PRICING AND RESERVING LIFECYCLE

MACHINE LEARNING APPLICATIONS

Neil Covington
Global Head of General Insurance, FIS

FIS

ABOUT OUR SPEAKER

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Global Head of General Insurance and AI/ML Lead, FIS

With 30 years of industry experience, including serving as Chief Actuary and Head Actuary for multi-line, multinational businesses, Neil Covington’s expertise covers the design, development and implementation of risk models.

With a knack for translating complex concepts to diverse audiences, Neil specializes in capital modelling, IFRS 17, reserving, pricing and AI/ML. At FIS, he is also responsible for global GI and AI/ML insurance solutions management and development, alongside pre-sales and professional services support.

FINTECH THE FINANCIAL WORLD IS BUILT ON

ECONOMIES RELY ON FIS

Trusted to move the world's money.

$40T

was processed on our asset management technology in 2022. That's nearly half the world's total and 1.5x
the GDP of the U.S.

BUSINESSES RUN ON FIS

Our business is powering business.

95%

of the world's best banks use our technology

$112B

Processed in transactions last year

80%

of the largest asset managers

200K+

Clients worldwide rely on our technology

INNOVATORS BUILD ON FIS

We are the innovator's innovator

50%

of the world's most innovative companies are clients or partners

100%

carbon neutrality and renewable energy by 2025

FIS TODAY

$9.8B

REVENUE

$38.1B

MARKET CAP

FIS INSURANCE RISK SUITE

TRUST

34+ years
10,000+ users
70+ countries

RELIABLE

4.73T managed Net Written Premiums

COMPLETE

Life, Health, General and Annuity

REDUCE

the total cost of owning digital technology

GAIN

economies of scale with outsourced services

IMPROVE

efficiency and save money on business processes

InsuranceERM Americas Awards 2023 Winner
Regulatory reporting software of the year

InsuranceERM Americas Awards 2022 Winner
Actuarial modelling solution of the year

RiskTech 100 2022
FIS
Insurance

RiskTech 100 2022
FIS
Overall Winner

AsiaRisk Awards 2022 Winner

GENERAL INSURERS, WE HAVE YOU COVERED....

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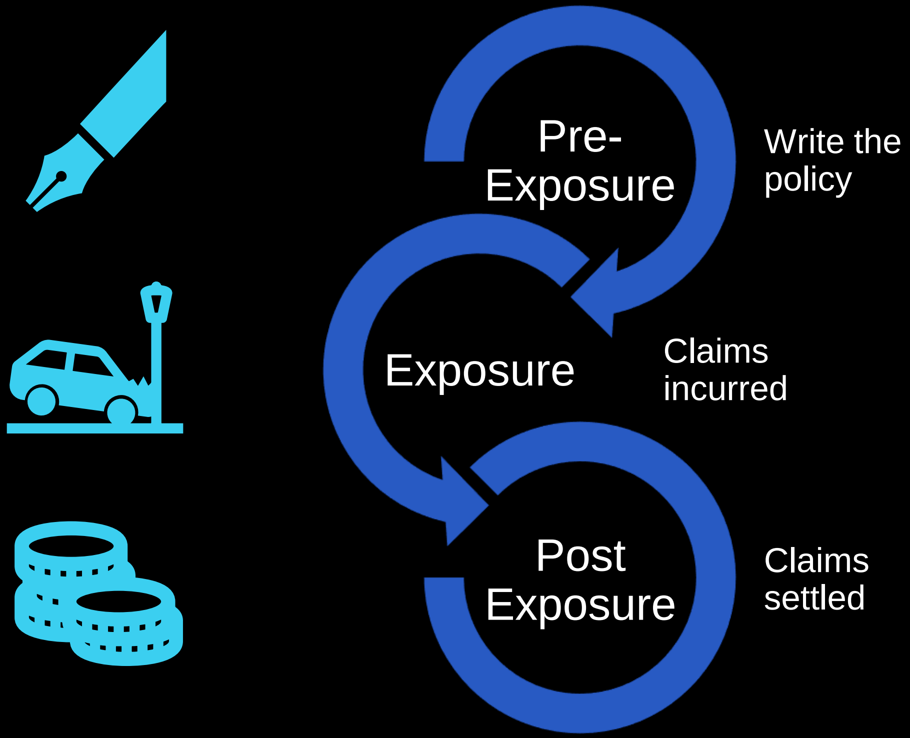
POLICY LIFECYCLE

