Machine learning in Reserving Working Party - UK survey findings

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Machine Learning in Reserving – UK survey findings

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Executive Summary

The survey found that there was near universal enthusiasm for developing techniques for machine learning in reserving. Whilst there has been a large interest in the working party, this was more positive than even we were anticipating. It contrasts strongly with GIROC's (GI Reserving Oversight Committee) 2014 reserving survey finding that there was very little appetite in the UK for new reserving methods at that time - there appears to have been a big shift in thinking.

The main findings were:

- Companies are at very different stages in their research, but overall we are still at an early stage.
- The two main barriers companies were finding were:
    - time and resource constraints, and
    - the difficulty in gaining the skills - this is not something you can pick up quickly.
- There was less collaboration within companies than you might expect, e.g. data science or pricing teams were often not looking at reserving.
- The push for developing these techniques was usually coming from the reserving teams rather than management.
- Global companies did not often seem be talking to their overseas colleagues about this.

Background

The starting premise of the working party was that, whilst machine learning techniques are widespread in pricing, they are not being adopted 'on the ground' in reserving.

To check whether our presumption was correct we went out and asked companies what they thought. The companies were sent a list of questions in advance (the full list is shown in the appendix) and then were interviewed over the phone. The phone calls took place between April and August 2020.

Only personal lines companies were invited to take part. It was thought they would have the richest data, and that many already undertake some individual claims modelling, say for large claims or PPOs. And so would be more likely to have looked into machine learning for reserving.

The take up rate was high. Out of 15 that were approached, 13 took part. As a result, we believe that this is a fair representation of the UK personal lines market view and practice on using machine learning in reserving, as at August 2020.

Findings

1. Current use of machine learning in reserving

No respondents have yet embedded machine learning as part of the reserving process. However, every actuary we spoke to was interested in doing something.

As the graph below shows, 6 out of 13 companies were already actively developing machine learning techniques for reserving. However, there was a wide range in what these 6 companies were doing, with some having looked at using a technique such as clustering, to one having a full proof of concept individual claims model.
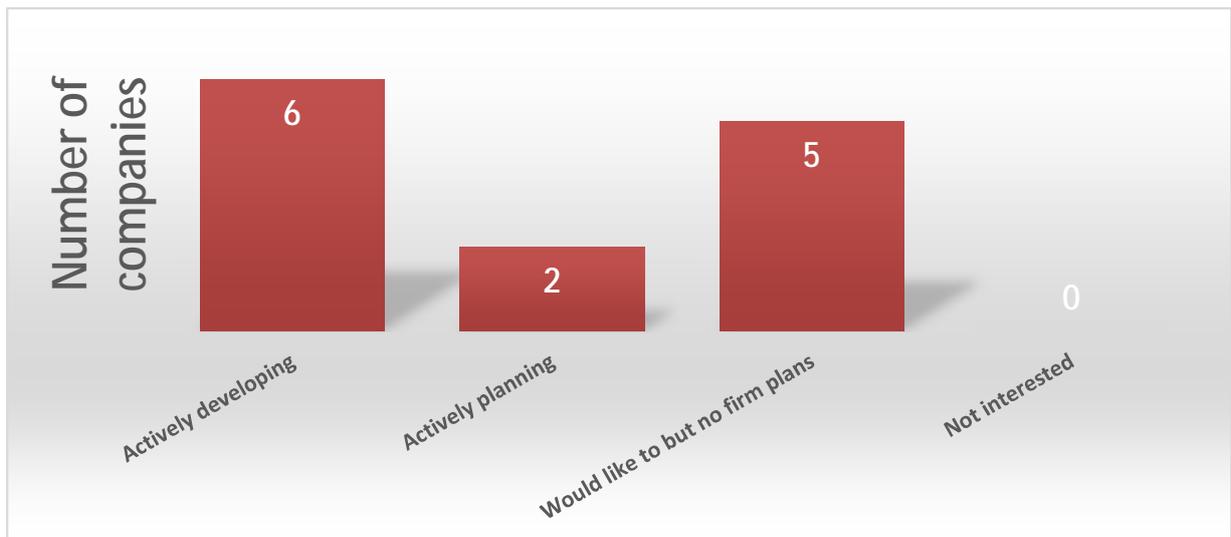
Of the rest, two had specific plans already in place to look into this. Of the remaining 5, whilst not all had firm plans, all expressed interest in looking at this further in principle.

