



# Latent Effects Modeling & Machine Learning

A Primer with Use Cases

## **Table of Contents**

About This eBook

Latent Effects Modeling - A Layman's Introduction

Use Cases for AI in Marketing

- Creating Customer Segmentations
- Optimizing Marketing Campaign ROI
- Sentiment Analysis
- Customer Experience
- Product Mix Optimization
- B2B SaaS
- eCommerce

Deployed Case Studies - AI in Practice

- Insurance: Blue Cross/Blue Shield
- Product Development: Continental Mills Krusteaz

About Cascade Strategies

## About This eBook

Thank you for your interest in our eBook. We'll cut to the chase: this eBook is intended to spark your thinking about how Artificial Intelligence (AI) might be applied to marketing challenges your organization faces. It is not for the AI practitioner, Data Scientist or Developer. It does not contain the answer to your every AI question. *That book* is still being written and has a long way to go. Although you won't be able to call yourself an expert after reading this, you will be able to better understand situations where AI can play a role in solving advanced marketing challenges. Please read, absorb, and let your mind conjure up scenarios where AI might be part of the solution.

Now that you've found this eBook you know where to find us. You're welcomed and encouraged to contact us to ask our opinion about the appropriateness of AI in solving the challenges your organization faces. And we promise to minimize the use of AI jargon and speak in plain business English.

Thank you and feel free to share any feedback with us.

**Cascade Strategies, Inc.**

# Latent Effects Modeling - A Layman's Introduction

## The Benefits of Latent Effects Modeling

There are things you're doing in your life right now that may increase your risk of dying early. For example, if you're smoking, you are increasing your risk of getting lung cancer. If you're overeating, there's an increased risk of getting Type 2 Diabetes.

In ordinary conversation we might say "I smoke too much, so I worry about lung cancer." But there's another perspective on the same behavior – a statistically-based one. That statistical perspective can be expressed as follows: "There's a lung cancer latency in your current behavior."

Why should we care about that statistical perspective? Because it holds the promise of solving some massive social, economic, and cultural problems we currently see in American society.

## Latent Effects Modeling

I live in Issaquah, Washington. Let's say I take a random sample of 10,000 people from Issaquah and seek to predict the age of death for each person. I will assemble a dataset of lifestyle and behavioral variables from these people – how much they eat, how much they smoke, how much they drink, stress out, take drugs, and so forth. That will become my predictive dataset.

Most people involved in a similar project would simply let the lifestyle variables be the input vectors (features) and let the actual age of death from a similar sample (say, of the US population) be the dependent variable (the target). They would predict the age of death for each person, or row in the dataset.

I would look at the matter differently. I would explore the input dataset to learn what latencies exist there (regardless of the impact on the target). I would do this because defining the project this way will serve humanity better. I can explain that.

A "latency" in this sense is kind of an early warning. It's a way of saying "this is what I need to worry about now, at this moment." A "latent effect" is the bad thing (or good thing) that actually happens, like heart disease or Diabetes, many years down the road.

Exploratory modeling using AI can reveal all sorts of latencies – some that restate that obvious and some that are quite surprising. The surprises are the more interesting findings of this exploratory modeling.



*Fire Lookout*

Many, if not most, data modelers produce knowledge about overt effects inherent in the data. This is because it's the knowledge that most companies will pay for in the current day. An overt effect is something you can plan for in the current day (which is what most companies want to do). An example of an overt effect from the case above is “doctor visits increase as unhealthy lifestyle choices are made” or “smoking cessation programs will be popular among certain subsets of people in the population.” Healthcare and pharmaceutical companies pay big money to predict these things like number of doctor visits and smoking cessation programs, which are overt effects that can be detected in the data.

But there are latent effects inherent in the data, too. These effects may be not manifest themselves until many years in the future, but their subtle clues are nevertheless present in the data now. They are harder to detect, but that doesn't mean they are undetectable.

### **Why is Latent Effects Modeling better?**

Why does looking at the data this way serve humanity better? Because it tells you what you should be worried about – now – rather than giving you a decision parameter after the bad thing has already happened. Therefore, it gives you much more time to remedy, and even eliminate, the problem before people learn it's a problem in the first place.

Unfortunately, the vast majority of statistical modeling projects give managers a decision parameter after the bad thing (the latent effect) has already happened. A great example is the coronavirus epidemic. In this case, the bad news struck in early 2020, and then data modelers all over the world were asked to predict things such as likely infections, hospital beds needed, likely deaths, masks and ventilators needed, and so forth. But how many exploratory statistical models had been available in the run-up period of many years to tell decision makers to restore the depleted US reserves of ventilators, PPE, and proper test kits, as well as how to expand the available supply of hospital beds to accommodate Covid-19 patients?