POLICY LIFECYCLE



POLICY LIFECYCLE

Pre-Exposure	Price GLMs, GAMs Frequency and severity all periods
Post Exposure Pre-Claim	IBNR Paid, incurred, frequency, severity triangles Frequency and severity this period
Post Exposure Post Claim	RBNS/Case, IBNER Paid, incurred triangles Severity this period, this claim

POLICY LIFECYCLE

Pre-Exposure	**Pricing**
Post Exposure Pre-Claim	**Reserving**
Post Exposure Post Claim	**Reserving**

PREDICTIVE MODELLING FRAMEWORK

PREDICTIVE MODELLING

What is it?

- Uses statistics to predict outcomes
- Given predictor variables what is an outcome
- Synonymous with machine learning
- Often referred to as predictive analytics

Predictive modelling

Uses a statistical model to predict a future event or outcome based on known data.

Predictive analytics

Typically refers to analysing historical data about events to make predictions about the future.

PREDICTIVE MODELLING

Continuous – Regression

RISK COST

CLAIM COST

PREDICTIVE MODELLING

Discrete – Classification

ACCEPT RISK

FRAUDULENT CLAIM

MANAGE OR PAY CLAIM

PREDICTIVE MODELLING FRAMEWORK

Question

Model-Building and Testing

Uncertainty Evaluation

PREDICTIVE MODELLING FRAMEWORK

Pre-exposure

Question	What is ***the total*** claim cost
Model-Building and Testing	GLMs, GAMs
Uncertainty Evaluation	Model testing, validation

PREDICTIVE MODELLING FRAMEWORK

Post exposure, pre and post claim

Question	What is ***this*** claim cost
Model-Building and Testing	Triangles
Uncertainty Evaluation	Residuals, actuals vs expected

MODEL PREDICTORS AND PREDICTIONS

MODEL PREDICTIONS

What affects the outcome?

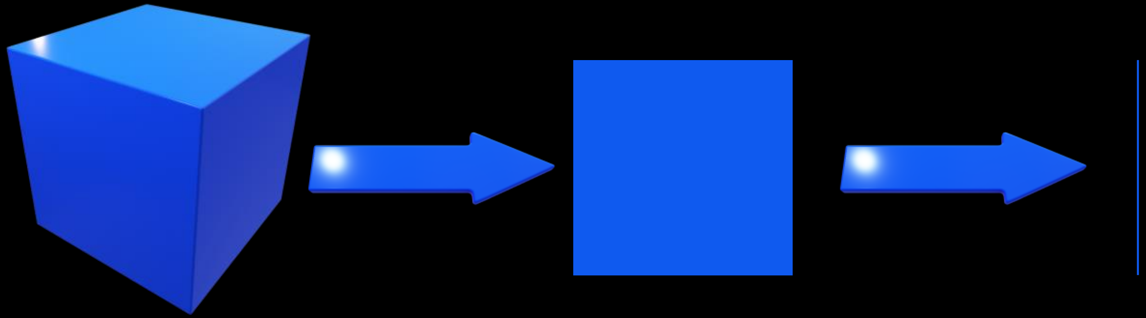
Cause

Effect

DIMENSIONALITY REDUCTION

What really matters?

