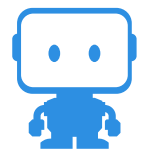


Transforming Healthcare with Automated Machine Learning



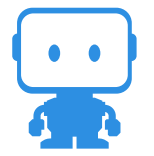
HEALTHCARE OVERVIEW



DataRobot



Executive Summary



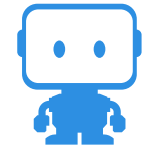
The future of healthcare is data-driven, and machine learning is key to enabling the artificial intelligence (AI)-driven healthcare organization. The effective use of machine learning will help healthcare organizations extract the insights locked in large repositories of data from sources such as electronic medical records (EMR), clinical trials, and billing and claims. Machine learning will reduce costs, maximize revenue, improve patient outcomes, and optimize operations throughout the healthcare industry.

However, healthcare providers and payers are struggling to effectively utilize machine learning. Many providers do not have the skills, tools, or time to develop and deploy conventional machine learning solutions. Many payer organizations are facing difficulties fully staffing their analytics organizations to address critical projects. Not only that, but most healthcare organizations do not have the IT resources to deploy and maintain conventional machine learning tools, let alone the predictive models developed using those tools.

The DataRobot automated machine learning platform makes advanced predictive analytics more accessible by reducing barriers to more accurate predictions. With embedded AI, DataRobot improves the productivity of data scientists while empowering domain experts to develop highly accurate predictive models without prior programming knowledge. DataRobot also offers simple methods for deploying and maintaining models, allowing overworked IT departments to quickly integrate advanced predictive models into production systems.

In this paper, we share examples of payers and providers that are using predictive analytics to transform their operations across the board and discuss the benefits of AI in healthcare. We also introduce the DataRobot automated machine learning platform and discuss how DataRobot optimizes and accelerates predictive analytics for healthcare organizations.

How Healthcare Payers and Providers Use Machine Learning



HHealthcare payers and providers are guided by the common aims of lowering the cost of healthcare while improving health outcomes, enhancing the patient experience, and optimizing the caregiver experience. Machine learning helps both payers and providers achieve these aims by:

- Uncovering the drivers of quality
- Identifying at-risk populations
- Cutting fraud, waste, and abuse
- Improving resource utilization
- Predicting hospital-acquired infections
- Discovering lapses in adherence

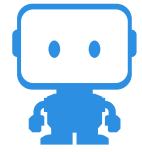
Here are some examples of how healthcare organizations are using machine learning to transform their business:

Lower costs

Providers and payers want to optimize the flow of costs and revenue through their system, identify opportunities to maximize resource utilization, and control fraud and waste.

- The Mayo Clinic uses machine learning to optimize the utilization of its resources, including supplies, services, and staff; control costs; and improve patient safety and care. Their models identify performance improvement opportunities and guide the selection of appropriate laboratory tests based on the best-predicted patient outcome, reducing the number of costly and unnecessary tests.
- Anthem, a large payer, borrowed insights from the retail industry and applied machine learning to develop behavioral models of their providers and members to cut fraud, waste, and abuse. The behavioral models help them identify potential billing anomalies and proactively identify suspect claims or improper payments, saving them tens of millions of dollars compared to their previous analytic models.

Better Health Outcomes and Better Patient Experiences



Better outcomes

Care organizations want actionable clinical insights to deliver the best care and outcomes while managing costs and safety.

- The Michigan Center for Integrative Research in Critical Care is testing the use of machine learning to build models that predict critical care events such as internal bleeding. By exploiting the data streaming from ICU machines, including pulse-ox, blood pressure, and temperature, the models may one day allow caregivers to continuously monitor the patient's condition and proactively intervene when it becomes necessary.
- Indiana University Health applies machine learning to predict and minimize the incidence of potentially life-threatening central line-associated bloodstream infections (CLABSIs). By predicting risk for CLABSI, the care teams can intervene and decrease the number of infection incidences.
- Beth Israel Deaconess Medical Center (BIDMC) harnesses machine learning to drive a sepsis monitoring system that stratifies patients by risk scores that in turn inform clinical alerts and targeted decision support. Machine learning also helps BIDMC improve the accuracy of breast cancer diagnosis in pathology images.
- Deaconess Health utilizes machine learning to monitor patients with opioid prescriptions and identify those who may be at risk for drug abuse.

