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Machine Learning, Skynet or the Future of Actuarial Software?

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As an actuary who has spent his career focused on actuarial software, my ears perk up at every new buzzword that shows up on the tech blogs. Some, like cloud computing, SaaS and GPUs have become ingrained parts of the actuarial software landscape. Others, like blockchain and bitcoin, seem promising, but are still too abstract for me to be able to tell when, or if, they will become part of my day-to-day work. Machine learning falls in between these two ends of the spectrum.

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As a discipline, machine learning has been around a long time and is relatively easy to understand. Regardless of what is happening under the hood, the idea that computers can analyze data, infer patterns and apply those patterns to new data is a pretty easy concept to understand. Actually implementing a machine learning algorithm, on the other hand, required a Ph.D. in CS! Because of this, actuarial software has been slower to incorporate machine learning. Actuaries have had enough problems to solve over the past decade, that figuring out how to implement a machine learning algorithm just so we could find a problem to solve with it hasn't been a top priority. This has changed significantly in the past year, as major software players have begun making machine learning tools available to regular developers. Both Microsoft (*https://azure.microsoft.com/en-us/services/machine-learning-studio/*) and Google (*https://ai.google/research/teams/brain*) have easy to use tools that take the logistics out of using machine learning and allowed developers to get creative and start coming up with problems for machine learning to solve.

While the obvious applications, like predicting economic data or modeling investment behavior, will likely be the headliners, one under the radar application that will impact many actuaries is using machine learning to write better code. This feels a bit like Skynet in the Terminator, the machines learning to program themselves to be better machines, but it is actually a very logical application of machine learning. Coding has become such an integral part of an actuary's day job that many schools have included some computer science in their actuarial curriculum. As more people in the profession are writing code, it is important that the tools provided to them improve as well.

So, how exactly can machine learning be used to improve code? A computer program is simply a series of instructions that are executed with varying degrees of efficiency. This efficiency can be measured a number of ways, but the primary ones are compute time and memory usage. Without getting into the details of all the different types of machine learning algorithms, most require two main things, a set of data and some measure of "better." The algorithms can then analyze the set of data, and extract drivers of which factors make things "better" and which make things "worse." The set of data is typically randomly broken down into two subsets, one of which is used to train the model, and the other used to evaluate the model. Once a model is calibrated to the developer's satisfaction, it can then be applied to new data to predict outcomes. With respect to coding, the measure of "better" was described above, so what is the set of data? This is the series of instructions noted above. Breaking code down into meaningful subsets is called tokenization, a topic which sounds easier than it is, and could be the subject of an article of its own. Once the code is tokenized, it just becomes a standard machine learning problem, analyzing tokens to see which improve the model, and which make things worse, and using those findings to analyze new code, and ultimately recommend "better" code. For example, this analysis would show that raising numbers to an exponent has a negative impact on performance, compared to addition.

We are still far from the days where machines are writing all our code for us (hopefully, at least, until I'm ready to retire), but machine learning is no longer an abstract subject that requires a Ph.D. to understand. Machine learning will soon become just another tool in the actuary's toolbelt, available to be applied to problems that we aren't even thinking about trying to solve right now. ■

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