- Transformation of data from a high-dimensional space into a low-dimensional space
- Low-dimensional representation retains some meaningful properties of the original data
- Converging to intrinsic dimensions
- Dimensions for shape or colour?
  - Shape requires all dimensions
  - Colour only requires one



DIMENSIONALITY REDUCTION

Features

Feature Selection

Find a subset of features

- Filter
- Wrapper
- Embedded (try it and see) e.g. GLM factor regression

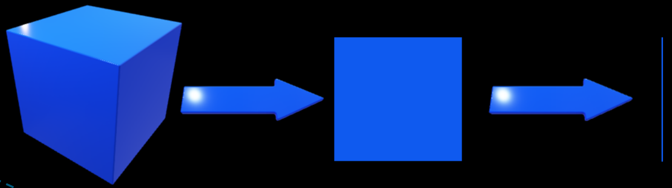
Feature Extraction

Transform the data

- Linear e.g. Principal Component Analysis
- Non-Linear e.g. Autoencoder, Clustering

MODEL PREDICTORS

Motor Example



Pricing Shape

- Cover
- Policyholder age
- Location
- Type of vehicle
- Age of vehicle
- Value of vehicle
- Mileage
- Policy duration
- Marital status
- No claims period
- Voluntary excess
- …

Reserving Colour

- Cover

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MODEL TYPES

Forecast

- One of the most prominent predictive model types
- Predict future values based on historical data
- Manage metric value predictions by estimating the numeric value for new data based on learnings from historical data.

Classification

- Used to assign classes to data
- Generally easier and more cost-effective to implement than predicting continuous values
- Examples of these types of models include binary, multi-class and regression models

Outlier

- Used to identify anomalous data points that do not fit the pattern of the rest of the data
- For example, an outlier model might be used to identify incorrect credit card charges or other fraudulent numbers
- It would look at individual data points to determine whether they are incorrect compared to the rest of the data

Time Series

- Used to predict future events based on past data ordered in a sequence
- It is an econometric technique used to predict future values based on past values
- A time series model uses the trends, seasonality and cyclicality of a system, as well as other factors to forecast future behaviour

Clustering

- Used to identify groups of data points that are very similar to each other
- The clustering model is used to group similar items, which can help with tasks like customer segmentation and finding the best way to market products

MODEL TYPES – APPLICATIONS

Forecast	Pricing, Reserving
Classification	Underwriting decision, fraudulent claim, manage or pay claim
Outlier	Fraudulent claim, unusual claim
Time Series	Inflation, trends
Clustering	Dimensionality reduction, model points

CURRENT APPLICATIONS

MODEL PREDICTORS

Motor Example

Pricing

- Cover
- Policyholder age
- Location
- Type of vehicle
- Age of vehicle
- Value of vehicle
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- No claims period
- Voluntary excess
- …

Reserving

- Cover

MODEL PREDICTORS

Motor Example

Pricing

- Cover
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Reserving

- Cover
- Policyholder age
- Location
- Type of vehicle
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- …

MODEL PREDICTORS

Motor Example

Pricing

- Cover

Reserving

- Cover

MODEL TYPES

Motor Example

Pricing

- GLM
- GAM
- Other machine learning
  - Random Forest
  - Gradient Boosting
  - Etc.

Reserving

- Triangles

MODEL TYPES

Motor Example

Pricing
- GLM
- GAM
- Other machine learning
    - Random Forest
    - Gradient Boosting
    - Etc.

Reserving
- Triangles
- GLM
- GAM
- Other machine learning
    - Random Forest
    - Gradient Boosting
    - Etc.

MODEL PREDICTORS

Motor Example

Pricing

Overfitting?

- Models the training data too well
- Model learns the detail and noise in training data
- Negatively impacts the performance of the model on new data
- Noise or random fluctuations in training data picked up and learned as concepts by the model