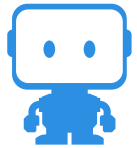
Better patient experience satisfaction

There is a growing understanding that a better patient experience leads to lower costs and better outcomes. As a result, revenue is increasingly being tied to quality of care. Both payers and providers have begun implementing quality and intervention programs to improve how they engage with patients and their communities.

- Symphony Post Acute Care employs machine learning to predict risks of an infection or fall after discharge, allowing Symphony to head off complications before they happen. Additionally, machine learning insights have helped them optimize their staffing to provide better care in the clinic.
- Clover Health, a data-driven healthcare payer, turned to machine learning to build a diabetes complication model which predicts the likelihood of those with diabetes to develop complications in the next 6 months. This allows Clover to proactively engage with patients and their care, reducing hospitalization rates and avoidable costs.
- American Family Care applied machine learning to gain insights from patient feedback. Classifying the numerous suggestions, requests, compliments, and complaints they receive helps them follow up with patients personally to resolve issues and improve the way they deliver care and interact with patients, which has had a positive impact on their patient satisfaction scores.



Ensuring Provider Satisfaction

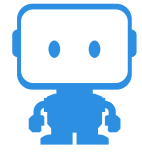


Provider satisfaction

Orchestrating a positive provider experience ensures that staff practice at the top of their license and avoid dissatisfaction or burnout that could lead to a reduced quality of patient care and health outcomes.

- Johns Hopkins developed a triage tool to help staff better prioritize emergency department patients. Since they built the tool using machine learning, they are able to take full advantage of their health records to more accurately identify critically ill patients and assign priority treatment levels.
- Hamilton Health Sciences created a system to alert staff of potential Code Blue situations. Built with machine learning, the system provides a grading scale for preemptive interventions before patients are in danger. This not only improves patient safety but allows Hamilton staff to be more effective and reduce stress and anxiety due to heroic efforts required during Code Blue events.

Three Challenges of Machine Learning



As these examples show, machine learning is a powerful tool in healthcare. But integrating a machine learning program at a payer or provider isn't easy. We've identified three key challenges: skills, time, and tools.

Skills: data scientists are rare

Finding, hiring, and retaining data scientists is a struggle for healthcare organizations, and the competition is fierce. Reports in [The New York Times](#) and [The Chicago Tribune](#) document the gap between supply and demand – and the fact that the gap shows no sign of narrowing in the near future. [The Harvard Business Review](#) suggests that you stop looking or lower your standards because of the rarity of true data scientists. Not only that, but what few data scientists there are tend to gravitate to large tech companies who can pay top dollar to attract top talent.

Challenge: If you are managing the data science team for a hospital or payer, how do you recruit the people you need?

Tools: provisioning is a headache

Data scientists need software tools and the hardware to run them. You can get conventional machine learning tools from a vendor, but there is also the cost of software installation and maintenance, including the time required of your team. And while there are hundreds of free libraries you could use, the expense and expertise needed to install, manage, and maintain such libraries are more than a typical healthcare organization can afford.

Challenge: How much time do you want to spend acquiring and maintaining the tools rather than delivering the results?

Time: projects take too long

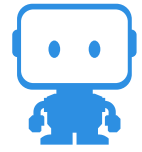
Predictive modeling using traditional methods can take weeks or months, with many data scientists citing between 30 and 60 days to develop and deliver a predictive model. In the healthcare environment, with the challenges of data integration and transformation, model building is likely to take much longer. Using conventional tools, machine learning projects may include thousands of separate tasks, many of which are routine and repetitive but must be coded individually. Big banks and insurers employ armies of junior data scientists to perform this work, but most healthcare organizations don't have that luxury.

