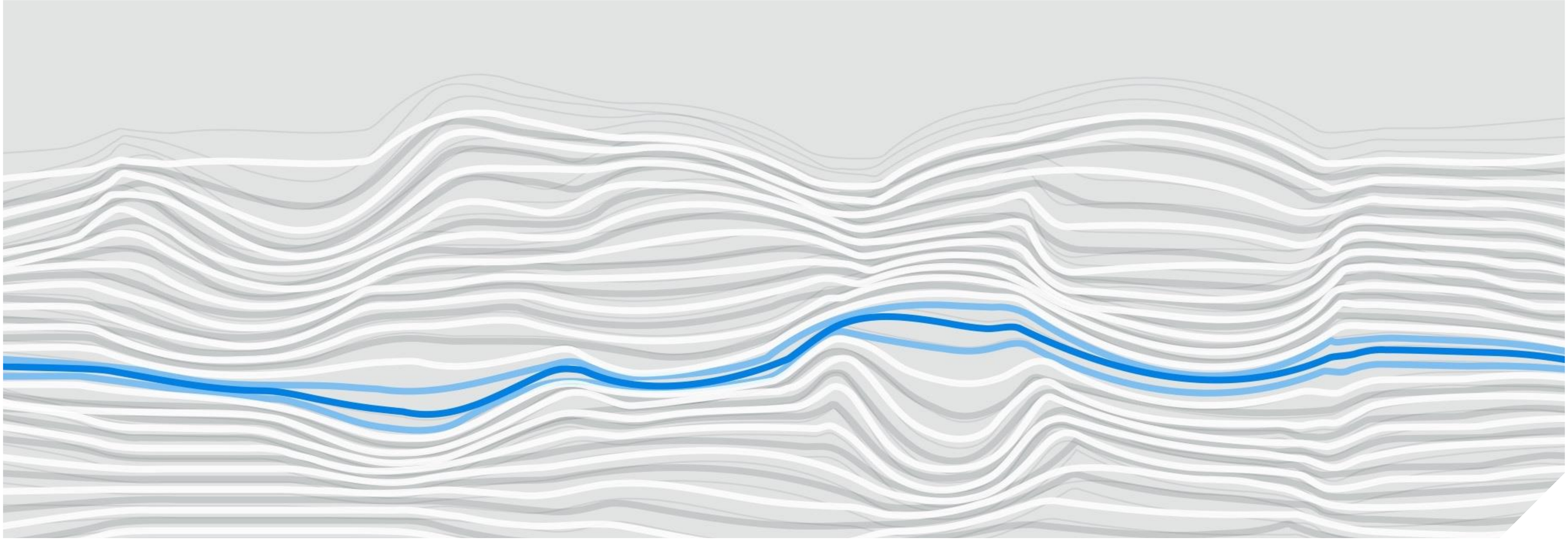
Validating the Black Box

Eoin Ó Baoighill
Eibhlín O’Kane



About us

Eoin Ó Baoighill

Eoin is a general insurance actuary whose experience includes:

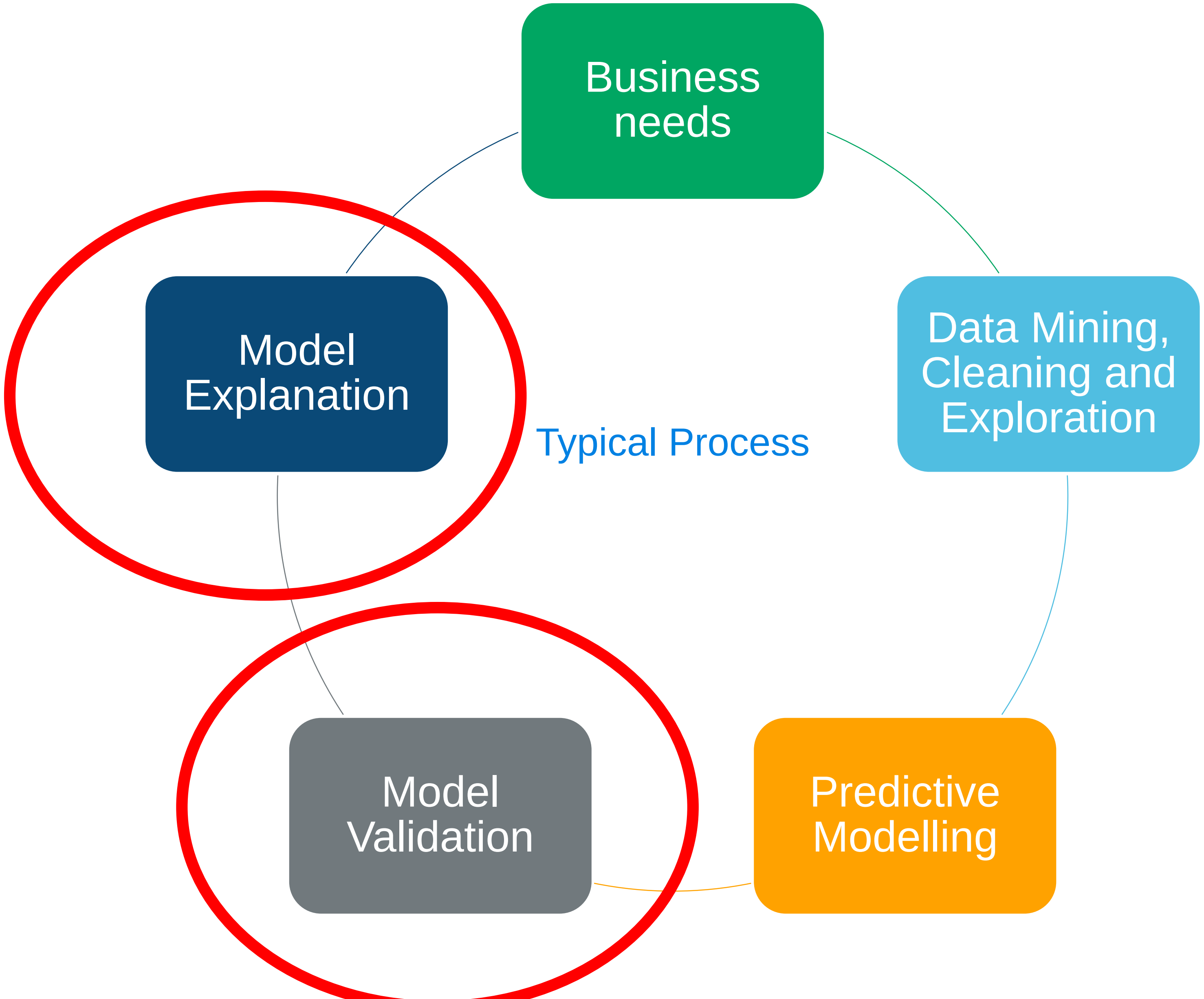
- 20 years experience in general insurance
- Worked with Milliman since 2014
- Previous roles included Head of Pricing in Liberty Insurance, Head of Technical Pricing in RSA, and Chief Pricing Actuary in Zurich Insurance

