The Future Of Work Now: AutoML At 84.51°And Kroger

One of the most frequently-used phrases at business events these days is "the future of work." It's increasingly clear that artificial intelligence and other new technologies will bring substantial changes in work tasks and business processes. But while these changes are predicted for the future, they're already present in many organizations for many different jobs. The job and incumbents described below are an example of this phenomenon. Steve Miller of Singapore Management University and I are collaborating on these stories.

Data science and machine learning developers are among the hottest jobs in the world right now. In 2012 I and my co-author DJ Patil (who went on to become the first Chief Data Scientist of the United States government) wrote an article about data scientists that was subtitled "Sexiest Job of the 21st Century." Data science has only become more important since then as AI and machine learning have proliferated throughout organizations.

Data scientists work with AI every day in the sense that they are developers of AI applications. But many of them are now also working with AI in another way as well: their work is being automated. Some of it, anyway. A relatively new technology called "automated machine learning, or "AutoML," is shaking up the world of data science. It's making professional data scientists more productive by automating aspects of their work, and enabling the emergence of "citizen data scientists" who may not have graduate degrees in quantitative fields, but can still develop effective machine learning models using AutoML.

84.51°—an organization named after the longitude of Cincinnati, where it is based—is the dedicated analytics and data science group for the supermarket giant Kroger. It collects and analyzes longitudinal data—observations over time—so the name is appropriate if unusual. In 2015, Kroger purchased a majority of dunnhumbyUSA to create a new, wholly owned business, 84.51°. Now it serves only Kroger and its large network of supplier partners.

84.51° Projects and Automated Machine Learning

The website of 84.51° provides a few revealing numerical facts that convey the enormous size and scope of their data science efforts:

  1250 consumer packaged goods partners

· 60 million households

· 1 billion personalized offers delivered to customers last year

· Over 10 petabytes of customer data analyzed

· 3 billion customer shopping baskets analyzed

· 138 different machine learning models in production.

Many of the group's predictive models are used every day by Kroger. For example, the sales forecasting application creates forecasts for each item in each of more than 2500 stores for each of the subsequent 14 days. In most companies, these types of sales forecasting models are updated rarely or never, but sales forecasting for Kroger is dynamic. These forecast models are updated on a nightly basis based on the most recent data. Using another 84.51° capability, "Kroger Precision Marketing" analyzes the relationships between media exposure and store sales. It uses customer purchase data to make brand advertising more addressable, actionable, and accountable. Over the past three years media campaigns for over 1000 brands have been orchestrated using the results of this data science-driven analysis.

Dealing with such vast amounts of data and large numbers of models would be challenging without some degree of automation. Several years ago 84.51° began a project called "Embedded Machine Learning." Its objective was to increase the productivity and effectiveness of machine learning through automation in conjunction with a more standardized work process and a standard tool. The tool chosen was an automated machine learning system called DataRobot (I am an advisor to the company). It automates many steps in the machine learning process, including data preparation, feature engineering (deciding what features or variables to include in the model), trying out many different machine learning algorithms to see which ones provide the best predictions, and generating the programming code (or automatically producing an application program interface, or API) to implement the model.

It's not uncommon for professional data scientists to distrust AutoML or disbelieve that it can create effective models. At 84.51°, some experienced data scientists were concerned that they would be moving to a world in which their deep and hard-earned knowledge of algorithms and methods would have no currency. The company's leaders emphasized that the new tools would empower people to do their work more efficiently. Over time, this proved to be the case, and there is little or no pushback from the experienced data scientists about the use of the DataRobot tool.

The initial focus for AutoML at 84.51° was to improve the productivity of data scientists. But the group has also used the automated tools to expand the number of people who can use and apply machine learning. 84.51° has been growing its data science function to meet rapidly expanding demand for modeling and analytics to solve complex business problems. It is a challenge to find well-trained data scientists. So 84.51° employs AutoML to make it possible for those without traditional data science training to create machine learning models. 84.51° now regularly hires "Insights Specialists"—people who don't have as much experience with

machine learning, but who are skilled at communicating and presenting results, and who have high business acumen. Aided by AutoML, a substantial number of activities within traditional model development such as use case identification and exploratory analyses can now also be done by these Insights Specialists. The data scientists with more statistical and machine learning experience can focus their time on the aspects of machine learning that requires their deeper expertise, and also to spend more time training and consulting with others having less experience.

Two Data Scientists and their Reaction to AutoML

Alex Gutman and Nina Lerner are senior data scientists at 84.51°. Gutman, formerly a data scientist across Cincinnati at Procter & Gamble, is a "Lead Data Scientist" and was instrumental in introducing AutoML to 84.51°. He trained many 84.51° employees in the use of DataRobot, and now runs predictions for the optimal item assortments in particular Kroger stores.

Gutman was one of the data scientists who was initially intimidated by AutoML; he felt threatened by the automation and by the tool's capabilities. But when he became head trainer of DataRobot, the more he learned, the better he felt about it. However, he still started his two-day training sessions by saying, "You might feel intimidated by this."