*Vintage safety poster*

In truth, there were a few such exploratory models around. But there's also the problem of disparate belief. Given the reactive, post-hoc behavior of most public- and private-sector decision makers, very little credence was given to exploratory models (“unnecessary alarmism,” and so forth), while huge volumes of faith and confidence were placed in the after-the-crisis models that predicted cases, deaths, hospital beds, and so forth. How much better would life in the US be right now if at least one key decision maker – a true leader – had heeded the few exploratory models that were out there?

Latent Effects Modeling serves true leaders, while managers generally don't have time or regard for them.

## Leaders versus Managers

There's a fascinating emerging literature on true leadership (versus the management of crises). One of the signal books in this genre is *Upstream: The Quest to Solve Problems Before They Happen* by Dan Heath. The author explains that true leaders are people whose names you don't know. Why is that? Because true leaders use tools such as Latent Effects Modeling to discover in time T1 (i.e., now) what they will need to be worried about in time T3 (i.e., years later, when the bad thing could actually occur). True leaders confront the latent effect now and develop remedies now, often quietly and without fanfare, so that in time T3 the problem has vanished or is a dud.

Sam Walker of *The Wall Street Journal*, in commenting on Mr. Heath's book, adds that true leaders can often come across as nags or neurotics because of this.

But how are true leaders greeted by the public? Well, not at all. The public doesn't know them. Nothing is written about them. They created an alternative future in which at least one problem was eliminated or reduced. There is nothing to report when all you have to say is "a big problem was going to occur, but it never materialized."

Managers, on the other hand, are celebrated. They "grip the problem" and show a can-do attitude about fixing the mess that's been created. We need information! What's the size of the problem? Bring the statisticians in quickly! Let's have a task force to manage this crisis with discipline and resolve!

Oh, the public knows the name of these people! Churchill taking over from Chamberlain. Iacocca taking the reins at Chrysler. Grant assuming command of the Northern Army after numerous failed generals. This is not to disparage these titans of government, industry, and the military. It's to remind us that we have somehow grown comfortable with a leadership paradigm that allows the proverbial "poop" to hit the fan, then look around desperately for someone to rescue the matter.

Under this paradigm, all manner of predictions are demanded from data modelers after the bad news hits. But there's really no voice amid the din to say, "the science of prediction could have been managed in a more humanity-serving way."

## What Latent Effects Modeling Should Ask About?

True leaders could potentially ask astoundingly good questions about what they should be worrying about now, if they have the will to do so and enlightenment to listen to the results. Here are just a few rough ideas:

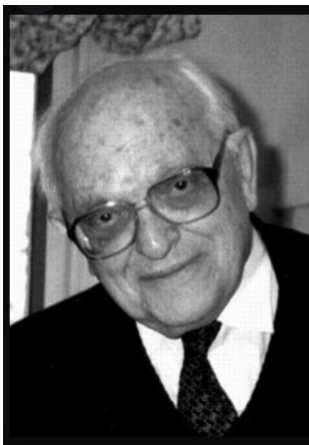
- Looking at demographic data in China, there's a jaw-dropping shortage of women. (We won't go into the reasons right now.) What latent effects are discoverable in those data? Could regime change be one of them? Are there other latent effects that could be detected?

***"Downstream actions react to problems once they've occurred. Upstream efforts aim to prevent those problems from happening."***

Dan Heath  
*Upstream*

- Looking at US electoral data, more and more candidates for Congress are being elected from the extreme right and left, and fewer from the political center. What latent effects are discoverable in those data? Could we be moving toward a new form of government that's hard to define right now? Are there other latent effects that could be detected?
- Looking at workforce data, more and more workers' tasks are being undertaken by robots or AI-driven programs. What latent effects are discoverable in those data? Is a new American aristocracy one of them? Is a proletarian rebellion one of them? Are there other latent effects that could be detected?

Any way you cut it, it serves humanity better to ask data scientists "what should I be worried about?" than it does to ask data scientists "how large is the problem that has just burst upon me?"



To gain knowledge, we must learn to ask the right questions; and to get answers, we must act, not wait for answers to occur to us.

(Anatol Rapoport)

## Use Cases for AI in Marketing

When we're able to ask the right questions of our situation, we're able to manage risk and opportunity with a forward-looking perspective that's proactive rather than looking to the past, or worse, wait for what comes. We'll now dig a little deeper into marketing use cases to spark your thinking about where AI-powered insights could provide value to your organization.

