Prices are Risky Business

Machine Learning in Insurance Pricing

Alistair Rogers

Revenue - Cost = Profit

Mainly what this talk covers

Costs

Claim Frequency

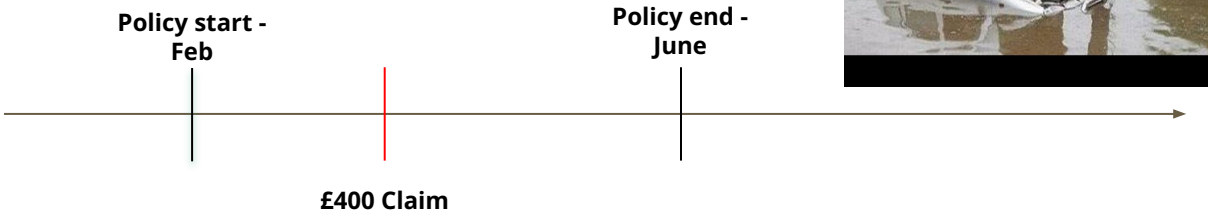
At what rate will you make claims?

Claim Severity

What's the average claim amount you would make?

$$\frac{\text{Claim Count}}{\text{Exposure}} \times \frac{\text{Claim Amount}}{\text{Claim Count}} = \frac{\text{Claim Amount}}{\text{Exposure}}$$