He saw the primary benefit of AutoML as increasing his productivity:

"It used to take days and weeks to transform raw data into an algorithm-ready dataset and build a model—now it's a few hours or at most a couple of days. That frees up my time to think deeper about the problem I am trying to solve with machine learning—what we call solution engineering."
The automation capabilities also help him give rapid feedback to his internal customers. "This helps me find new features or supplemental data assets to improve prediction accuracy, and gets results more quickly to show to the decision-maker to see if they are on track."

The DataRobot system uses a "leader board" that ranks the alternative models it generates in terms of their degree of ability to predict the data. Even with this automated model ranking, Gutman says there is still an important role for the data scientist. "If you want to interpret the model you need to have some insight into how it works. You need to be able to explain it to the decision-maker."

Nina Lerner is a Director of Data Science at 84.51° and is responsible for developing new data assets to enable data scientists to more accurately predict and understand consumer behavior. She also oversees the data governance of behavioral segmentations across the business. She was an early adopter of AutoML and has helped to migrate multiple users over to the technology.

Lerner has a graduate degree from Columbia University in quantitative analytics. She was trained to take pride in the process of building analytic models and in using them to successfully predict and categorize outcomes—"We built them with our own hands," she said. Consequently, AutoML was initially very threatening to her. "You no longer needed all of your training and time investment for model creation. It was intimidating and scary for that reason."

She quickly embraced the technology, however, and became a strong advocate for AutoML. She said:

"It was such a game-changer. Previously, I would sometimes spend two months building a model, choosing between XG Boost, Random Forest, Ridge Regression [different algorithm

types], and other model types. And now, within two days, I can explore many more methods than those."

Like Alex Gutman, she had plenty of things to do with the time she saved. "It freed me up to spend time on what made the difference in the models. I could craft more thoughtful features, add new features, and define the problem better." She loves the new focus and says she thinks the areas of the problem she addresses now have more value to the business.

DataRobot is always adding new algorithms to its platform and Lerner acknowledges that she does not always know the details of these new approaches. However, if a new method is identified by the tool as promising, Lerner is able to understand the formulas for the models she digs into as result of her academic training. She can use all of her quantitative data modelling knowledge to assess the quality of the model, understand why the machine learning scores come out the way they do, and use diagnostic techniques to ensure the model is sound.

For both of these data scientists, AutoML gives them more time to think deeply about the problem they are solving and to explore more alternatives. They admit that there are some people in their organization who use DataRobot in a more black-box way that eliminates the need to understand anything. They both emphasize they do not espouse or endorse the approach of: "I have a dataset, let me try it in DataRobot and see what happens."

Both Alex Gutman and Nina Lerner have to present their results to Kroger. In doing so they make heavy use of a feature in DataRobot called "prediction explanations." It identifies the key features in the chosen machine learning model, and their direction of influence. "It might tell them," Gutman said, "why someone would redeem this coupon, or not." Lerner agreed, "We share interpretable output, not the model itself, with our Kroger stakeholders. We tell them why households got a particular score, why scores changed since the last model, and what features drove the prediction."

Working with Insights Specialists

Nina Lerner has worked with Insights Specialists on making use of AutoML. She trained one such person, for example, to use the DataRobot system and follow their machine learning process. She commented that there was more handholding involved than in working with those with strong statistical backgrounds. But while more guidance on her part is required, Insights Specialists tend to have strong capabilities for linking the model results to business needs, and they take on more of the effort to provide informative explanations to Kroger stakeholders. They describe what business value the data is providing, create business relevant stories to explain the AutoML models, and know what questions a client might ask.

Alex Gutman has less experience in working jointly with Insights Specialists on projects. But he had these types of employees as students in his training classes. There he noticed in modeling competitions (giving the class a dataset, and seeing who got the best result) those who "beat the leaderboard"—found a better model than the one automatically selected by the AutoML technology—were likely to be in the Insights role. Rather than trying the latest Python program, their approach was to really understand the variables that predict the outcome. One Insights Specialist, for example, combined household income with house value to create an affordability measure that was a good predictor of buying behavior. Lerner added, "Subject matter engineering always adds the most value."

The Future of Data Scientists

Neither Gutman nor Lerner is particularly concerned that data science will be entirely automated by AutoML. "It's just another tool in the toolbox," Lerner commented, noting that she has observed quantitative analysts in the past who felt threatened by the previous generations of statistical packages like SAS and SPSS.

Alex Gutman says that after teaching AutoML tools to many 84.51° employees, he thinks there will always be a need for consulting from data scientists like himself and Lerner who understand what's happening beneath all the automation. "As powerful as AutoML is," he adds, "it doesn't do much to shorten the entire pipeline of solving a problem with machine learning. You still have to spend a lot of time defining the problem, and gathering and curating the data to address it. AutoML has just shifted the focus."

Nina Lerner concluded with some reflections on her overall career in data science:

"I've approached my career in terms of adaptability and being willing to change with the technology. I can't let the world pass me by. If automation is here, I need to be an early adopter or be left in the dust. I have to stay at the forefront of the technology. I could have become an expert on Random Forest [a particular modeling technique], which someone once advised me to do. But I wouldn't be as successful if I had. I've had more personal career growth because I can do a lot of things in the field and I move quickly to embrace new approaches."