Eibhlín O'Kane

Eibhlín is a data scientist/part qualified actuary who:

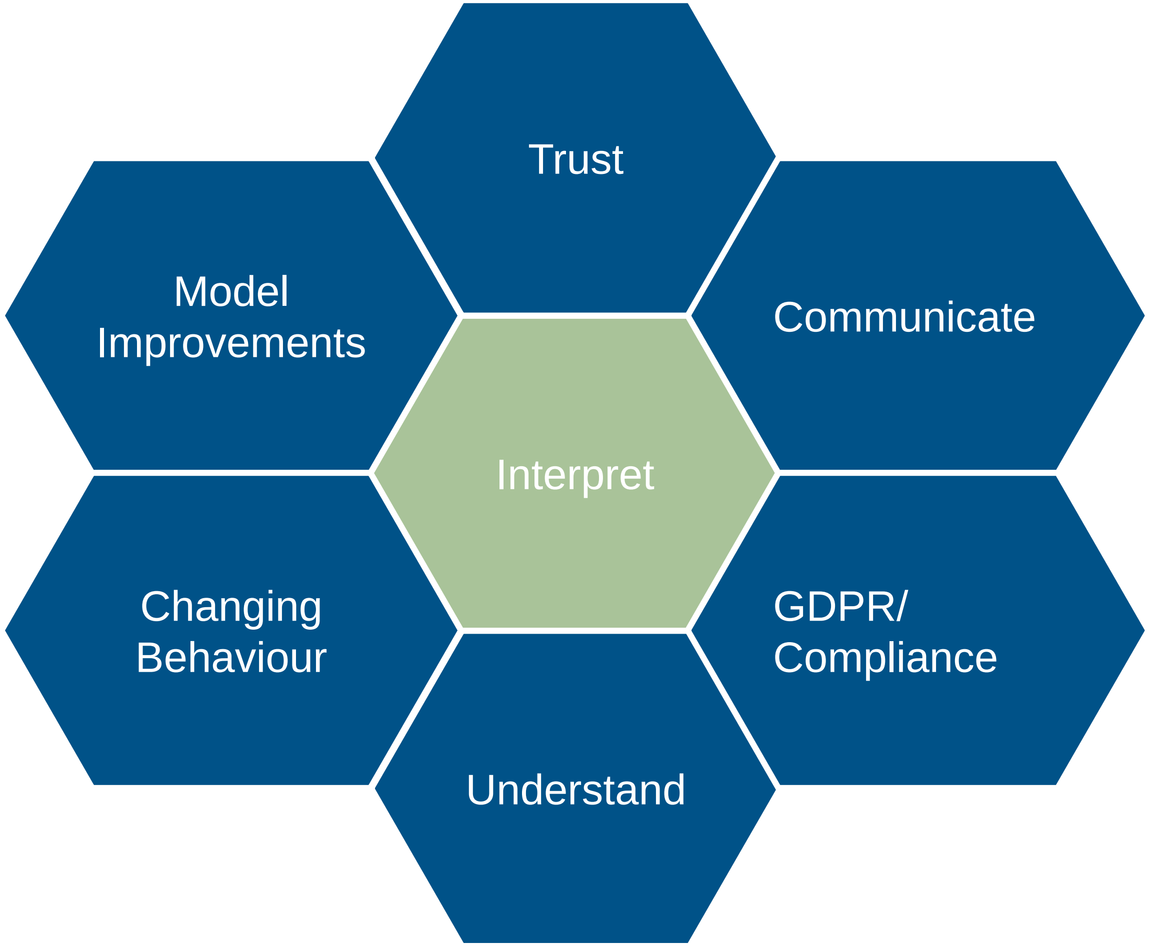
- Holds a BSc in Actuarial Science from Dublin City University (2011-2015, First Class Honours)
- Recently completed a MSc in Data Science from Trinity College Dublin (2017-2018, Distinction)
- For her Dissertation, carried out research on the Ethereum Blockchain and tried to identify patterns in the transactional data using unsupervised learning techniques.
- Currently works as a consultant with Milliman
- Has worked on a number of pricing and capital modelling projects for various insurance companies

The Model Cycle



Milliman

Black Box Models – Believe or Understand?



Expectation Vs Reality

Models that appear to be strong may have weaknesses

Model validation

Understanding and Validating a Model

Model Lift

- Measuring the "economic value" of the model
- How well does the model differentiate between best and worst risks?
- Does the model help prevent adverse selection?
- Is the model better than the current rating plan?

