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# PRICING ADVISOR™

## Pricing in the Age of Machine Learning – Hype v. Reality

*The wisdom of crowds, machine learning, and cloud computing are all trending topics in today's business world. But how do these trends and advancements affect the profession of pricing? Author Tim J. Smith, Ph.D. is the founder and CEO of Wiglaf Pricing, adjunct professor at DePaul University, and Academic Advisor for the Certified Pricing Professional designation. His most recent book is Pricing Done Right: The Pricing Framework Proven Successful by the World's Most Profitable Companies (Bloomberg Financial, 2016). He can be reached at [tsmith@wiglafpricing.com](mailto:tsmith@wiglafpricing.com).*



by Tim J. Smith  
Ph.D.

Verner Vinge, a Sci-fi author and retired mathematics professor, along with Ray Kurzweil, a futurist, predict a singularity in 2045 – where machines will surpass humans in intelligence. Thomas H. Davenport of Babson College declared “Data Scientist: The Sexiest Job of the 21st Century” in *Harvard Business Review* as early as 2012. The wisdom of crowds, machine learning, and cloud computing are all trending.

### What does this mean for pricing?

Sci-fi and futurists bring a certain value to society in driving us to imagine possibilities and explore ethical questions, yet not everything they imagine becomes reality. At some point, we must separate hype from reality. Concurrently, we can also reduce confusion created by terms like “data

scientist,” “wisdom of crowds,” and “machine learning” with clarity and plain language.

When we do this, it is clear that pricing is trending, and pricing professionals have a bright future.

### Singularity? No.

With respect to the impending machine singularity, a consensus is coalescing: there will be no singularity and it was, in fact, the wrong mental model. Ken Goldberg, UC Berkeley Professor of Industrial Engineering and Operations Research, suggests the right mental model is one of multiplicity, where humans and machines work together to address important questions.

This drives a major shift in thinking and anticipated outcomes: singularity implies a disruption in human-machine

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relationships, where machines can overtake humans, and therefore companies can operate without employees. Multiplicity provides a more accurate continuation of the current trajectory where humans use machines as tools to improve performance, and human resources will still be required.

On strategic challenges, experience has repeatedly demonstrated that people working with machine learning are able to outperform either people alone or machines learning alone. Furthermore, while there have been major advances in machine learning, many argue that computers are not getting significantly better at creativity, design, or innovation.

The dystopian future of people being replaced by computers is not a future reality – it is a just frightening hype (and good drama for Westworld fans). Instead, we are looking at a future where people and computing work symbiotically to drive results.

The multiplicity paradigm matches the reality of a pricing professional. Though we use tools and models to inform pricing decisions, the decisions firmly remain under human control at firms where individuals outperform their peers. Moreover, pricing professionals don't expect a single form of analysis to be applied across all industries, all firms within an industry, or even all pricing challenges within a firm. Rather, we use the power of multiple forms of analysis and collaborative managerial insight to drive better pricing decisions.

### Machine Learning? Yes and ...

Similarly, there has been much published, often in confusing hype, about the value of machine learning—but what is machine learning? Let's add a little clarity to these terms starting with machine learning.

Machine learning in pricing has been

described by *Software Advice*, a review site for software buyers, as:

1. Gathering data for machine training
2. Choosing an algorithm to use against the training data to drive price predictions
3. Training the price optimization model
4. Tweaking the algorithm
5. Optimizing prices
6. Creating a feedback loop to capture new data and continuously improve the model

Nice, but what does it mean to someone who hasn't studied computer science? That is, what is machine learning as applied to pricing in plain English? Let me offer a translation:

**1. Gathering data for machine training:** For a historical price performance analysis, this means getting historical data about transactions. If you like, think of it as a set of line-item sales data that includes aspects about the sale (timing, customer, location, customer segment, salesperson, etc.), often pulled from an ERP system. This is nothing new. In pricing, two-year data pulls are common and have been used for the past 20 years to drive pricing analysis.

**2. Choosing an algorithm to use against the training data to drive price predictions:** This sounds daunting for it has the term “algorithm” in it. Algorithm is computer-ease for what I usually call a “rule” or “model.” For competitive pricing, an algorithm could be as simple as “Find the price at a competitor and match it.” For pricing and machine learning, a basic algorithm to be examined is the impact of a prices on units sold. We get fancier with our algorithm when we examine the role of the salesperson, the customer, the

overall sales to that customer, and other factors in our analysis. And some industries have their own models, such as hospitality, airlines, and rental cars. In all cases, one assumes a rule: that the change in an input factor impacts the price that is or can be captured. In an Artificial Intelligence (AI)

approach, one can use any and all of the fields in the historical data set to see if it has an impact on prices and sales. Again, pricing professionals have been doing this for decades.