Today much of AI is deployed in areas of loss prevention, fraud detection, and other areas that are generally considered risk mitigation. It's easy to appreciate how the technology is applied in these areas, but as Marketers we tend to have interests that are aligned with growing revenue, building a loyal customer base, and getting the right message in front of the right audience. AI is ready made for savvy Marketers who want to leapfrog competitors and go beyond chatbots (not that chatbots are bad...just sayin' there's more we can do), but think about the questions that need to be asked and be bold enough to ask them.

## **Behavior-based Customer Segmentations**

Developing customer segmentations to drive marketing and sales strategy is not breaking new ground. Often due to limitation of skills, the data points used to develop segments are rather pedestrian. They often include customer surveys, buyer demographics, purchase histories, and the like.

Expanding the data sources adds complexity as well as relationships that were not previously known. Purchase data coupled with browser data, third party data and demographics applied at scale can result in new segments and relationships. Be adventurous and ask around what metrics are being tracked in your organization. There may be complementary initiatives or data sources helpful to your needs. Further exploration can yield valuable insights. Consider consumer life events that drive purchases. The resulting insights can drive development of creative that targets audiences likely to be receptive to offers of products and services triggered by life events. The Customer Service or Retention Marketing teams could be great partners.



*Segmented pipe fittings*

## **Optimizing Marketing Campaign ROI**

The Cambridge Analytica fiasco brought to light the precision by which consumers can be targeted. While targeting audiences for political propaganda is more than a little unsavory (and a black eye to digital marketing), the truth is micro-targeting audiences yields better campaign ROI. Personalization done right gives the people what they want, when they want it.

Following on the stream of thought presented by the prior use case on segmentation, tailoring campaigns to precise micro-audience needs, A/B/MV testing at scale and identifying the most effective media source is within the realm of AI-driven advanced campaign analytics. Let's take it a step further. Use predictive analytic tools that leverage AI to uncover tactical campaign changes in response to projected future events such as election outcomes, weather patterns, or economic conditions. Marketing is fundamentally about putting the right message in front of the right potential customer at the right time to earn a desired outcome.



*Definition of an optimized campaign*

## **Sentiment Analysis**

As marketers driven by analytics, it can be disheartening when clients don't take full advantage of the data generated by campaigns. Social media is far more than "likes" and "follows." By understanding the sentiment of comments about a brand, campaigns can be tailored to take proactive action. The sentiment is analyzed and correlated against external and macro-level events. Relationships can be identified between events, social media sentiment and buyer behavior to proactively adjust the campaign.



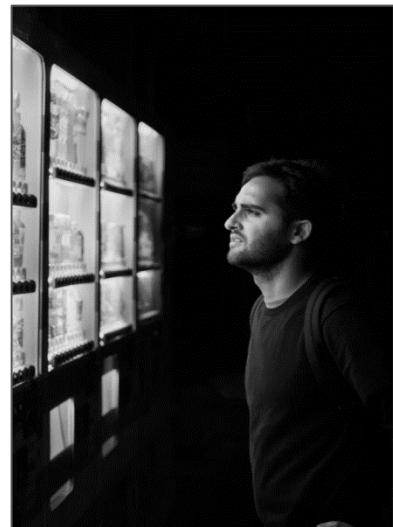
*Sentiment is not always easy to define, more so the motivations behind it.*

By understanding *what motivates* social media users to comment, marketers can understand how to improve their customer acquisition efforts and customer experiences. For example, if a competitor's promotional campaign is receiving a strong positive sentiment, a brand might consider crafting campaigns to counteract those of their competitors.

Sentiment analysis is applicable in the B2B world as well. A business can monitor social channels, user forums, public releases, investor news and third-party sources to gain market insights from user experiences. In response to insights gained, modifications can be applied to sales scripts, advertising messages, feature/benefit statements, exploring new markets or any number of other ways to get an edge.

## **Customer Experience**

Service industries such as retail banking and healthcare who receive negative feedback will want to address these issues. Implementation of programs to improve service delivery by collecting feedback on customer experiences can reveal trends. If improvements are reflected in the data, it's a strong indication a corrective action program is working and improving the customer experience. Often the subtleties in the data are challenging to recognize. AI methodologies like Latent Effects Modeling can illuminate issues to address now with high precision models able to project future states.



*Too many choices, none right*

Mobile app usage combined with online purchase and retail visit data trends create insights into habits of omni-channel customer journeys. In response, programs can be developed to encourage behaviors that lead to improved customer satisfaction ratings. Incentives to share positive experiences as reviews helps the brand build its

reputation. These insights can also reveal where certain channels or customer journey touchpoints are inhibiting a positive customer experience and need attention to resolve.