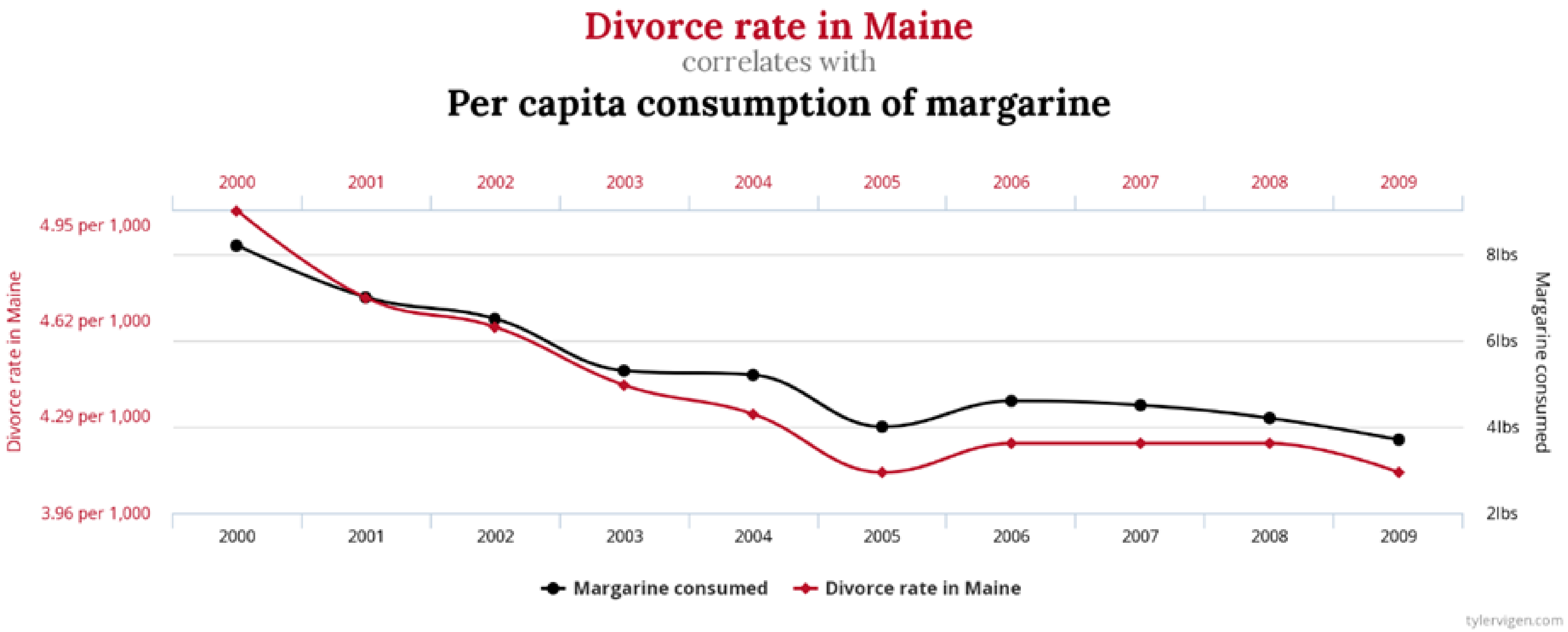
Goodness of Fit

- Assessing how well the model fits the data.
- What kind of model statistics are available, and how do you interpret them?
- What kind of residual plots should you consider, and how do you interpret them?
- What are some considerations regarding actual versus predicted plots?

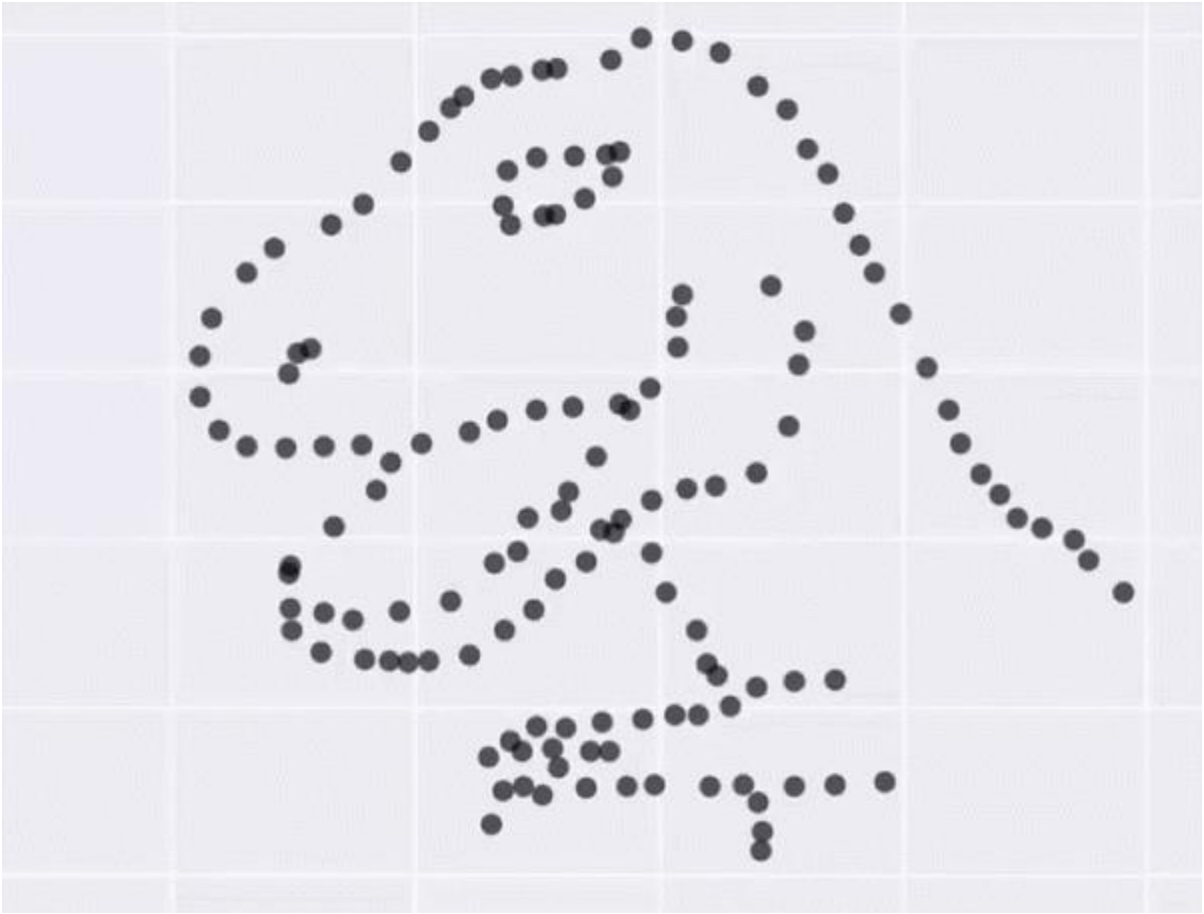
Stability

- Seeing how stable the model results are.
- How well does the model perform on other data?
- How will the model perform over time?
- How reliable are the model's parameter estimates?

