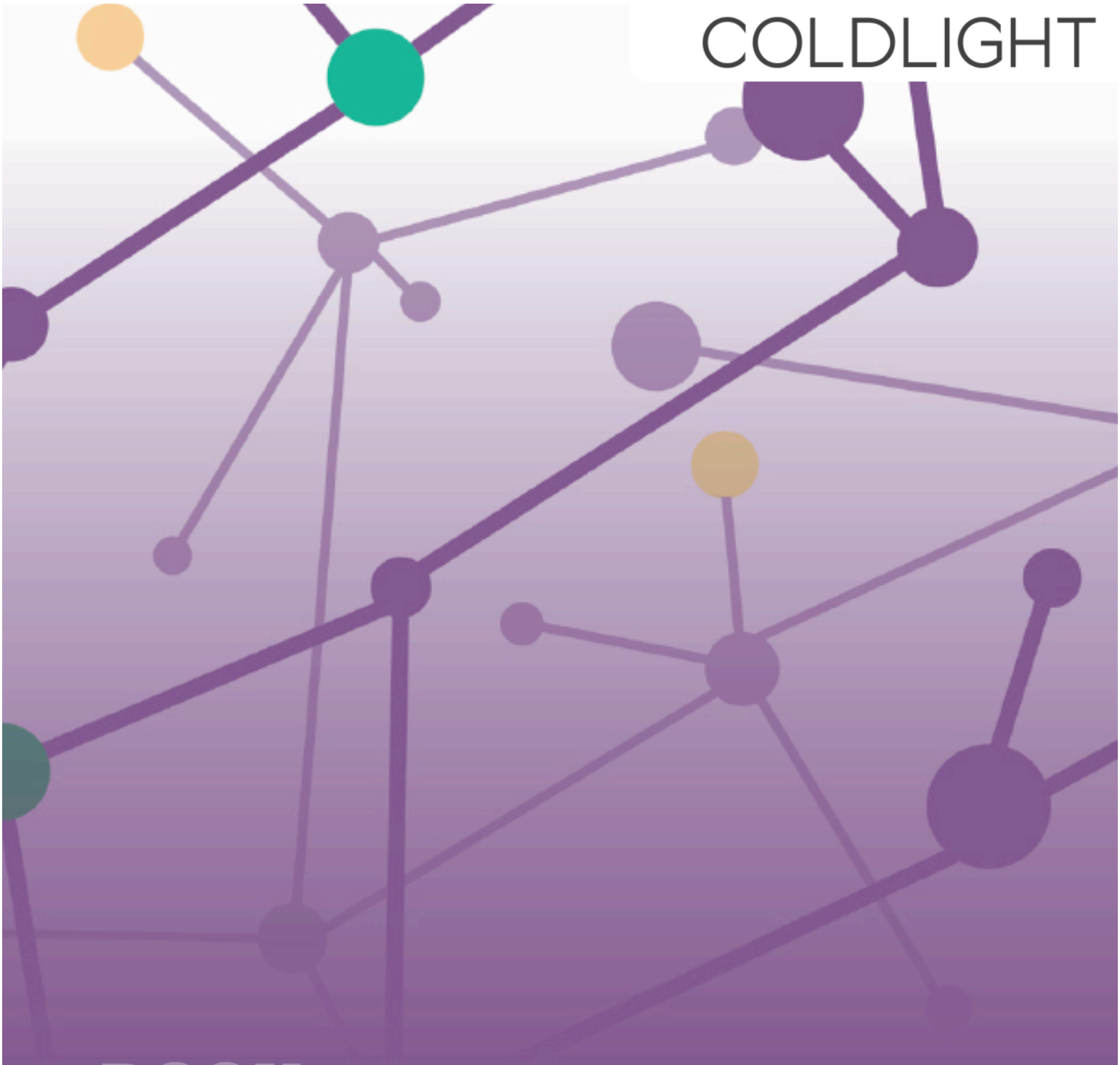
COLDLIGHT



eBOOK

Adaptive Analytics for Population Health Management

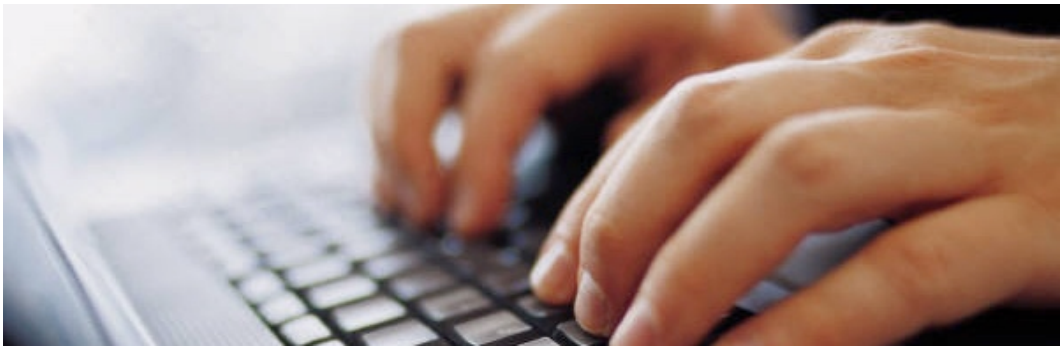
1

The Data Problem

The healthcare industry is reinventing itself in search of a more financially sustainable business model that also results in better outcomes for the people getting care. That is the great hope behind the disruption and confusion and the explosion of buzzwords like big data and population health. For those working in the industry – and the software and service providers who support them – the challenge is to turn the promise into something real.

The push to use health data more productively is driven by both business and regulatory pressures. Employers want better ways of reducing the cost of health insurance, ideally by making employees healthier rather than refusing care. In the U.S., the federal Medicare system is actively promoting the concept of an Accountable Care Organization that takes responsibility for the full spectrum of care, inpatient, outpatient, in the doctor's office, and in the patient's home, with financial incentives aligned to make better care more profitable care. Private payers are moving in the same direction for their own reasons.

Meanwhile, technologists are justifiably excited about the vast amounts of data they can now gather, store, and analyze. Used effectively, the new analytics should help caregivers identify heart attacks and strokes before they happen and prescribe preventative measures that save the system money and save the individuals unnecessary misery. But can we really find the right answers for the right patient at the right time to make a difference? A few pioneers in managed care and accountable care have demonstrated encouraging results, but what will be required to scale up those examples, improving health and reducing the cost of care for whole populations? Often, the success stories focus on prevention for a single chronic disease, such as diabetes, and the analytics challenge is limited to the risk factors for that disease. Ultimately, we want to treat the whole person, or a whole population.



Populations can be defined according to geography, health characteristics like the population of diabetics, or other demographic groups like veterans or coal miners with common concerns. What matters is finding the patterns that can predict problems and help minimize them.

That means making population health management and clinical decision support tools examine data about all sorts of conditions and health concerns. A model might incorporate provider data, payer data, government data, and data licensed from other sources.

But what data points are worth comparing? Answering this question is an expensive proposition if you pick the wrong data points when you are hiring a data scientist by the hour to build your models. Frankly, spending time figuring out what data to model is simply time wasted. Even if you picked the right data points to model for one area of the country or a subpopulation, these might not be the same for another locality with different conditions. In a clinical context, modeling the wrong data could even put lives at risk.