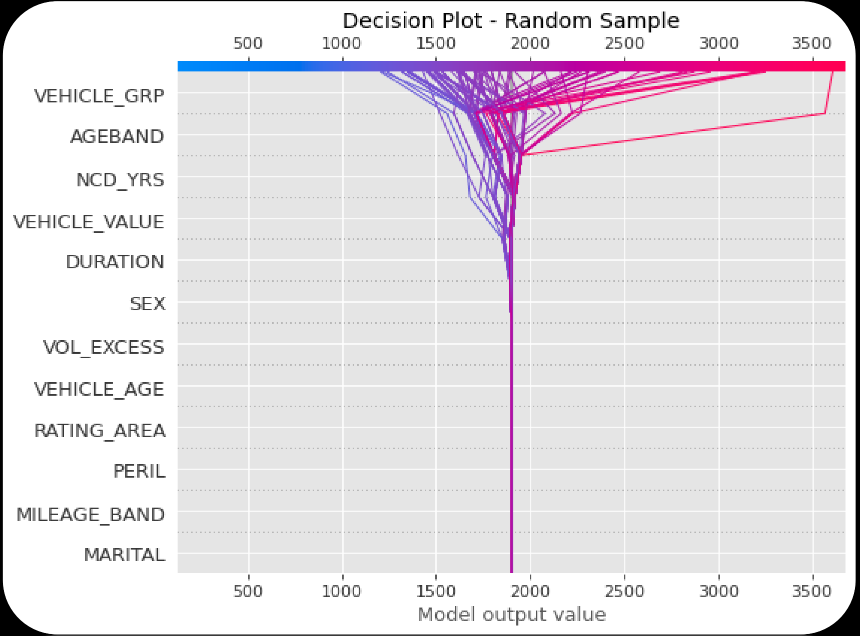
Reserving

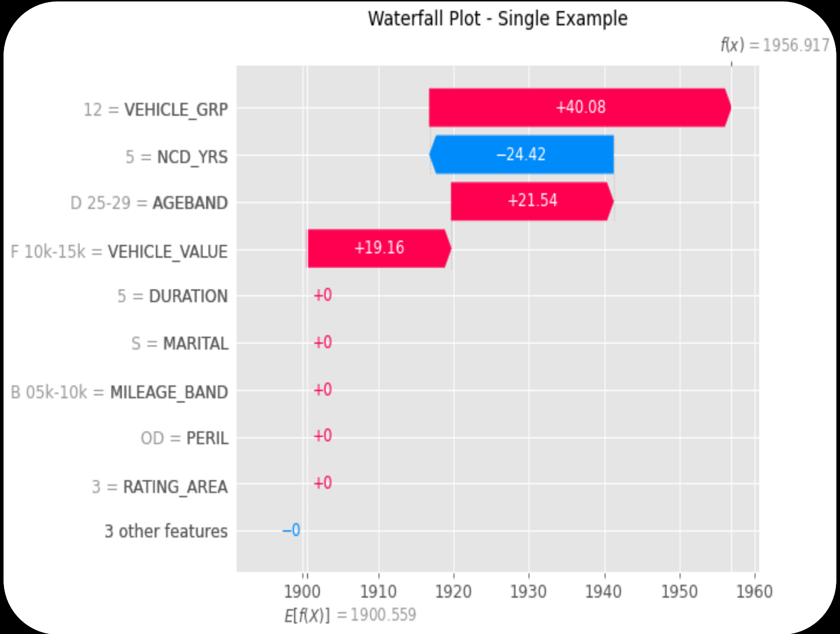
Underfitting?

- Model can neither model training data nor generalize to new data
- Not a suitable model

WHAT MATTERS

SHAP Values - Claim Severity, Gradient BOOST Model





WHAT MATTERS

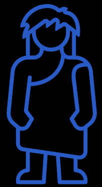
GLM Regression – Claim Severity

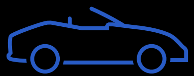
	AGEBAND	DURATION	MARITAL	MILEAGE_BAND	NCD_YRS	PERIL	RATING_AREA	SEX	VEHICLE_AGE	VEHICLE_GRP	VEHICLE_VALUE	VOL_EXCESS
GLM Backwards		×	×	×		×			×			×
GLM Forwards	✓			✓	✓		✓	✓		✓	✓	✓
GLM Bi-Directional	✓			✓	✓		✓	✓		✓	✓	✓