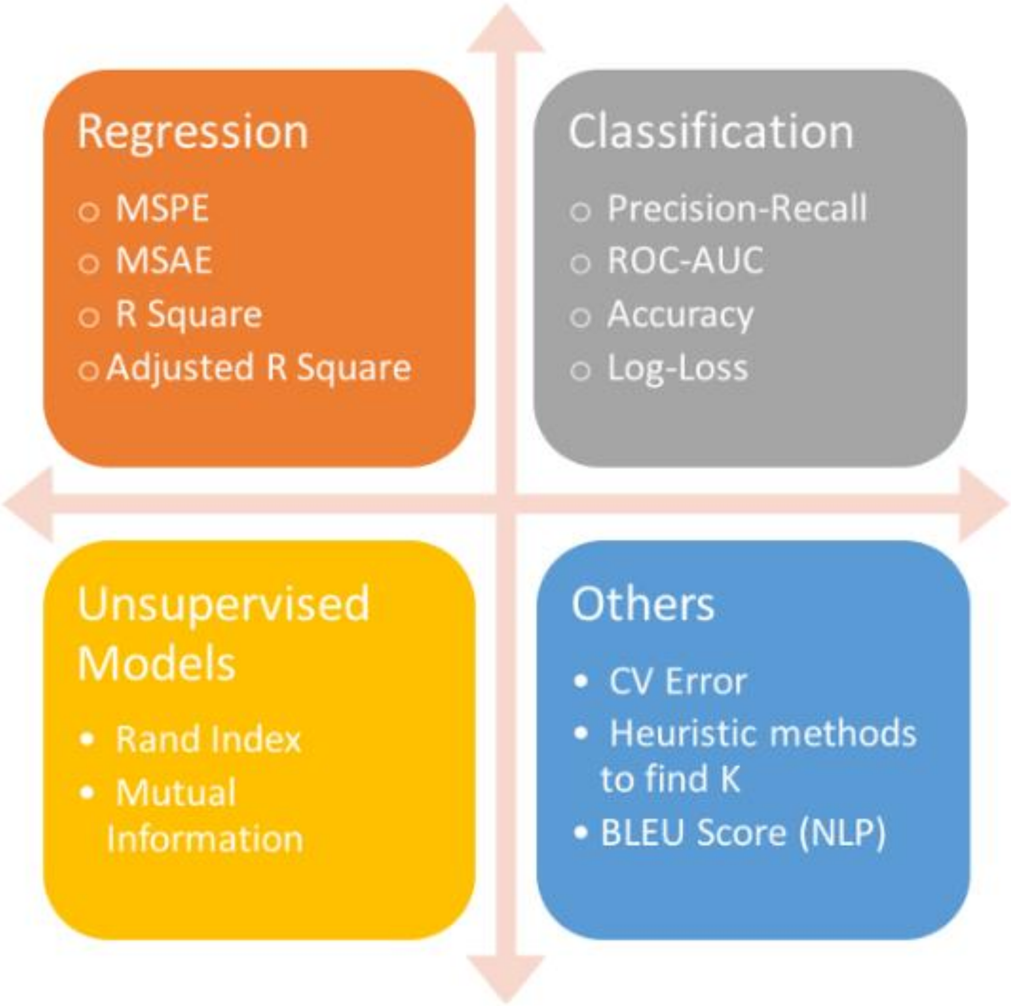
Correlation – Spurious Accuracy



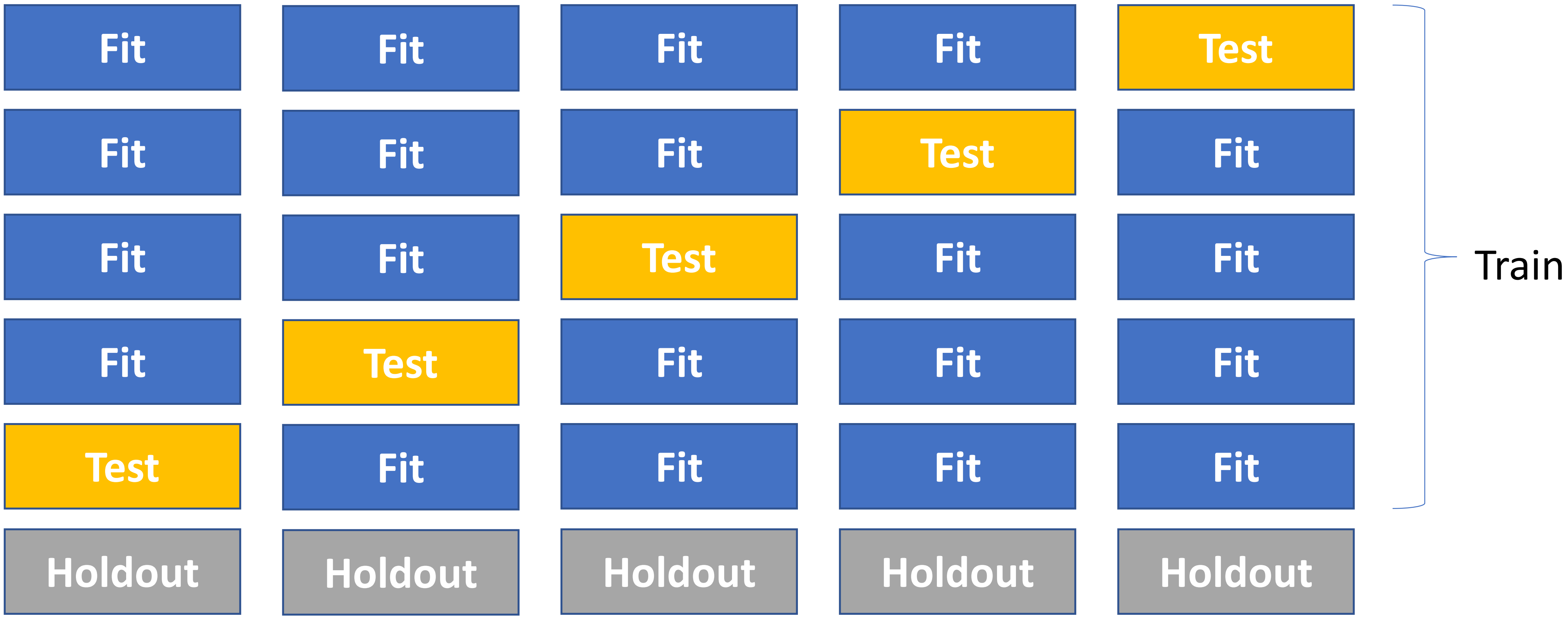
Always Visualize your Data – The Datasaurus



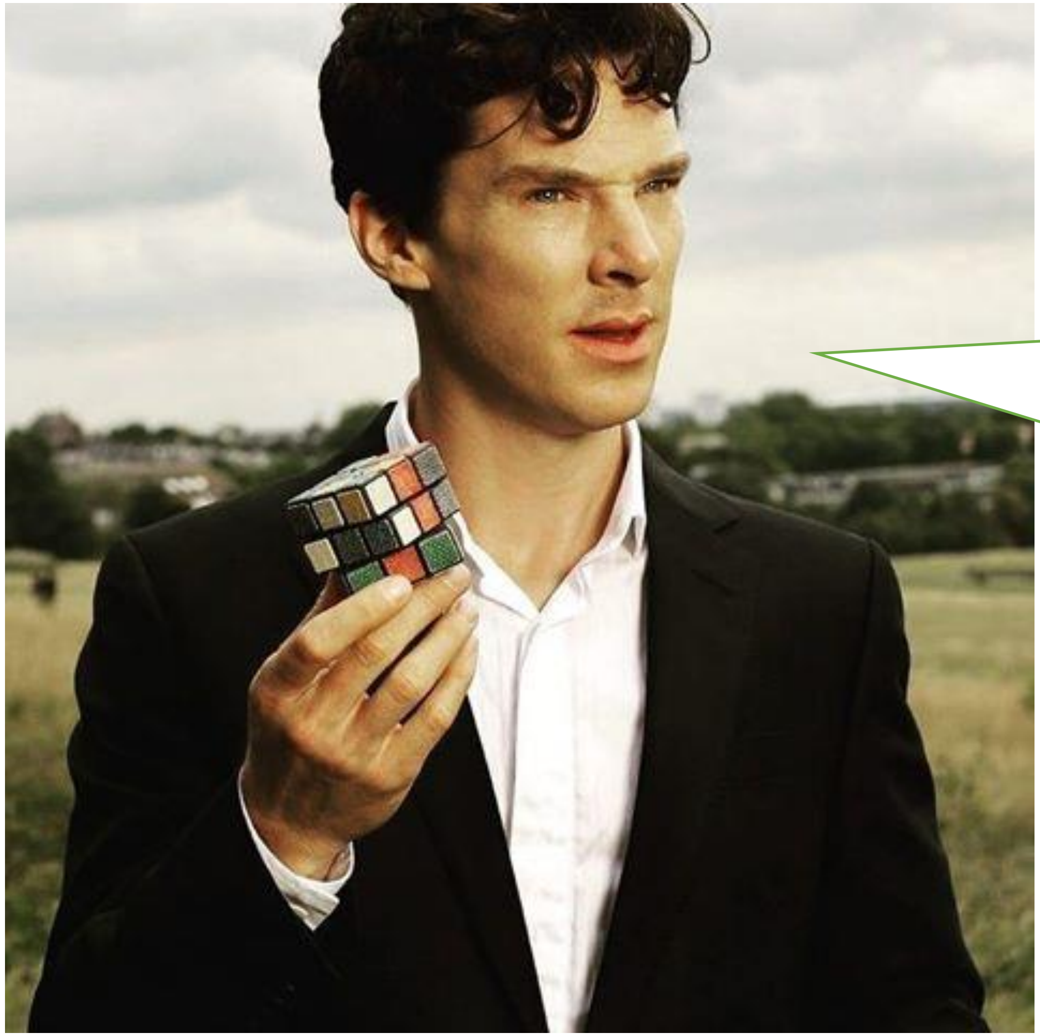
Classification vs Regression - Evaluation Metrics