### **Product Mix Optimization**

In the single-digit-margin-world of grocery retailers, extra pennies earned or saved make a difference. Yet the promotional calendar rarely deviates from promotions anchored to holidays on the calendar. Are the promos actually driving revenue at the expense of profit?

To improve profits grocery retailers, need to look at strategies to increase revenue while not sacrificing profits. For example, are there items that generally need to be accompanied by other purchases to fully enjoy them? Some will argue it's hard to have a true hotdog "experience" without buns, mustard, and catsup. For that matter if it's a summer weekend, customers will probably be open to chips, beer, soda, and other items to complement their BBQ or picnic. Adding data such as weather forecasts, local events, and seasonality overlaid by audience segmentation profiles of the trade area can then be analyzed for their impact. Adjusting variables such as expected temperature can be run through models to determine the impact. We all know a 78F day is more enjoyable than a 98F degree day, right? But what if it's extremely humid and stagnant at 78F while the heat is dry with a mild breeze at 98F - big difference.



*Optimizing product mix for market conditions*

### **B2B SaaS Support**

Consider a technology company that releases software updates on a regular basis. It is expected that an increase in service support tickets will occur after these releases. The majority of tickets are related to users not being familiar with where to find existing features or perform tasks as they used to. NLP applied to service tickets, chatbot support and recordings of help desk calls can be used to determine which inquiries require a personal response or simply a link to a reference document.

There might be further analysis of support request type by geography. Increases in specific regions that are statistical outliers are cause for additional investigation. It is

conceivable that supporting a global product would be more efficient and effective with localized support teams and documentation reducing cost and increasing user satisfaction.

## **Ecommerce**

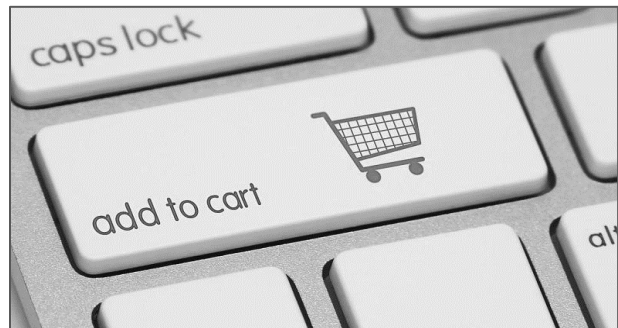
Last but certainly not “least” is ecommerce. The COVID-19 pandemic has been an accelerant to ecommerce initiatives for many companies. Consumer adoption and implementation by retailers, service providers, and others have seen significant growth. Among the largest 2000 global ecommerce sites, June 2020 ecommerce raked in \$21.96B versus \$16.2B in 2019, a 36% year over year increase. As such, AI and ecommerce are a natural combination.<sup>1</sup>

The essential technology that enables ecommerce are secure payment platforms. With the growth in ecommerce use we’ll also see an increase in chargebacks. Improved fraud detection will come from pattern recognition based on user purchase histories, real time geolocation confirmation, and anomaly detection. Minimizing fraud has an immediate impact on the bottom line for businesses and as such, expect rapid growth and innovation in this sector.

Hyper-personalization can help develop a loyal customer base. By using historical data on past purchases, timing of purchases, web pages viewed, and trends among similar audience segments, experiences can be tailored to the individual. According to a McKinsey 2019 study, personalization can drive 5 to 15% increases in revenue and improve marketing spend efficiency by 10 to 30%.<sup>2</sup>

With the enormous growth in the digital home, expect to see development of tying home maintenance needs to ecommerce platforms powered by AI. Imagine home sensors indicating it’s time to replace systems in your home? Once a sensor hits a threshold an email is sent letting them know and connecting them with a professional or asking if the homeowner would like to place an order with the local retailers carrying the items needing to be replaced.

We’d be remiss if we didn’t mention recommendation engines. But realize ecommerce platforms are now including this feature as standard. More broadly, features that help navigate ecommerce during the initial search for products such as autosuggest, suggested corrections, and advanced search options can increase average order size and when executed well, can increase loyalty.



*Increased adoption of ecommerce driven by macro concerns*

# Deployed Case Studies

## Latent Effects Modeling & AI in Practice

### Case Study: Blue Cross / Blue Shield

As the Affordable Care Act (ACA or *Obamacare*) was enacted health insurers needed to understand the impact to both those needing insurance coverage and healthcare providers needing to estimate the economic impact.