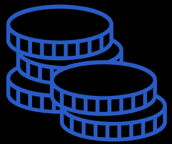
WHAT MATTERS

GLM Regression and Boosting – Claim Severity

	AGEBAND	DURATION	MARITAL	MILEAGE_BAND	NCD_YRS	PERIL	RATING_AREA	SEX	VEHICLE_AGE	VEHICLE_GRP	VEHICLE_VALUE	_EXCESS
GLM Backwards		×	×	×		×			×			×
GLM Forwards	✓			✓	✓		✓	✓		✓	✓	✓
GLM Bi-Directional	✓			✓	✓		✓	✓		✓	✓	✓
Gradient BOOST	✓				✓					✓	✓	

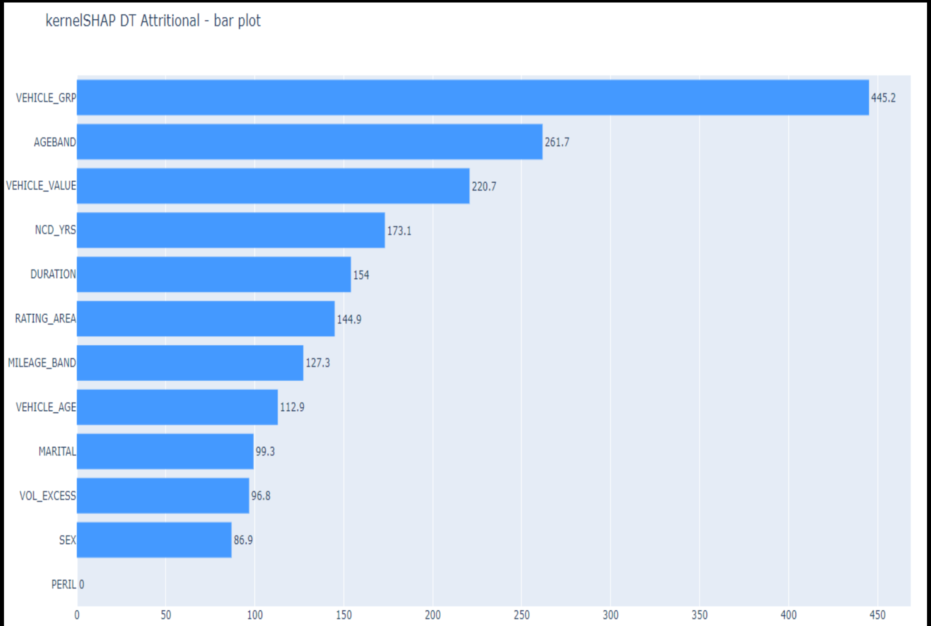


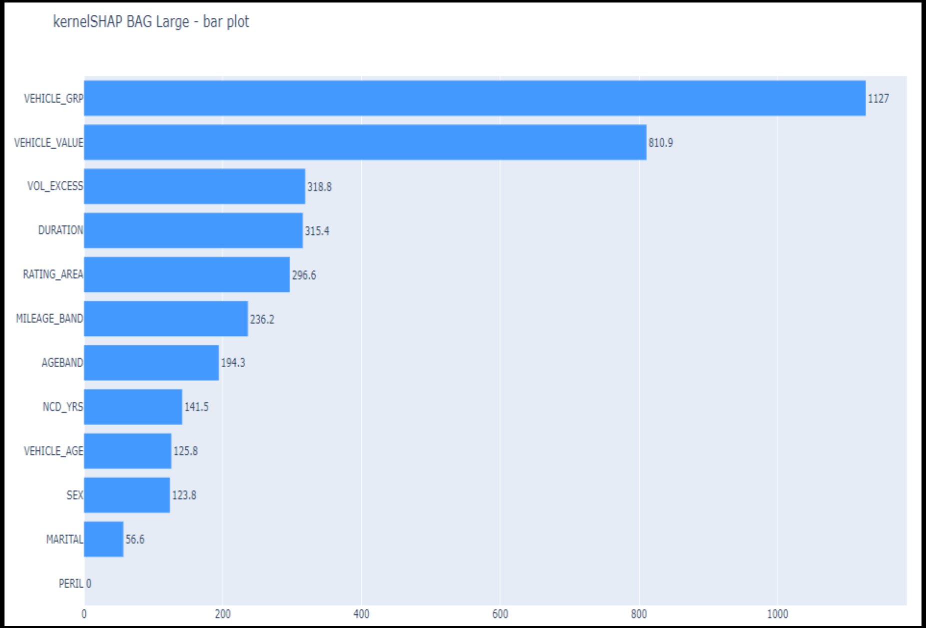




WHAT MATTERS

SHAP Values - Claim Severity, Attritional Large Split





WHAT MATTERS

SHAP Values - Claim Severity, Attritional Large Split

RESERVING

Why not using Machine Learning and more predictors

Triangles aggregate data for statistical significance Not statistically significant enough if split?	Quality and availability of detailed claims data?	Claims development based on current paid and estimate levels
Investigating individual claim reserving methods	Triangles widely understood and accepted	Machine learning less explainable

PRICING

Why not using other Machine Learning algorithms

GLMs and GAMs more widely understood, accepted and programmable

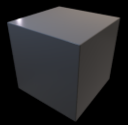
Other machine learning algorithms less explainable