Cross Validation



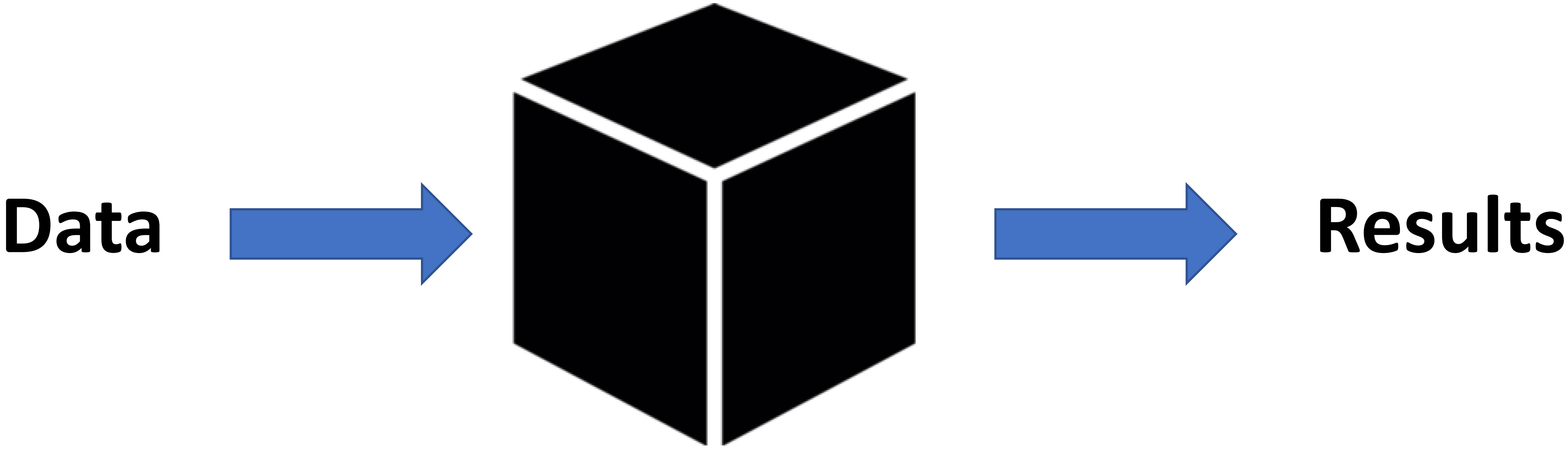
Interpreting the Results



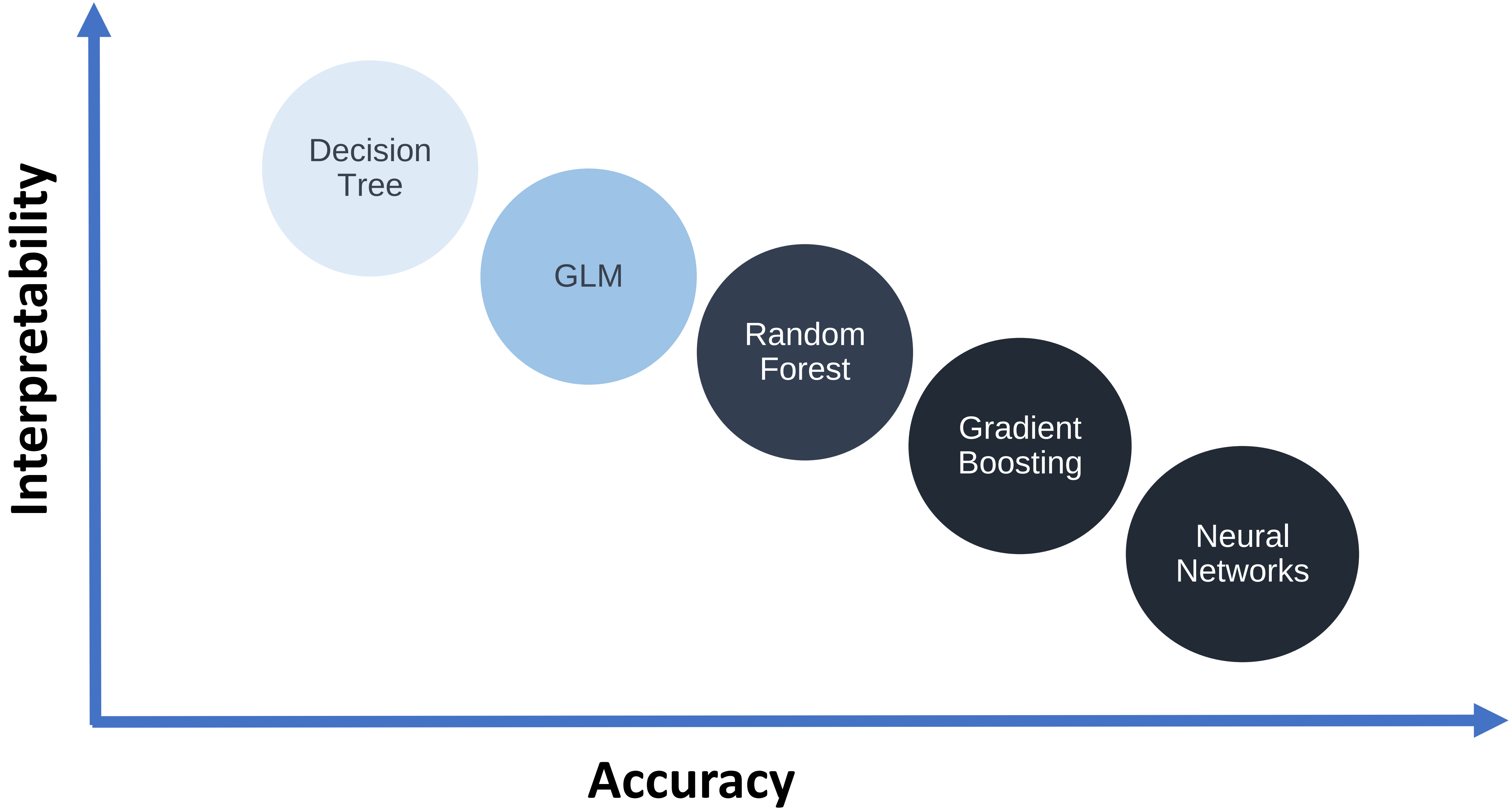
Can you explain how your model works?