**The Problem** - Two very large healthcare providers urgently needed to learn about the new members who came in through the ACA, their healthcare needs and how to best serve them while maintaining profitability. Like today, millions of Americans had medical bills they may be unable to pay. Big money was at stake for providers who would potentially have to take on those liabilities.

One of the organizations opted to sue the federal government to recoup funds which was a provision allowed within the ACA. The other organization opted to alleviate the problem by steering high-risk new members to health remediation programs to reduce long term losses. Both courses of action required very precise supporting evidence. Claims of loss as well as a highly accurate prediction of the number of members that would stem losses was needed.

**The Solution** - A sophisticated machine learning model was developed that incorporated Latent Effects Modeling. The modeling was able to illuminate imperceptible changes when current models could not. Additionally, the model revealed members that combined a high quality of engagement with personal health and positive net value (projected premiums minus estimated costs) to enable Blue Cross to provide services, do so profitably and support their legal challenges. Furthermore, the model presented a hierarchy of members most suitable for health remediation programs and enabled onboarding in a phased-in fashion that minimized financial losses.



*Balancing the needs of various stakeholders leads to success.*

## **Case Study: Continental Mills**

The popular Krusteaz brand of baking mixes was considering a redesign of their packaging. With self-display being a large factor in purchase decisions a poorly received redesign could be devastating to market share.

**The Problem** - The marketing leadership team was uncertain about a design approach to take. A new design would be rolled out across 10 different SKUs. More to the point, focus groups and traditional research approaches were deemed unsuitable to assess nuances in packaging design in an unbiased manner. A biometric survey was considered that would yield insights, but the client was uncertain about the approach.

If the research proved faulty and the new design went into the market and wasn't met with enthusiasm, the results could be disastrous. Not only would the cost of the redesign need to be absorbed, lost market share would take months of additional investment to recoup.

**The Solution** - An innovative biometric study was approved by the forward-thinking leadership team. The exercise studied respondents all of whom were Krusteaz buyers and familiar with the brand. Participants were then "wired up" to track eye movements and brain waves as they shopped and made purchase selections in a virtual storefront. An advanced machine learning model was then developed to analyze minute changes in physiological reactions amongst the participants. The results were unexpected and shocking. Had Continental Mills gone to market with the proposed redesign, sales were projected to *decrease* by \$19 million. Consumers clearly had a strong affinity for the current packaging.



*Some projects results suggest a situation is best left unchanged.*

# About Cascade Strategies

Cascade Strategies is a highly innovative market research firm based in Bellevue, WA. The firm is composed largely of career strategists and researchers who have mastered many of the most complex and advanced methodologies available to the research world, while at the same time maintaining a strong base of traditional quantitative and qualitative research projects for clients.

The company has been headquartered in the Seattle area since 1991. Members of Cascade's professional staff come from all over the US and have amassed a combined 56 years of research experience. Cascade's clients cover a wide range of industries including health care, financial services, high tech, retail, foodservice, and many others.

## Select Services

- Advanced Marketing Analytics
- Qualitative Research
- Quantitative Research
- Consumer Satisfaction Studies
- Segmentation Studies
- Brand Positioning
- Ethnographic Research
- Consulting

Do you have a complex research, analytic or marketing challenge you're trying to solve? Please visit our website at <https://cascadestrategies.com> or call us at (425) 677-7430 to learn more.

## Reference Links

1. <https://www.statista.com/statistics/1112595/covid-19-impact-retail-e-commerce-site-traffic-global/>
2. <https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/the-future-of-personalization-and-how-to-get-ready-for-it>

## Resource Links

Below are links to entry level resources we've found useful and informative. It is by no means an exhaustive list, but they should pacify your curiosity and lead to further exploration.

Amazon Web Services - <https://aws.amazon.com/ai/>

Boston Consulting Group - <https://www.bcg.com/publications/collections/strategy-digital-artificial-intelligence-business>

Emerj AI in Business - <https://emerj.com/>

Google Cloud Services - <https://cloud.google.com/products/ai>

IBM Watson - <https://www.ibm.com/watson>

Medium Towards Data Science - <https://medium.com/towards-artificial-intelligence>

SAS Analytics - [https://www.sas.com/en\\_us/insights/analytics/what-is-artificial-intelligence.html](https://www.sas.com/en_us/insights/analytics/what-is-artificial-intelligence.html)

Sloan Review (MIT) - <https://sloanreview.mit.edu/big-ideas/artificial-intelligence-business-strategy/>  
<https://sloanreview.mit.edu/projects/winning-with-ai/>