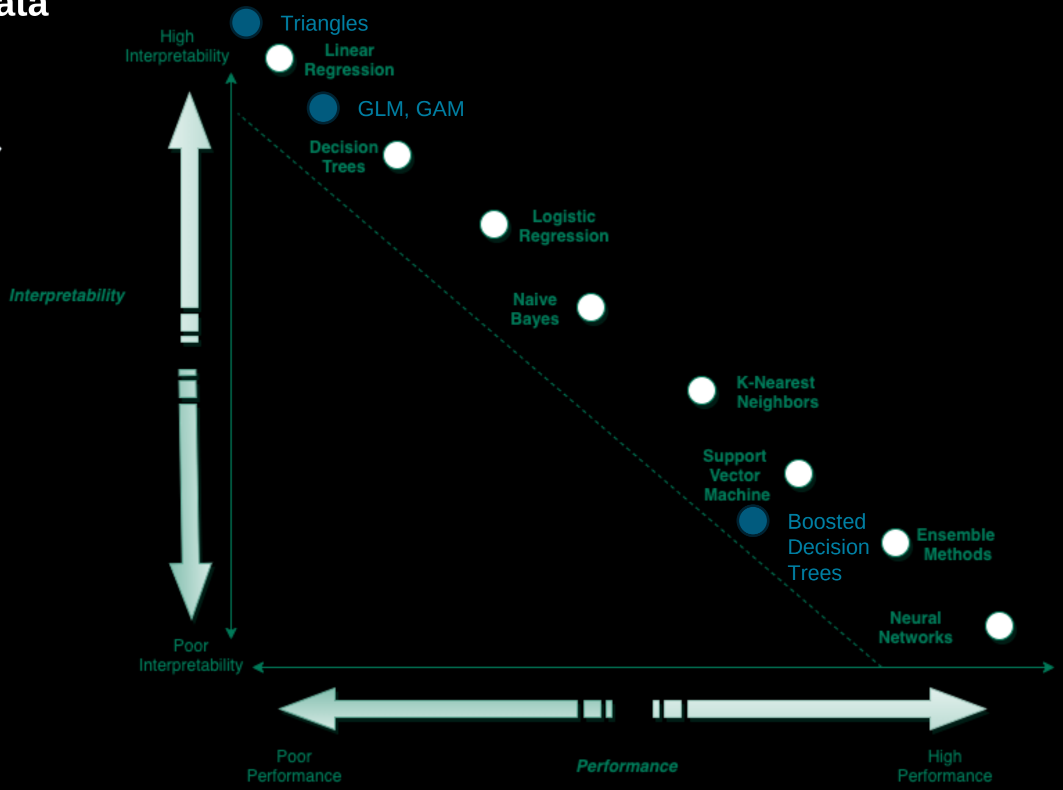
EXPLAINABILITY

Interpretability
Vs
Performance

EXPLAINABILITY