If you look past the flash and dazzle of technology demos, too many population health analytics products do little more than trend analysis. Improving population health takes more than straight-line extrapolation of a trend. Many established analytic models with proven predictive power have been created for use in other industries, such as credit scoring. These can be adapted for use in healthcare. However, identifying the appropriate model or set of models to be applied to a given problem is a task in and of itself. Human health has many more variables than a few key financial data points, so an exact replication of the success of trend-line-based modeling in healthcare might even be dangerous for healthcare financing and medical decision making.

2

Better Models, Lower Cost

The possibilities of health data analytics are great, but the availability of data scientists and statistical programmers who know how to create the models is limited. One large mid-Atlantic healthcare provider, which includes two hospitals and a network of outpatient facilities, initially tried to reduce readmissions for patients with ischemic heart disease using traditional modeling techniques. This approach yielded incremental improvements at great cost. A few of the drawbacks:

- The models did not adjust automatically with changing conditions.
- Over time the results from the static models did not accurately reflect a dynamic environment.
- A lack of longitudinal modeling across patient records from different sources limited the ability to track patient progress and setbacks.
- To adjust the models, reprogramming was required, which meant finding and hiring the difficult-to-find and expensive data scientists.

One way to break the logjam is to automate the creation of the models themselves by applying machine learning techniques. While this does not eliminate the need for those rare data science experts, they can work more productively with the help of automation. It is also true that in some cases software that iteratively refines a model may even detect patterns that a human analyst would never think to explore.
After trying more traditional modeling, the hospital system found that its heart disease model tended to become outdated. Analysts thought there must be a way to get better data from the many sources available.

This healthcare provider began discussions with ColdLight about how its proprietary intelligent system technology embedded in its Neuron product could automate more of the analysis process and independently discover through its complex analytical processes new connections within the data where none were seen before. Suddenly, it became possible to increase the volume of data incorporated into a model without dramatically increasing the cost, giving the hospital system a financial edge and a better ability to track patient health patterns over time.