Model Interpretability

Black Box Models



Accuracy vs Interpretability



Black Box Models – Options

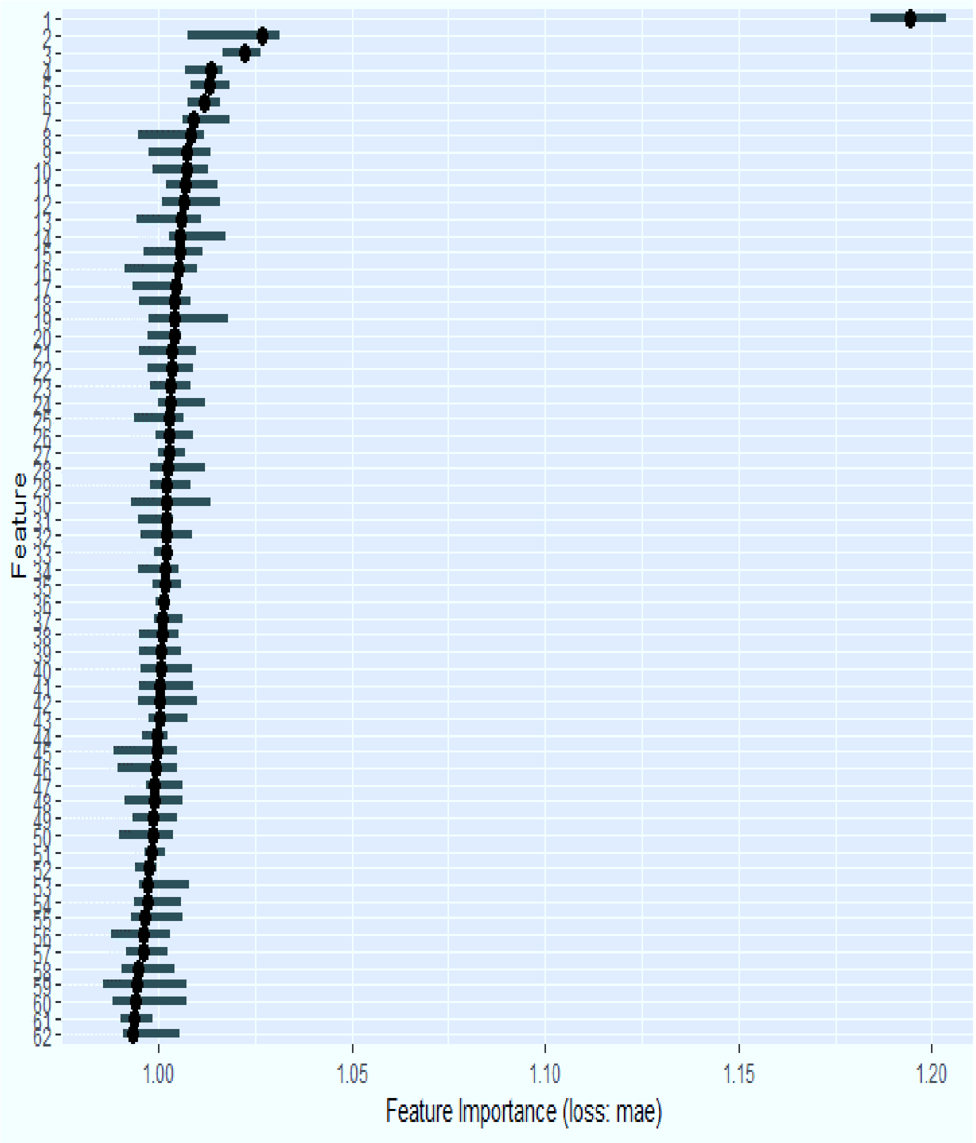
Model Specific Methods

Interpretable Models

Model Agnostic Methods

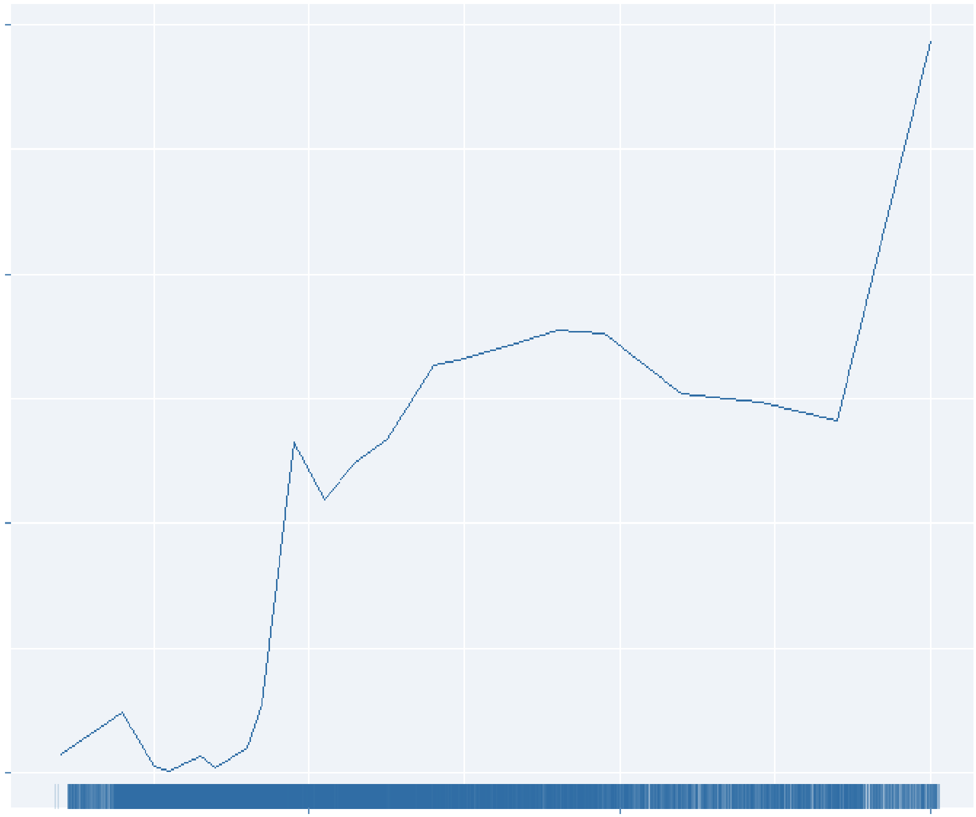
Black Box Models – Feature Importance

- Feature Importance plots
  - Ranks by what is most importance
  - Doesn't indicate direction of the relationship, or whether it is linear
  - Can underestimate impact of two way interactions