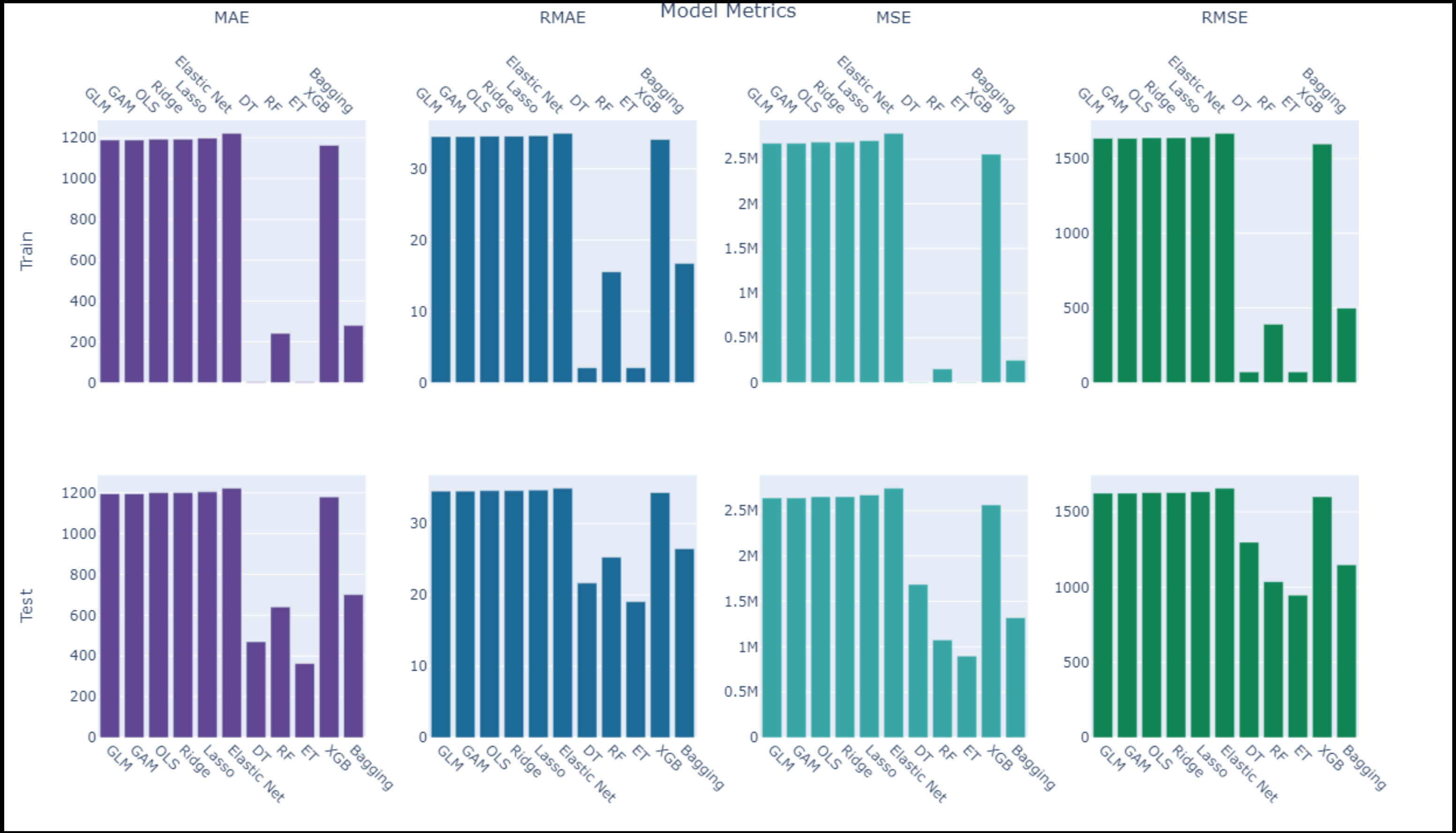
Reduce and Refine Data





MODEL COMPARISON

Claim Severity



FEAR OF THE UNKNOWN OR BEING DIFFERENT?