One of the products of this work was a new risk stratification report for case managers. Neuron automatically generates models to identify the top 5% of patients with the highest risk of readmission. Case managers are able to see why the patient has been flagged, allowing the care team to intervene or pay special attention to the client, reducing the risk of readmission. ColdLight has already had a personal impact on many of the patients at a hospital that leverages Neuron to process risk scores for all patients with heart-related heart admissions. One patient in particular, a middle aged man, found himself in the hospital with a mild form of a heart attack. Using the hospital's dated models, the man was predicted to be a low risk for readmission, but Neuron repeatedly flagged this person as high risk based on its constantly-calibrated predictions derived from wider data beyond what was in an EMR system. Care managers used Neuron's predictions to follow up with the patient. Care managers soon found that the man would need further treatment and he was readmitted to the hospital for more care. Had the care managers not used Neuron's model to provide the right level of care for this individual, his condition may have gotten much worse before he came back to the hospital. Providers were able to intervene sooner and save a life."

ColdLight Neuron tests multiple analytic techniques against a given data set to determine the best approach. Neuron sits on top of big data, learns from it, then generates insights and predictions that are not obvious in real time. Neuron is flexible: it can be embedded in existing software or run standalone, it can be deployed on-premise or in various virtual environments, and it is scalable for big data as your needs grow. For example, your company might initially draw data from its own data set, then add publicly sourced data, and even license additional data. The modeling within Neuron automatically adjusts to the new data, learns from it, and creates new insights as a result. In fact, Neuron analyzes the existing static models and can use this as a basis for a new way of looking at the numbers. This creates continual, automatic improvements with minimal human interaction. In fact, failing very fast is a goal of Neuron ~ Neuron learns where no correlation exists so it can ignore that particular data point and move on to more promising areas.

This technology was not readily available until recently due to the robust processing power required for analyzing big data. But as with so many other areas of computing, Moore's Law is really paying dividends in the big data analysis world. The organizations that could afford data modeling on a drilled-down scale that is really required to do the job right were very few. Neuron's automation brings data analysis possibilities to much smaller organizations at an affordable cost, making them more competitive with the "big boys."

Application developers can leverage this capability to narrow the possibilities and select an approach to embed in their own software. At the option of the software publisher, the adaptive analytics engine can be configured to continue to refine the model even after the "final" product is delivered to customers.

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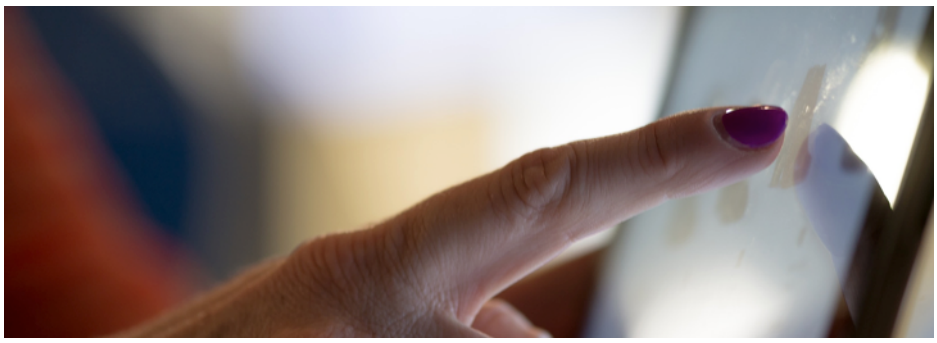
Another advantage to using dynamic modeling over static modeling is the changing healthcare industry itself. There have been great changes as a result of the Affordable Healthcare Act in access to care, medication availability, and co-pays with more surely to come as the Congress tries to make adjustments to the Act through sudden actions in omnibus spending bills and judicial review.
For the most part, the underlying algorithms Neuron uses to create analytic models are standard ones. They are time tested in financial services and other industries and are increasingly being applied to healthcare. But while the formulas are standard, the way Neuron combines, adapts, and applies them is unique.

Amid so much change, healthcare must be a learning industry. That means the analytic software employed by the industry must be able to learn and improve itself, too.



About ColdLight

ColdLight makes data science simple and accessible for more people and technologies through the use of Neuron. Neuron is a learning technology that simplifies the process of automated advanced and predictive analytics by using proprietary artificial intelligence and machine learning technology to automatically learn from data, discover patterns, build validated predictive models and send information to virtually any type of application or technology. By doing the work of 1,000's of data scientists in parallel, Neuron is able to quickly help everyone and everything discover key insights into massive data sets and accurately predict future outcomes without ever having to manually program or implement a data model or algorithm. Neuron has been proven to do everything from quickly identifying high-risk patients within a population to helping some of the largest companies in the world determine accurately the lifetime value of an asset.
Founded in 2008, ColdLight is headquartered in Wayne, PA, and backed by Intel Capital and Kayne Partners. Comcast, JD Power, GSK, Christiana Health System, and Medecision are just a few companies that rely on ColdLight and Neuron for automated predictive analytics. To learn more about ColdLight, visit www.coldlight.com.

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