



A Final Consideration for Predictive Modeling in Insurance Applications

By Eileen S. Burns

I was part of a team of six authors and many more supporters for a research project sponsored in part by the Predictive Analytics and Futurism Section. We produced a report titled *Considerations for Predictive Modeling in Insurance Applications*.¹ The research had four objectives: a survey, literature review, considerations and a case study. The survey and literature review led to our recommendations (the considerations). We used a case study with a U.S. life insurer to demonstrate what they mean in practice. We identified the components of an advanced predictive modeling function that, based on our experience, a company must address to have the best chance of gaining buy-in from stakeholders.

The components are:

1. Project objective
2. Data acquisition and preparation
3. Algorithm selection
4. Feature engineering and selection
5. Model evaluation and measurement
6. Model deployment
7. Model governance
8. Software selection

Within each of these, we detailed the many aspects that a good predictive modeling function would consider in order to avoid the myriad potential pitfalls. These are not prescriptive; it's not a Practice Note. They are framed as a list of questions and modeled somewhat after the principle-based reserves checklist, though more open-ended.

If you're busy like the rest of us and have limited time, I recommend skipping to the Considerations section and breezing through the questions we've laid out. Chances are you've thought about many, but not all, of them, and you'll find a way you can improve your processes or communication. If you run into a question on which you need more background, hop back



to the literature review to see our summary of leading practices, or dig deeper into our sources, or skip ahead to the case study to see it in action.

A FINAL CONSIDERATION

There is one bit of advice I would share that isn't documented in the report. I shared our research at the Society of Actuaries (SOA) Life & Annuity Symposium, held in May in Tampa; at the Society of Actuaries in Ireland (SAI) Annual Convention in Dublin in May; and with several clients. And at the same time, I was part of a team that had evolved from purely predictive analytics into a team that built a software product to share predictive analytics. We adopted a lean, agile framework for our software development. Such a framework is natively set up to hit the mark in terms of not only the project objective, but all of the components of an advanced predictive modeling function. In this approach, you start with a quick win, one for which it is easy to show the value, and you can iterate to improve from there. If you find you've taken a wrong turn, the agile part allows you to correct course quickly.

The final consideration then: Why not use a lean, agile approach for predictive modeling? (Or even better, for all of your actuarial models?) A predictive model is, after all, simply a special case of an actuarial model. In the spirit of the report, I'll frame this as three new questions to consider:

The most common feedback I've heard from companies getting started is that they don't know where to start. ...

- Why do you think predictive modeling will provide the right solution to your business problem?
- How can you most quickly demonstrate the potential gains it will provide before investing heavily in building out a mature team?
- What is the next incremental step you can take?

Insurance companies in the life and annuity realm are at various stages of adoption of predictive analytics. Common entry points are improving marketing or refining experience assumptions. The most common feedback I've heard from companies getting started is that they don't know where to start, and they're not gaining buy-in that predictive modeling is important. Common feedback from companies with established teams is that there isn't a large bottom line impact to the revised assumptions which have been developed, so why bother implementing them?

FOR NEW PREDICTIVE MODELING FUNCTIONS

Let's say your team is newly setup. Where do you start? How can these considerations help?

Focus on No. 1, the project objective. What business problems is your company facing for which past experience can potentially give guidance? If you approach each of the problems with predictive modeling, what value will you be able to provide to the business and customers? What will the cost be of getting to that solution? What are the risks, timeline, accuracy, etc., of each?

Pick the single business problem that has the best chance of providing a positive value to the business. A lean development framework will be your best friend: Build out the solution simply and quickly first (agile uses the term Minimum Viable Product). This will build goodwill and get you the leeway to build out a bigger solution next. In turn, the incremental gains from the bigger solution will help you quickly gain buy-in for the next problem you wish to tackle.

FOR ESTABLISHED PREDICTIVE MODELING FUNCTIONS

Let's say your team is already set up. How can the considerations help? Looking at the component areas, which one makes you lose sleep at night?

1. **Project objective.** Are you having trouble showing business value?
2. **Data acquisition and preparation.** Are you worried what will happen if your data expert goes on leave?
3. **Algorithm selection.** Are you concerned that the stakeholders won't understand the form of the model you made?
4. **Feature engineering and selection.** Are you concerned you've got too many variables in your model, or that they're not the right ones?
5. **Model evaluation and measurement.** Are you worried there's no real benefit to the model you've built over the prior one, or that you're not communicating the added benefit well enough?
6. **Model deployment.** Does it take many manual steps to get your model into production, or to update it when you refresh the underlying data?
7. **Model governance.** Is your model poorly integrated with your company's model governance framework? Are you worried you haven't identified risks it may cause?
8. **Software selection.** Has your predictive modeling software solution stopped playing well within your greater technology environment? Is it becoming too costly? Is your current staff less comfortable with it than your staff was when you selected it?