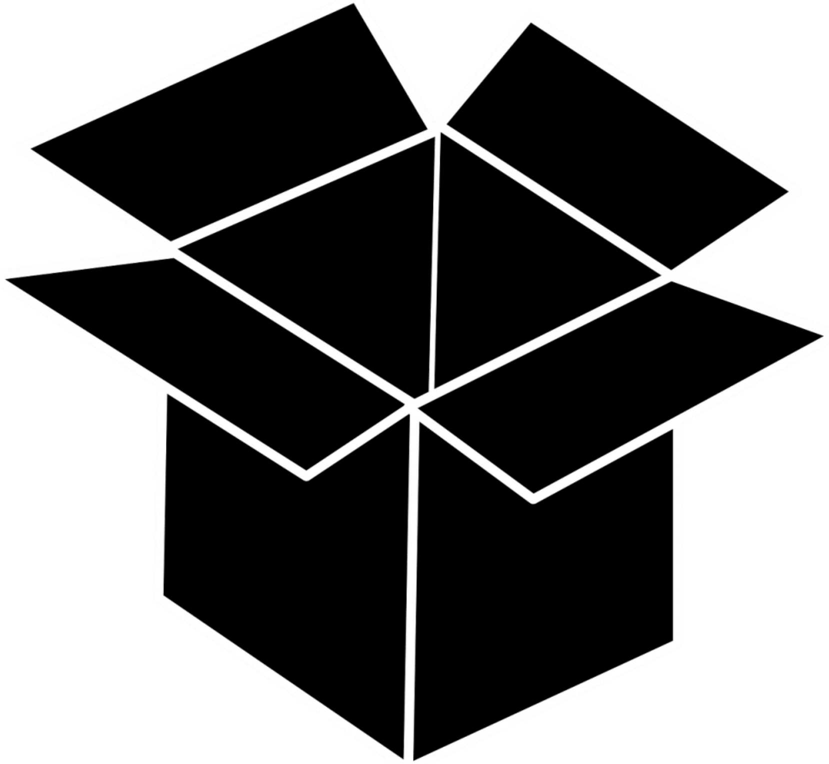
Black Box Models – Partial Dependency Plots

- Partial dependency plots
  - Can be done on most important factors and interactions
  - Linear versus complex
  - Assumes factors are not correlated



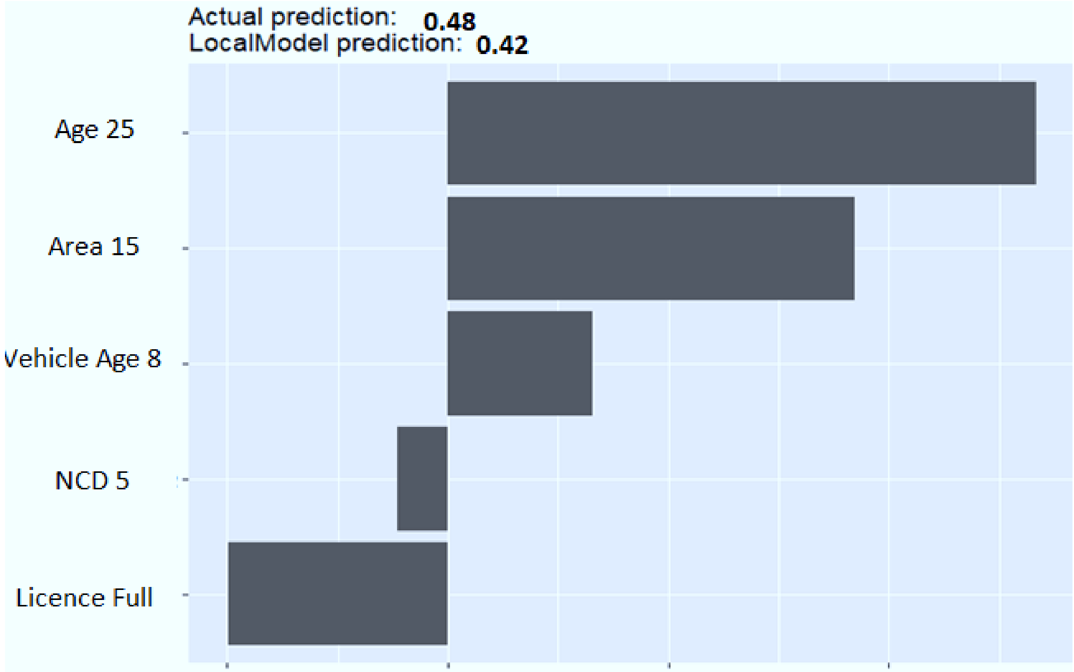
Individual Explanations

Local Interpretable Model-Agnostic Explanations



Local Interpretable Model-Agnostic Explanations

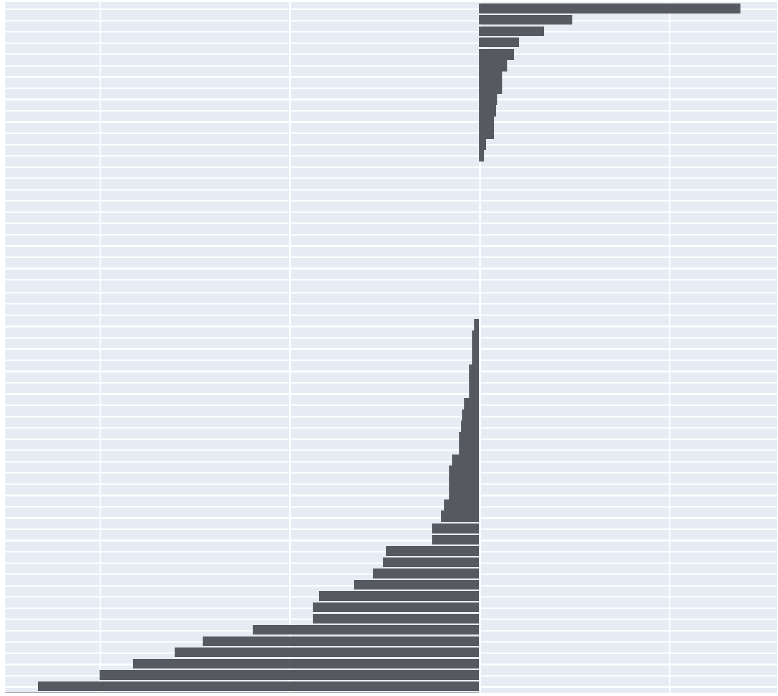
- Local Model
- Fits simple interpretable model on predictions using similar data
- Picks features that best describes the complex model outcome
- User decides on number of features
- Distance measure used is subjective



