually make the decision
- Reason: both are not simple yes/no decisions

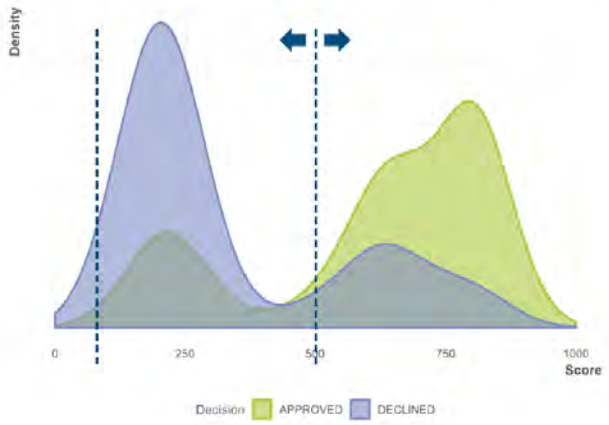
Desirable

- Interpretability
- Good at rank ordering
- Relative score enough

Modelling result



Modelling result vs UW decision



Modelling

Models

GBM

`library(h2o)`

+ High discriminatory power
- Hard to interpret
- Risk for instability

Hierarchical GLM

`library(brms)`

+ Interpretable
+ Stable
+ Low risk of overfitting

Discriminatory power

~ 0.80 AUC-ROC
for both model types

Modelling

- Features
- Personal data
- Medical Data (High level)
- Primary Insurer data, in particular their decision

Deployment

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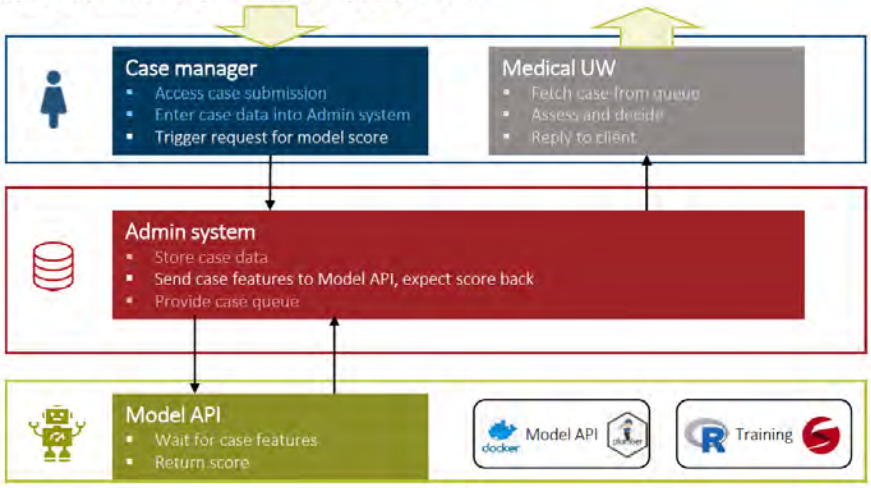
Medical UW Workflow



Testing, evaluation and monitoring

Hypothesis: We win more business if we get quicker on acceptances

- Does speed impact the win rate?
- Does the model deployment impact speed?
- Does the model deployment impact the win rate?

Is our model still relevant?

- Change of underwriting guidelines
- Change of data or data quality
- Adding new clients
- Clients' change of their strategy

Feedback on data generating process

- Does the model deployment influence Medical Underwriting's decisions?

Deployment

Model monitoring

Monitor performance over time and by group

Lessons learnt

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Summary

End-to-end Machine Learning

Lessons learnt

- Understand the data generation process
  - Which variables are entered when? Can you use them?
- Think about the people
- Think of **model integration** from the start
  - Where in the process does the model fit?
  - How to test the impact of the model?
  - How would the new process impact the data generating process?
- Think about the people