If one or more of those question gives you pause, focus on that part of the considerations and dig in. You may find that your current process isn't ideal in one respect. Go ahead and exercise the agile framework and make the incremental change which will realign you. Wash, rinse, repeat.

LOOKING FORWARD

Succeeding with predictive modeling in the long term is all about staying connected to evolving methods. That requires following lots of streams of information. The SOA frequently publishes new research into how actuaries are using predictive modeling. This very publication is a great example of that! Conversely, some companies are hiring only data scientists for this work, so you'll also want to keep tabs on where the data science community is going. There are many blogs, online courses and other content available on the web to help you. We shared a number of key resources in the report.

Personal interactions are helpful too. For example, if you aren't the type to follow technology, make sure you have a network of professionals who do. Once a month my colleague, Guy Yollin, emails me a link to an article with a new take on R versus Python.

It's something I expect we'll keep an eye on for years, though the R community is constantly adding to the capabilities of R, so I don't anticipate migrating myself in the near term.

And finally, don't forget about the power of networking. There are events all the time in Seattle, where I live, where I could go meet new people with new ideas for old problems. Groups of people who use Predictive Modeling Software, or who follow lean and/or agile development practices, or who code and drink beer at the same time. As I said in the Chairperson's Corner of the print issue, our section is hoping to encourage actuaries to participate in such events.

Many thanks to Gene Dan, Anders Larson, Bob Meyer, Zohair Motiwalla, Guy Yollin and the project oversight group who made this research happen. Wherever you are in your predictive

modeling journey, I hope our research gives you something new to consider. ■



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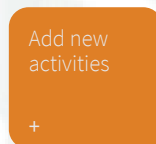
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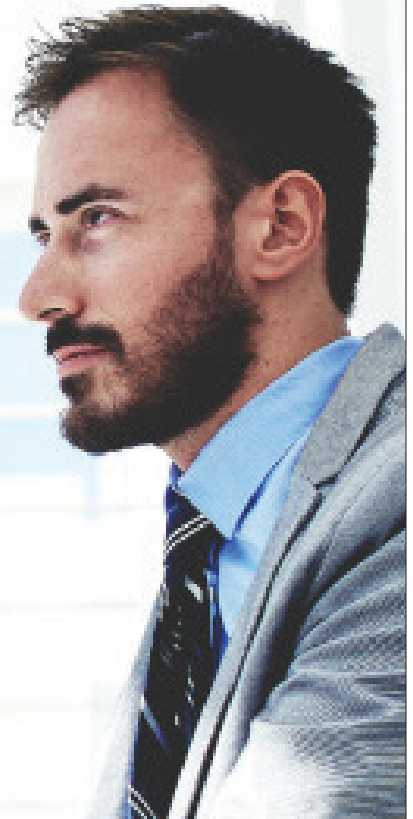
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Advanced Analytics and Programming—Getting Started on the Journey

By Nathan Pohle



Do you know how many choices you typically make in a day? According to a study performed by Sheena Iyengar, the average is about 70 decisions.¹

Do you feel overloaded or confused when trying to decide on how to learn about programming languages and advanced analytics? If the answer is yes, you are not alone and the Predictive Analytics and Futurism (PAF) Section has recognized this need. And in a similar fashion to Iyengar’s study, the root cause is not due to a lack of information but, rather, to the choice overload problem. With our busy lives and so much information out there, it is challenging to know where to start. For example, there are paid courses and free courses, there are in-person courses and online courses. Which ones are the best, and where to start if you are a beginner? What if you are an expert? Should we use the Society of Actuaries’ Predictive Analytics Exam (Exam PA), LinkedIn Learning courses, neither or both?

The PAF Section is forming a subcommittee to develop journey maps for actuaries wanting to learn more about the best programming and advanced analytics resources. This subcommittee will aim to share insights into how to select a language and, once selected, highlight the best resources for learning that language.

In addition, the field of predictive analytics encompasses a wide variety of mathematical algorithms, so the subcommittee hopes to outline resources helpful in identifying, selecting and applying these algorithms. In addition, these resources will explain how actuaries can get started learning these new skills and progress from a beginner to an expert.