Frequency

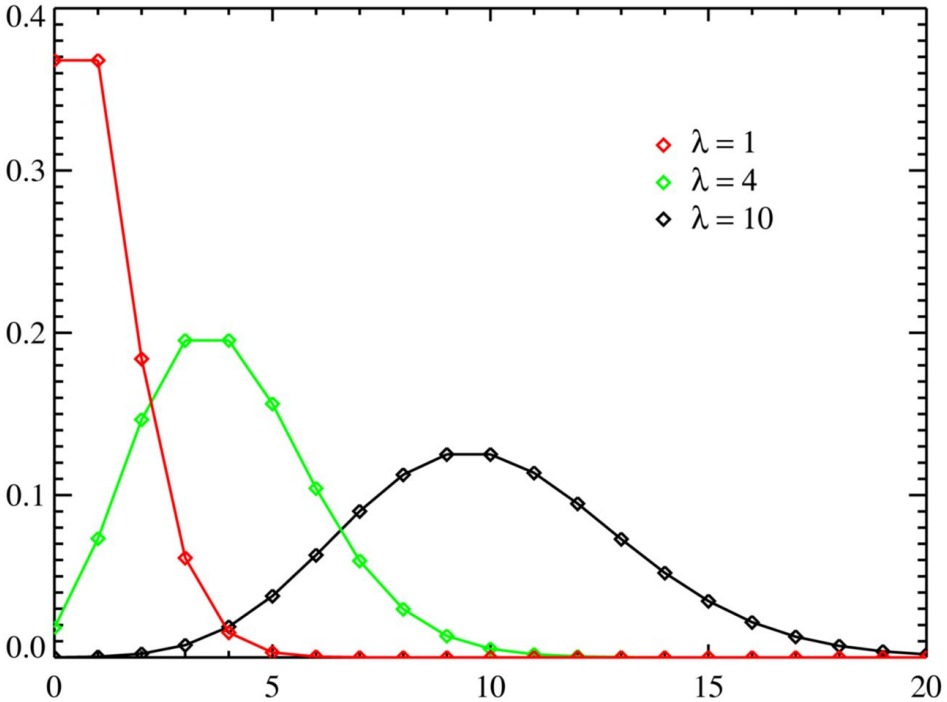


Exposure = 5/12 = 0.42
Frequency = 1/0.42 = 2.4

Exposure = 12/12 = 1
Frequency = 3/1 = 3

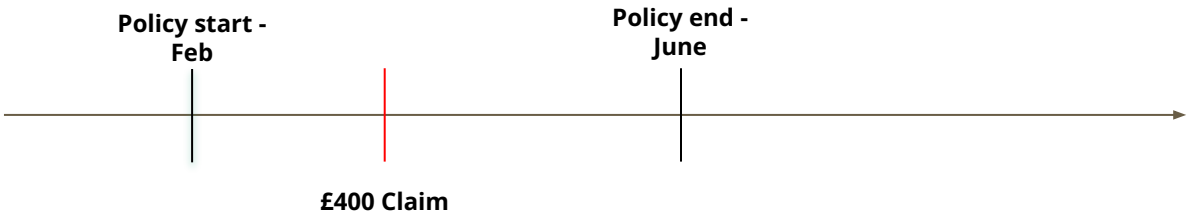
Exposure = 11/12 = 0.92
Frequency = 0/0.92 = 0

Frequency Model - Poisson Regression



- Predicts Claim Frequency
  - Rates or Counts
- Weighted/Offsetted by Exposure
- Some maths about modelling rates vs counts

