AWAKENING DATA SCIENCE IN CLAIMS RESERVING

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A first consideration:

Insurance business is a lot about data and analytics

...indeed...

it is a lot about ‘predicting the future’

‘predicting the future’ is a lot about analytics...

...it is a lot about data science
Data science is a lot about:

- "mining" data
- modeling & exploration
- ‘scripting’ & coding
- Understanding & explaining results
Actuaries are a lot about:

- pricing
- reserving
- risk management
- reporting
Very similar skills and mindset…

...sometimes different tools...

...sometimes different methods...

...sometimes different language...

...often different approaches...

Gradual awakening of data science in claims reserving
Different approaches and ‘philosophies’
THE ACTUARIAL CLAIMS RESERVING

A high level overview
THE TRADITIONAL CLAIM RESERVING PROCESS

Claims Reserving:
Estimate and forecast the outcome for each potential claim (Ultimate Claim Cost) in the future to ensure that the company has enough reserves to fulfill liabilities.

Step 01
Data Gathering
Insurance companies collect all information of claims occurred over a time span.

Step 02
Data pre-processing
Actuaries structure and group data into “triangular shape” datasets.

Step 03
Ultimate Claims Cost Estimation
Actuarial methodologies estimate the ultimate cost “developing” claims.
BRIDGING ACTUARIAL AND DATA SCIENCE WORLD

TRADITIONAL ACTUARIAL APPROACH

- Basic methodologies based on triangles
  - Data: Aggregated data
  - Data Aggregation: Human Aggregation
  - Projection: Actuarial Methodologies
  - Assume to work on grouped data

TRAJECTORY-BASED APPROACH

- Regression models based on claims evolution over time
  - Data: Claims historical patterns
  - Data Aggregation: Clustering
  - Projection: (Constrained) Regression
  - No “claim features”

DATA SCIENCE APPROACH

- Individual claims reserving with ML Algorithms (i.e. Gradient Boosting, NN etc.)
  - Data: Claim-by-claim dataset
  - Data Aggregation: Not required
  - Projection: Individual via ML Algorithms
  - “Claim features” required
THE TRAJECTORY-BASED APPROACH

Gradual introduction of machine learning techniques into traditional claim reserving process

References:
ASTIN Colloquium 2019
Carrato, Visintin
“From the Chain Ladder to Individual Claims Reserving using Machine Learning Techniques”
1. After its occurrence, a claim is reported and a case reserve is allocated

2. Subsequently, a certain amount is paid and the case reserve decreases accordingly

3. The claim continues its developing until is definitively closed (Ultimate Cost)
With clustering techniques, we are able to identify and aggregate claims with similar trajectories up to a fixed development period.

Two linear regression models, are fit on historical claims data to develop the paid amount (1) and the reserved amounts (2). Therefore, the projected point has coordinates defined by (1) and (2).
THE DATA SCIENCE APPROACH

Individual claims reserving with ML Algorithms (i.e. Gradient Boosting, NN etc.)

References:
Cerqueti, De Virgilis
“Estimation of Individual Claim Liabilities – A comparison of Traditional and ML Methodologies”
A NEW PARADIGM FOR INDIVIDUAL CLAIM RESERVING

- **A Claim is reported**
  - Initial Case Reserve
    - An initial case reserve for the claim is established

- **Claim assessment**
  - No Payment
  - Payment
    - The Claim is closed

- “Claims features” are required for both training and predicting (i.e. policyholder’s age, claimant’s car model etc.)

- After an initial claim assessment not all the claims are entitled to be paid (i.e. exclusions)
- Thus this can also be seen as a classification and regression problem
- We could also predict how much time takes for the each claim to be closed
1. First the ML algorithm classifies whether a claim might be closed with no payment.

2. If this first process will have a negative outcome (i.e. the claim will be paid), an amount will be calculated (Ultimates).

3. A third model will estimate the time that this process will take, from the moment the claim is reported until it is closed (Closing lag).

4. The overall reserve is then calculated by summing-up all the non-nil predicted amounts.
The introduction of new approaches respecting and gradually enhancing existing methodologies ‘fertilizes’ the awakening of the data science in claims reserving
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