The goal will be able to create journey maps to provide practical advice on the following:

- Programming languages (e.g., Python, R)

- Machine learning and advanced analytical tools/techniques (e.g., ordinary least squares, decision trees, generalized linear models, ensemble models, neural networks, machine-boosted algorithms)
- Visualization resources (e.g., Shiny, Power BI, Tableau, Qlik)
- Software (e.g., RapidMiner, Azure Data Factory, GitHub, Jupyter Notebook)

Similar to Iyengar's recommendations for the overload problem, defining and categorizing these concepts will be one goal, which will aid one in getting started and being successful. The intention is not to create static and prescriptive output, but rather to create a flexible guide. This is particularly important, given how quickly the technology and corresponding trainings are changing.

Whether it is in the grocery store or in choosing learning courses, sometimes less is more. The goal of this PAF subcommittee will be to have more actuaries getting started learning and minimize the choice overload problem. We hope you will actively participate in this endeavor, either by joining the subcommittee or using the journey maps once created. If you are interested, please contact me or any member of the PAF Council. ■



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Learning to Adapt From Assessing Metatrends—Surviving and Thriving in the Fourth Industrial Revolution

By Syed Danish Ali

Editor's note: This article first appeared on LinkedIn (<https://www.linkedin.com/pulse/exponential-actuary-future-syed-danish-ali/>).

*“An actuary who is only an actuary is not an actuary”
—Frank Reddington, iconic British actuary*

This article is a summary of the comprehensive white paper “The Exponential Actuary of the Future: A Systems Analysis Review of Future of the Actuarial Profession.”¹ The gist of the white paper is:

- **Take a systems approach.** This is because it is not the individual actuary at fault for a lack of innovative future-oriented skills, nor the employers nor the professional societies in isolation. It is the system and the structure itself that has created our present realities and it is this system itself that we must change to future-proof ourselves from the incoming tidal waves being brought by the fourth industrial revolution of artificial intelligence (AI). Blaming one party or the other is highly unproductive and we need positivity and unity now more than ever so that we can collectively create a new shared future.
- **Assess the metatrends and adapt from there.** The megatrends are most crucial; the future of actuaries cannot be ascertained without looking at the macro metatrends working in the larger scheme of things. Only by seeing the context of the bigger picture can we arrive at some evaluation.
- **There's no one direction here.** It would be naïve to give just one direction for future actuaries, for example, saying they will conquer the future or they will be decimated.



Based on a holistic understanding, we can arrive at multiple scenarios about how the future of the actuarial profession will likely emerge. This is a more comprehensive approach than trying to say what single path will most likely be the direction of the actuarial profession.

The paper also deals with many different clashes: the futurist vs. the skeptic, vision vs. execution, linear mindset vs. exponential mindset.

The white paper is structured as follows:

1. **Overview.** Set the right mindset for rest of the report.
2. **Probing the actuarial mindset.** Describe the social context of insurance, actuaries and the challenges actuaries are facing for the future.
3. **Note on metatrends.** Detail the relevance of the bigger picture for understanding our specific challenges.
4. **Scenarios for future of actuaries.** Develop probable futures of the actuarial profession through three scenarios:
 - **Utopia.** The flourishing future of exponential actuaries.
 - **Dystopia.** The atrophying future of risk-averse actuaries.
 - **Escalation.** Somewhere in between the first two scenarios.
5. **Plan of action.** Find the right tools and mindset to remain relevant in the future.

6. **Analysis of metatrends.** Dive deep into the automation apocalypse, future of work and education.
7. **Conclusion and final words.** Deliver the main learning outcomes in this report.

This write-up serves as a guide rather than as a definitive verdict on the topic. Take the time to train your own mind. There is no attempt here to create divisions by implying future actuaries will be better and wiser than the current and previous generations of actuaries; to do so would be to just create another source of conflict. This write-up is like a friendly conversation that accepts many inherent contradictions and aims to show the way rather than spoon-feed. It's an attempt to see similarities between the ideal and the real, the emerging and the current, without making any party better or worse off.

At the core of Isaac Asimov's famous *Foundation* series is a man who, armed with supercomputers, reams of historical data and an army of assistants, accurately foretells the future for centuries. Does that sound somewhat like traditional actuarial science?

The challenge, and the promise, for the actuarial profession is managing a shrinking world in which connections among the data—and the size of the data—are expanding exponentially.