These findings contrast starkly with the GIROC 2014 reserving survey which found that "triangles and chain ladder and Bornhuetter Ferguson type techniques are still the methods of choice and there is very little appetite for new methodologies to be found."

The overriding impression was that everyone is keen to do something in this area.

How companies were thinking of applying this varied, in that a number talked about using it on large claims specifically, others clustering and others full individual claims models.

Specific insights

There is one company that is probably more advanced than others. They have kindly said we could share some of the insights they have gained.

They have developed methods on individual claims as well as using triangles. Whilst they have a couple of methods they feel they sufficiently understand, they are not yet embedded as a central part of the reserving process.

These are their comments:

- Individual methods are a black box, and do take more time. But they provide more understanding than triangles. They need massive computer power, are complicated and are a lot of work.
- The structure of the model matters and will differ depending on the ML method employed. I.e. what you fit is more important than the method.
- Triangular methods are simpler and lend themselves more to automation.
- There are benefits to using ML outside of reserving and deriving the estimate itself, e.g. as an early warning system.

2. Advantages of machine learning methods

Whilst not a specific question in the survey, the reasons companies were investing time in developing ML techniques sometimes came up. The reasons cited could be classified under three categories:

- the deeper understanding/insights that can be gained,
- efficiency benefits,
- to be able to use additional data that is becoming available.

The following specific comments were made:

on deeper understanding:

- o the benefit is outside of reserving and estimate itself, e.g. early warning system
- o not used to set IBNR, but for development patterns/case strengthening conversations
- o do more to understand; deep dives, still reliant on person

on efficiencies:

- o automatically highlight issues
- o faster identifying of costs
- o accuracy and speed.

One respondent commented that "the necessity to move away from chain ladder techniques is ever more clear and present".

3. Why have we been slow to develop techniques?

Whilst there seemed to be a lot of enthusiasm for developing ML techniques, actuaries were finding it hard to develop them in practice. There were three recurring themes

- • resource/time limitations
- • accessibility of knowledge.
- • explainability.

Resource/time limitations

A major barrier was time and resources available. Many reserving teams are already stretched just keeping up with business as usual, or with ad hoc projects. It was not uncommon for actuaries to say they were often firefighting, with space to develop new ideas a luxury they do not have.

As one chief actuary said "we are not good at freeing people up to explore". Investment in R&D for new reserving methodologies has not been a priority for many companies.

Accessibility of knowledge

Another common refrain was the difficulty in acquiring ML skills. This is not something that can be learned in an afternoon. It takes months to build up the necessary skills, and on top of that we do not yet have any standard, recognised methods developed.

Specific comments from respondents were:

- o lack of experience
- o papers too extreme
- o anchoring, willingness to move away from chain ladder
- o it is complicated and a lot of work.

However, whilst many reserving teams in companies are finding it hard, a few companies have been investing in the research and development. There has also been a large increase in papers on this subject in recent years, and individual actuaries and data scientists are taking it upon themselves to develop these techniques, ideas and skills. See our literature review workstream for more information on this.

Explainability/black box

When you start talking about machine learning, one of the first questions that comes up is usually around the difficulty of understanding the models and that they are in effect 'black boxes'. How can actuaries understand what the models are doing themselves, let alone explain it to management, regulators or auditors?

There is likely to be much work needed before these models are accepted, but we are hearing that it is possible.

Specific comments that were made are:

- o explainability/might create volatility - human element smooths
- o if case estimate philosophy changes, how will the model deal with change? How could this information be fed into the model?
- o comfort around changes in methodology (internal and external stakeholders)
- o need deep understanding to explain, validation
- o bias issues
- o need to satisfy auditors
- o individuals are reticent
- o regulation: lack of transparency
- o regulation: requirement to document method.

This is an area the working party will be looking into. However our first priority will be to identify and develop accepted techniques.

4. Internal collaboration

The 2014 reserving survey showed that reserving actuaries had good communication with other areas of the business; particularly senior management, pricing and claims departments. In the UK many pricing, and increasingly, claims teams in personal lines companies are likely to already be using machine learning techniques. However, from the conversations, it became apparent that there was generally very little collaboration within companies when it comes to looking into using machine learning for reserving.

Four companies specifically mentioned they had data science teams, but most of these seemed to have little or no focus on developing techniques for reserving.