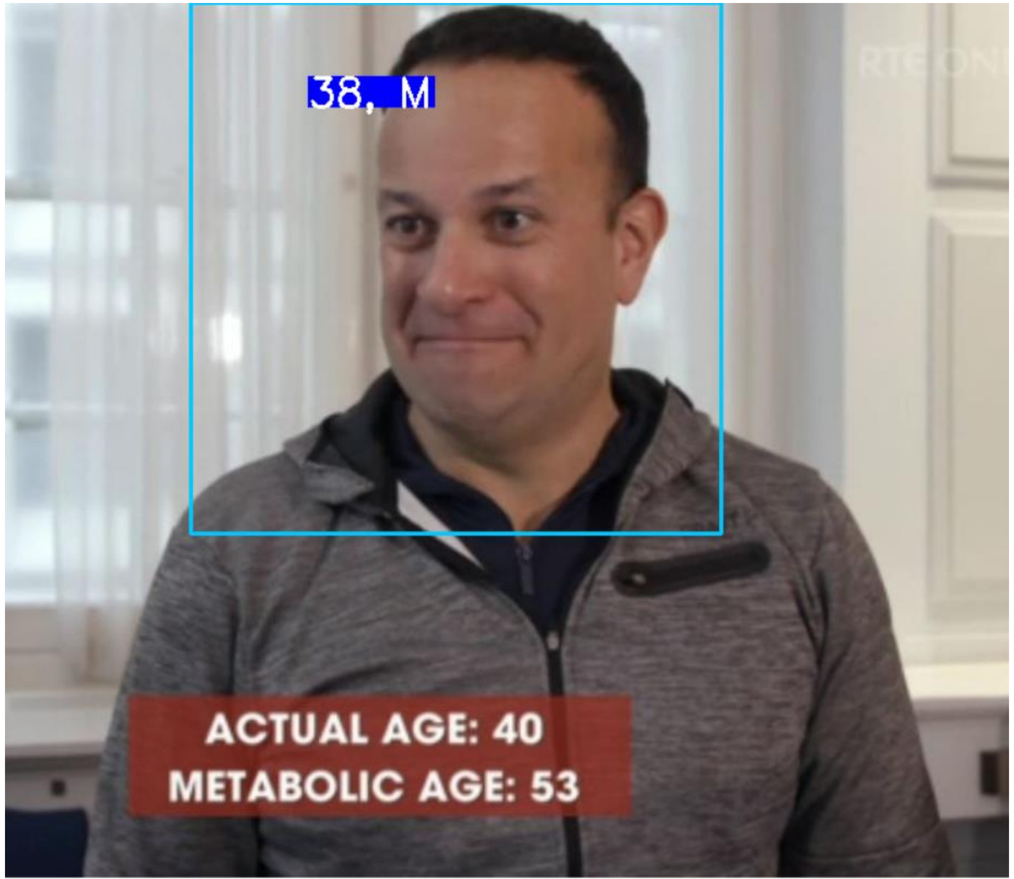
Shapley Values

- Game theory concept

- Shows contribution from all features
- More complete explanation than LIME
- Longer run times

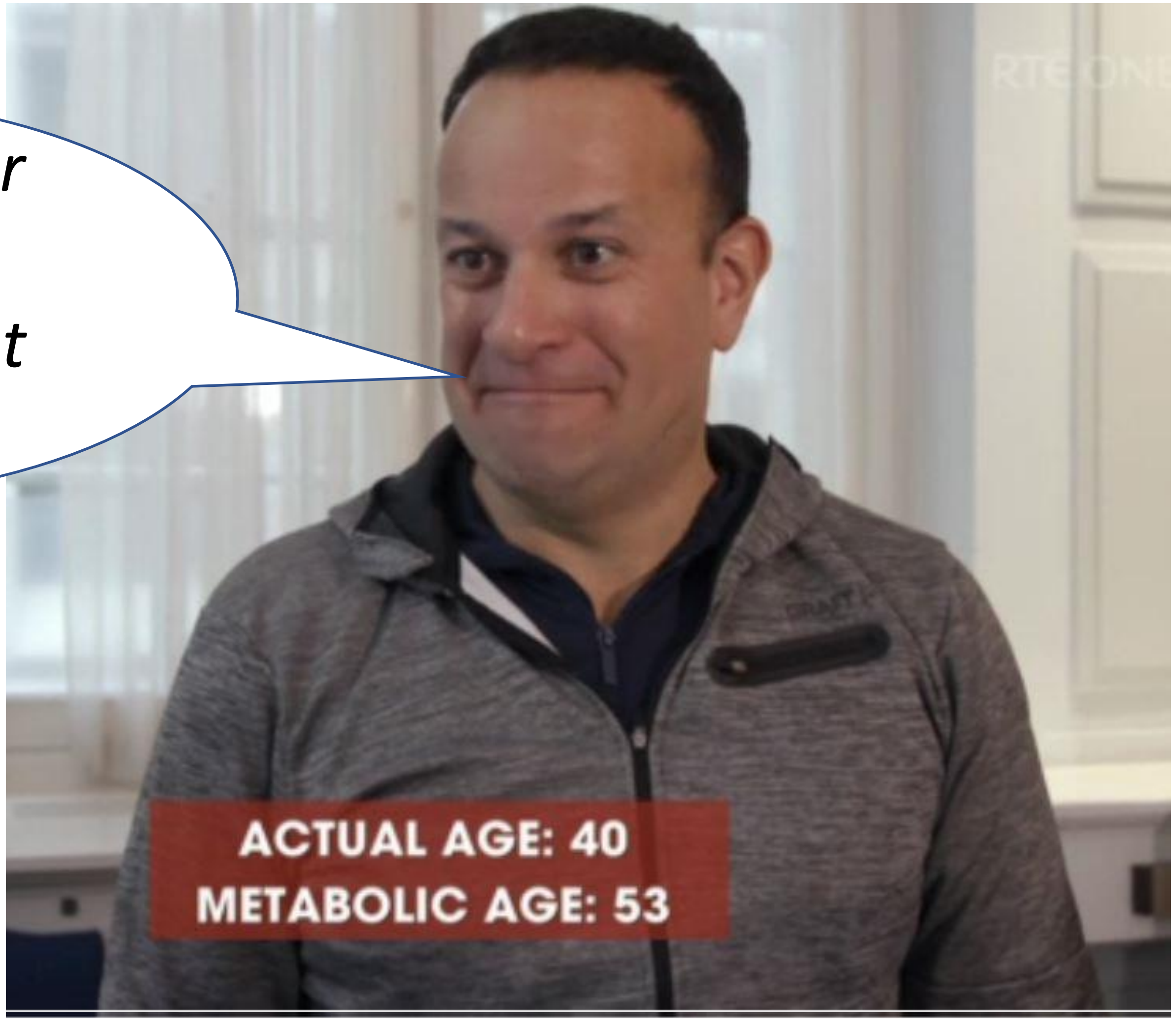


Age/Gender Predictor



Explaining the model

Surprised to hear that, kinda wondering about the science…



Most Important Features for model

Questions?


QUESTION
ANSWER