Today, actuarial teams are still integral in financial services; however, their role has become more compliance focused. Their contribution to broader business and strategic decisions has diminished. Actuarial teams have moved toward reporting and maintaining models rather than strategic insight generation. Furthermore, underinvestment in actuarial teams over time, combined with the resourcefulness of the actuaries, has resulted in a generation of actuaries who are not well equipped to meet the strategic needs of the organization. A huge proportion of actuaries are set to retire and there are few that can fill that gap.²

Actuaries deal head-on with regulatory, compliance and operational work but their mode of operation is still linear and not exponential. Actuaries need to hone their strategy skills more than their spreadsheet skills. The latest technology can be utilized to minimize the time gap between thought and execution so that actuaries can start focusing on making actionable insights.³

For the actuarial profession, this is an opportunity to foster the perception of commerciality and agility while keeping the existing reputation for high standards and technical excellence. Actuarial functions are at risk of becoming compliance functions unless individual actuaries and the profession undertake a fundamental transformation.

Current actuarial functions are at full capacity but not at full potential with the key drivers being outdated tech stack, being handcuffed by legacy systems, lack of skills in data science and lack of adopting a strategic mindset. We should not think that

“actuarial judgment” is a priceless black box made only by the intuition of human beings; it is a logical process that can be broken down into many subprocesses, then automated.⁴

The strategy and path that got us here is not necessarily the one that will be good for our future. At its heart, the so far (general) failure to adapt is a failure of imagination on the part of actuaries on what could be done instead of what is only currently being done. We have to focus on strategic leadership instead of being number crunchers living in our own subjective reality. We have to essentially inspire people, systems and practitioners and spark their imaginations to bring in more creative solutions to our problems. How are we, as a profession, realigning our structures around disruptive innovation?⁵

It is easy to dismiss these thoughts as fantasy as there is a clash of mentality between the hopeful futurist and the skeptical actuary; but then again, it's easy to underestimate the pace of change as change does not happen in a linear manner. According to an Ernest & Young report: “In retrospect, all revolutions seem inevitable. Beforehand, all revolutions seem impossible.” That observation, attributed to Michael McFaul, former U.S. Ambassador to Russia, is just as applicable to business and economic revolutions as it is to political ones.⁶

It may sound illogical, but organizations get disrupted not by doing the wrong thing, but by doing the right thing. The long list of companies that have fallen victim to disruption includes firms that dominated their industries for decades. They were often ruthlessly competitive, relentlessly focused on the market and led by competent strategic thinkers.⁷ In many ways, they succumbed to disruption not despite, but because of, that focus. We need someone to have the vision to be irrelevant and ask questions related to reality that is yet to emerge. To quote Friedrich Nietzsche, “One must still have chaos in oneself to give birth to a dancing star.”

We need to have a vision and build the new system collectively. It's easier to stay in our comfort zones by implementing new regulations (International Financial Reporting Standards 17 and 9,⁸ and many more) but we have to shift from regulatory-based innovation to technology-based innovation to future proof our profession.

Embrace the concept of duality to achieve oneness: be both disruptors and the disrupted. Duality is the co-existence of imperatives that are in contrast or conflict with each other but together make up two essential parts of the total system or outcome. In the connected and accelerated digital economy, we must address imperatives not only simultaneously but also together. As a result, strategy can be neither long term nor short term; an organization's strategy must encompass both, and the interactions in between.⁹

We tend to miscalculate the speed of revolutions. In assessing the cost, benefit and risk of investments, we often make comparisons

in the context of a world similar to today's. The better comparison, however, is against the environment that will exist in the near future, which could be radically different. The market potential of a disruptive opportunity may seem insignificant relative to the current business today—but that calculus could be very different in a disrupted environment, where the market share of the traditional offering has shrunk dramatically. In a world where everything is changing, the biggest risk is standing still.¹⁰

No one is immune from AI; every field is affected. A specter of uselessness is haunting all of us—not only actuaries but every profession, right down to data scientists and those creating the AI itself.

As is apparent, we have to have a polymath holistic attitude and not rest on our laurels to create the future insurer. As e.e. cummings wrote, “Listen: There’s a hell of a good universe next door; let’s go.” The polymath shall inherit the earth, even if in the present they are at a disadvantage for talking about irrelevant fantasies.

Whatever the future brings, we must understand that technology alone won’t be our savior. We need to guide it to human-centric and ethical usage and create the necessary social structures so that we can benefit from technology instead of being ruined by it. Big data needs bigger ethics!

Ending on an optimistic note, we actuaries have nothing to lose but our illusions. We have a world to win. Let’s go. This is truly an amazing time to be alive. ■



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