In fact, the initiative for research into machine learning seemed to be coming from individuals in the reserving teams themselves. Whilst reserving teams seem to have a lot of autonomy over what they choose to do, what is constraining them is a lack of time and resource.

Only one company specifically said that their management was engaged with machine learning. Not surprisingly this was one of the most advanced companies.

Another interesting point was that whilst many of those in the survey were global companies, it appeared that there was virtually no apparent collaboration with overseas colleagues.

5. How can the IFoA help?

Interestingly, almost half of those surveyed were not looking to the IFoA for help with this.

Fortunately, most of what was requested is very much in line with what the working party is already intending to do. For example, our Foundations workstream is publishing materials to help actuaries who want to learn the skills, as well as sharing code that replicates models in existing papers. Our literature review team will be publishing a list of related papers as well as blogs highlighting some of the most interesting ones. And our research teams are planning on providing output that will enable anyone to replicate their work.

Here are some of the specific suggestions that were made by respondents:

- o sharing methods
- o to see what other people are doing
- o ideas
- o how to gain expertise
- o list of papers
- o practical examples
- o possible use cases - e.g. improving segmentation
- o data science videos
- o guides, practical, specific to motor.

One of the more advanced companies did make the comment that not enough resources are provided by the IFoA currently for advanced users.

Another said that the data science MIG videos, the MLR WP, and the data science certificate provided by the IFoA were very good.

6. Recommendations

We asked respondents for any recommendations of what they had seen that they thought would be useful for the working party to be aware of. Most did not provide any suggestions - these were the responses from those that did:

- o one of the consultants is working on a large claims model
- o look at pricing/marketing - use similar underlying models
- o look for packages in R, easy use ML techniques, reserving package in R, interfaces to Python
- o one of the solicitors uses ML to set case estimates .

7. Data

Contrary to what we had expected to hear (as one respondent said, "all actuaries say data could be better"), overall companies were happy with the data they had available. Some were very positive indeed, and a couple commented that they were expecting improvements in the future e.g. "we will be very happy in a couple of years' time".

It is worth noting that not all companies had started looking into this in detail yet, and as one said "we won't be sure until we start testing".

However there were some specific gripes made:

- o   info not recorded on system - in handler's head
- o   lack of frequency: updated every 3 months - pricing/marketing updated more frequently
- o   we have granular data, but it is spread out in different parts of the organisation
- o   quality issues
- o   need more for enhancing
- o   legacy systems, would need to work on it
- o   getting it in the right format
- o   could be more granulated

One of the more advanced companies commented that "simulated data is not helpful, you need to work in the real world. Most of the value is in the outliers".

8. Open source software

Compliance when using open source software such as R and Python can certainly be an issue. However, over time companies seem to adapt, and ultimately seem to succeed in finding ways around it. Companies are currently at different stages in this journey, as the comments from the survey respondents below demonstrate:

- o   governance is an issue
- o   IT/Governance/security would hate it
- o   actuaries and pricing see the benefit
- o   methodology would have to be signed off
- o   data science team uses Python
- o   a few people use it, in pockets not embedded
- o   difficult when new packages released - have process, it is slow, causes delays
- o   we are open to R and Python
- o   R has approval, pricing use it ad hoc
- o   initially yes was painful, now everyone has R
- o   no issues, but not using in reserving process.

The working party has debated whether we should use R or Python. In the end there was no great consensus that one was better than the other, and going forward we decided to use both. Within the working party, which one is used when will largely depend on the individual producing the code, and what they prefer at that time.

Appendix: Survey Questions

1. Do you currently use any machine learning techniques for reserving?

   Do you use any individual claims or stochastic methods?

   Do you have contact with other areas of the business that might be using ML techniques, such as pricing, marketing or claims?

2. Do you have any plans to introduce, or develop further, ML techniques for reserving?

   If no, are there any particular reasons why not?

   If yes, have you faced any barriers and how have you overcome them?

3. Is there any work in this area you are aware of that you think might be relevant to our research?

   Is there anything you would like to see from the IFoA that would help you to develop your knowledge or use of ML?

4. How happy are you with the data you have available that would allow you to apply ML techniques?

   The working party would like to find sources of data on which to test and develop methods. Do you have any suggestions as to how we should go about this?

5. What is your organisation's attitude to using open source software such as R or Python?

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