**3. Training the price optimization model:** Ok, this sounds like a job for a major piece of software yet is it? What they mean is to use the data against the algorithm to find the parameters that enable the algorithm to predict reality. For much of pricing, this means regression analysis. For some of pricing, this might require a T-test, F-Test, Chi-Squared, or even cluster analysis. If it sounds like statistics, it's because it largely is. In most cases, this step can be done in excel or with off-the-shelf statistical software, yet I am aware of cases where more specialized software is needed.

**4. Tweaking the algorithm:** You've done your regression and you now have a function that takes inputs and predicts an output, like price is used to predict units sold. But is that function accurate? This is where tweaking comes in. If you recall from your statistics class, R-Squared is a measure of how much of the variation in the independent variable is predicted accurately by the dependent variables given the regression results. What tweaking means is adding and subtracting independent variables until you are satisfied with the quality of the model.

**5. Optimizing prices:** Once you accept the model (algorithm), then you can use that model to predict the price which leads to the highest profitability. This should be familiar to everyone in pricing.

**6. Creating a feedback loop to capture new data and continuously improve the model:** Lather, rinse, repeat says the shampoo bottle. As with shampooing, one should refresh the model periodically, or at least once a year during the annual price review.

If this sounds familiar to pricing professionals, it's because it is. We have been and will continue to do machine learning. We just called it applied statistics or pricing analysis.

There are other forms and applications of machine learning. Probing a little deeper into these other forms reveals that most are based in statistics. Machine learning for classification may rely on t-tests or logit regression. Clustering should be familiar to anyone thinking of market segmen-

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tation. Density estimation is an application of histograms and sometimes fitting data to normal-curve(s). And dimensionality reduction has been used in pricing market research to reduce individual customer interview results, and map them into key concerns as stated by the overall market. Pretty familiar.

### Data Science? Yes, Statistical Modeling is Good

In fact, C.F. Jeff Wu, Professor in Engineering Statistics at Georgia Institute of Technology and major promoter of the term "Data Science," has himself spoken about the fact that data science is really just statistics, albeit wrapped in a sexier term.

Hence, if you have studied market research, sociology, economics, or a wide variety of other fields that rely upon statistics, you can legitimately call yourself a data scientist if you like. And if you have ever used regression to create a predictive model, or simply to examine the impact of prices on sales volume, you have done machine learning and are a data scientist.

Or you can just say you do statistics and price stuff.

### Wisdom of Crowds and Cloud Computing? Yes and ...

If machine learning and data science are just new terms for applied statistics and statistical modeling, then what about the Wisdom of Crowds and Cloud Computing? Are these just hype too?

No, they are not just hype. These are long-term market trends.

For most industrial markets, the datasets are relatively small. It would be common to use a dataset with less than ten thousand transactions and less than 100

fields to describe each transaction at a business in a business-to-business market. This may sound like a lot, but it is actually rather small and definitely manageable with MS Excel.

In contrast, analytics (machine learning if you like) in consumer markets routinely deals with tens of billions of events with thousands of independent variables for each event. This yields a dataset several orders of magnitude greater than what desktop software can manage.

Hence, the rise of cloud computing, where specialized software for managing machine learning tasks can be developed and sold in an economically efficient manner, and the rise of the wisdom of crowds, for capturing that amount of data wasn't economically viable three decades ago.

But notice this definition of the wisdom of crowds does not imply groups of people are always smarter or wiser than individuals. Polls are often wrong and popular beliefs are found to be incorrect. And it doesn't mean everything is going to the cloud. Some computing is more efficiently done locally than remotely. They are just terms to highlight a current market trend.

### Bottom Line: Beyond the Hype and Obfuscation, Pricing is On Trend

So yes, there is a lot of hype. Some of it seems to confuse rather than clarify.

A common sentiment in science is that those that don't know attempt to obfuscate with hyperbole, terminology, and acronyms while those that do know can explain it in

simple terms. "If you can't explain something in simple terms, you don't understand it" is an old quip in physics. "KISS," or Keep It Simple Stupid, is its parallel for sales and marketing.

But what did you expect? The hype spewing out of Silicon Valley and its ilk is only dwarfed by the egos of those working there.

**If machine learning and data science are just new terms for applied statistics and statistical modeling, then what about the Wisdom of Crowds and Cloud Computing?**

And yet there is also a bit of reality in the claims:

- Machine Learning is a yes, and most people currently know this best as applied statistics.
- Data Science is also a yes, and most people currently know this best as statistical modeling.
- Wisdom of Crowds is, in part, also a yes and a good description of a market trend.
- Cloud Computing is, in part, also a yes and a good description of a market trend.
- But Singularity is a strong NO. Wrong mental model. Go for multiplicity if you want a highfalutin term for the better paradigm.

Pricing professionals swim in these waters and are therefore on trend. But let's stick with reality and leave the hype to – well, the braggadocios. Humility is sexier. ❖



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