THE FUTURE

WHAT'S IMPORTANT

NO ONE SIZE FITS ALL

NEED TO HAVE ROBUST SOLUTION TO BE ABLE TO APPLY TECHNIQUES TO OWN DATA

HAVE ALL TOOLS IN ONE PLACE TO SEE AND UNDERSTAND WHAT'S GOING ON

HYBRID MODELS

Reduce and Refine Data

Feature extraction instead of feature selection

Clustering to group risks and claims for applying models

Dimensionality reduction or expansion to identify intrinsic dimensions for each of pricing and reserving

HYBRID MODELS

Explainability Options

Traditional learning with refined data e.g.
- GLM
- GAM
- Triangles

Advanced machine learning using explanatory techniques
- Local interpretation
- Global interpretation

HYBRID MODELS

Explainability Options

CONSIDER MULTIPLE MODELS

COMPARE AND CONTRAST

IDENTIFY DRIVERS OF DIFFERENCE

SOLUTION PERSPECTIVE

INSURANCE RISK SUITE
GI EDITION

Actuaries

Underwriters

Risk Managers

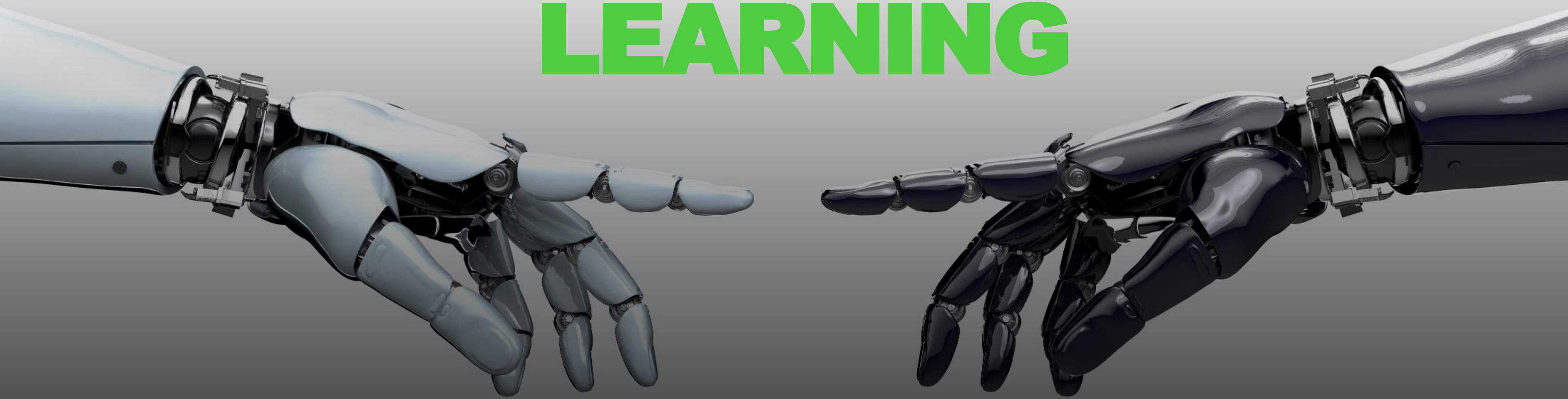
INSURANCE RISK SUITE
GI EDITION

Out of the box functionality

Transparent customisable calculations

Rapid development environment

AI AND MACHINE LEARNING



Ask us what we are doing …

GI EDITION IS READY ...

ARE YOU?

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THANK YOU FOR LISTENING

GI EDITION IS READY …
ARE YOU?

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Thank you for joining today's

PRICING AND RESERVING LIFECYCLE session

Any questions?

Feel free to reach out to me:

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