Severity

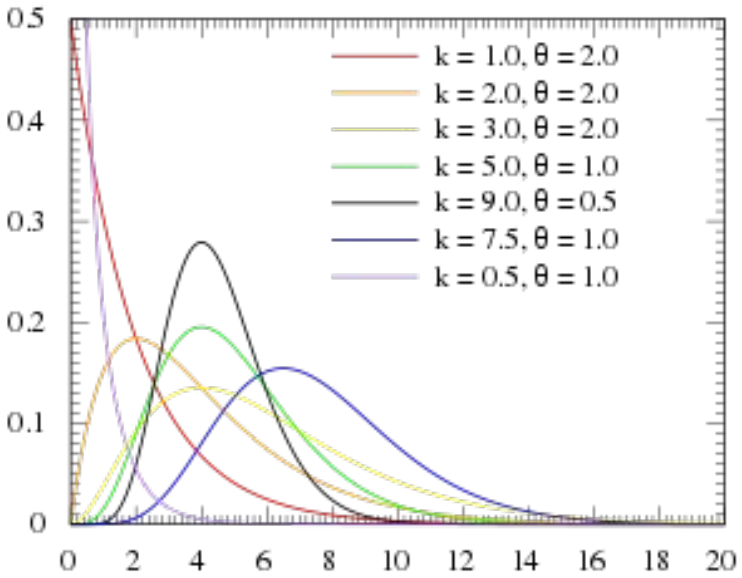


Severity = 400/1 = £400
Count = 1

Severity = (100+100+400)/3 = £200
Count = 3

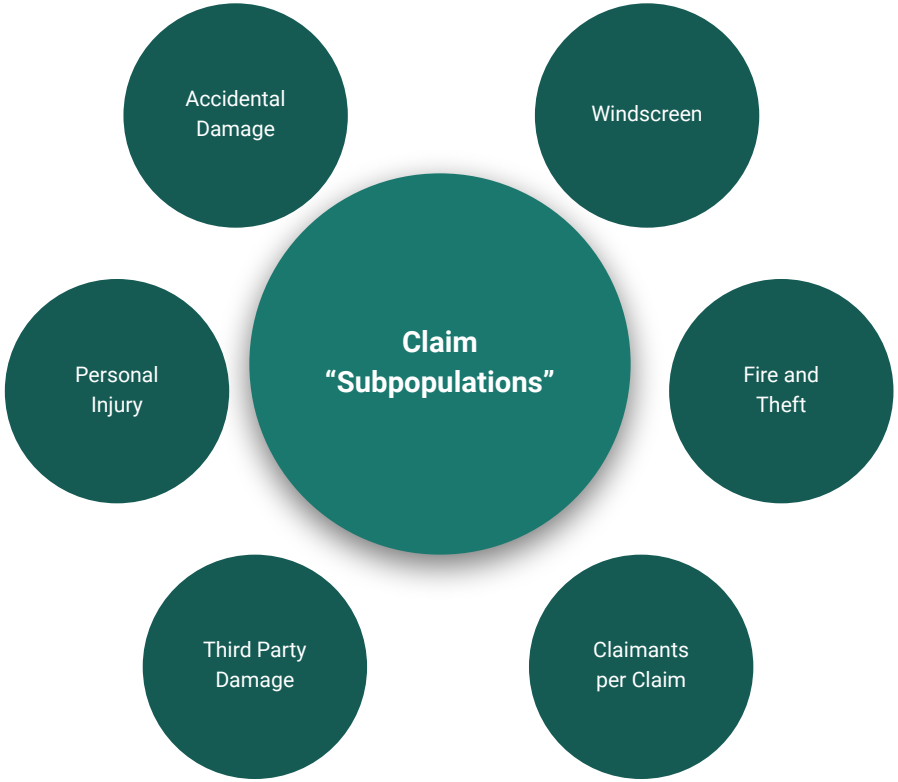
Severity = 0/0 = UNDEFINED
Count = 0

Severity Model - Gamma Regression



- Arises from poisson processes
- Weighted/Offsetted by Claim Count
- Some maths about modelling total value vs average

Perils


Accidental Damage
Windscreen
Personal Injury
Claim "Subpopulations"
Fire and Theft
Third Party Damage
Claimants per Claim

Putting it all together

Frequency Model
Accidental Damage
Fire and Theft
Third Party Damage
Personal Injury
Windscreen

Severity Model
Accidental Damage
Fire and Theft
Third Party Damage
Personal Injury
Windscreen

Claimants per Claim
1
1
1
Personal Injury
1

BURNING COST

Packages that allow Poisson and Gamma Regression

dmlc XGBoost

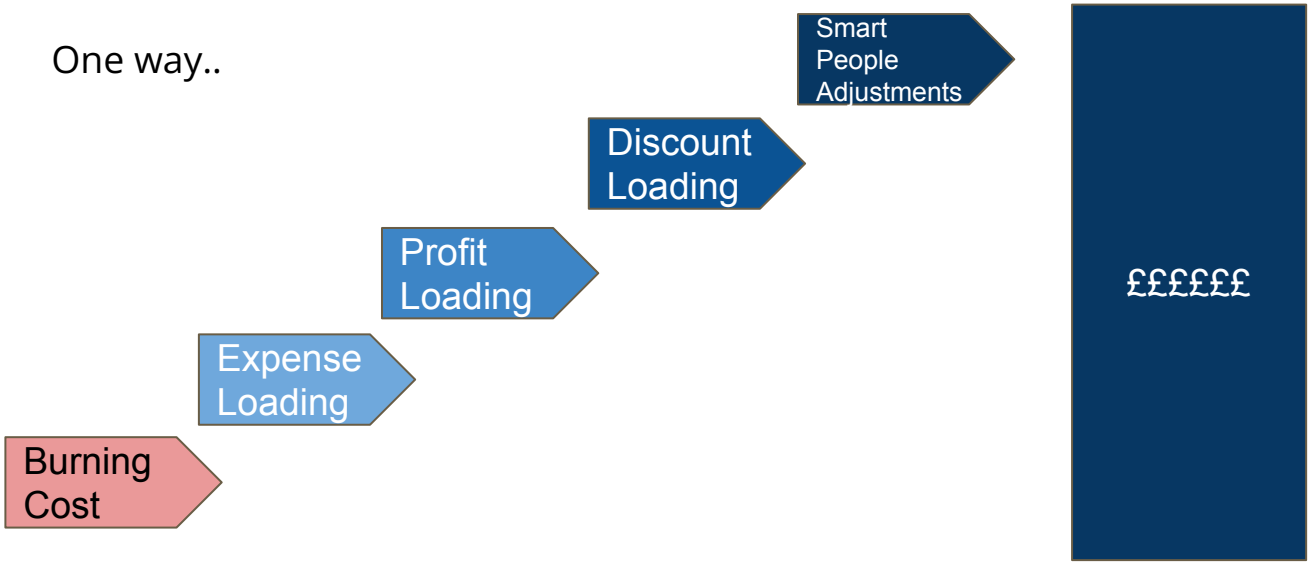
LightGBM

InterpretML

Explainable Boosting Machine - in develop as of 26/04/23

Yeah but how do I get a price?

One way..



Another way...

Expected Customer Life Time Value

Thank you!