Challenge: Do you want your valuable data scientists to spend most of their time doing routine and repetitive programming work?





Automation is the Solution



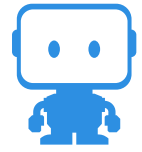
In manufacturing, automation increases the strength, productivity, and quality of output from factory workers. The same principle holds for machine learning. Automated machine learning directly addresses the key challenges of limited data science talent availability, long project timelines, and complicated provisioning.

Automation delivers the power of machine learning to the people who understand the business, expanding the pool of people in an organization who can contribute to data science projects beyond the data scientist to analysts and business leaders. Built-in expertise makes automated machine learning tools simple to use. Guardrails and best practices make it safe to engage more people in projects, with the assurance that users can't miss critical steps.

Surgical robots do not replace surgeons; they enable surgeons to do more demanding and productive work. Likewise, automated machine learning does not replace the data scientist; it augments their capabilities by handling the thousands of routine and repetitive tasks in a project that would otherwise consume valuable time, allowing them to deliver more insights.

By automating low-level tasks, expert data scientists can handle more projects and perform more high-value work like gathering a deeper understanding of care problems or explaining the results of the predictive models.

Automation speeds machine learning projects – but that's not all it does. An automated process means that data scientists will no longer spend valuable brainpower manually provisioning server instances, distributing jobs to servers, or maintaining complicated software stacks in virtual machines. Automated machine learning software handles these tasks behind the scenes with a single administrative interface, freeing up data scientists to focus on implementation and application.



DataRobot: the Leader in Automated Machine Learning

DataRobot, a global data science and machine learning company, helps healthcare companies around the world leverage the power of machine learning. DataRobot provides a platform for users of all skill levels to produce accurate predictions in a fraction of the time required when using conventional tools and methods. To leverage the most innovative techniques, DataRobot uses open source tools like Apache Spark, H2O, Python, R, TensorFlow, Vowpal Wabbit, and XGboost.

Empowers users

DataRobot's automated machine learning platform perfectly complements the domain knowledge and acumen of its users. In addition to end-to-end automated modeling workflow through an intuitive web interface and graphical model assessment tools, Datarobot provides flexible programming APIs so users can work with the tools they already know, eliminating the training and time necessary to pick up new capabilities. DataRobot also offers advanced tuning and supports custom extensions for the most sophisticated analysis.

Enables collaboration

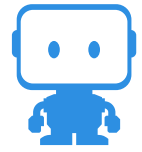
Care quality analysts, safety directors, operational analysts, fraud investigators, and other analysts collaborate on machine learning projects with DataRobot, which moves machine learning out of the skunkworks and into the front office. With a clear definition of the problem and a closed feedback loop that includes all stakeholders, machine learning projects deliver better results.

Interpretable and transparent

With DataRobot, every step in the modeling process is visible and reproducible. DataRobot offers extensive facilities for understanding the behavior of its predictive models. It also provides aid to the user or stakeholder seeking to understand and interpret the model. DataRobot explains its predictions by highlighting the most influential factors so your team can demonstrate results to patients, caregivers, executives, and regulators.



DataRobot: the Leader in Automated Machine Learning



Solves many problems

Healthcare companies use DataRobot for machine learning across many different clinical, operational, and financial functions. DataRobot is a general-purpose machine learning platform that is used to transform an organization across different services, functions, and regions. It helps organizations avoid the integration, training, and support headaches of using many different point-solutions across business functions.

Reduces time to value

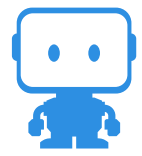
DataRobot is fast. Its modern software architecture uses distributed computing to run many experiments in parallel. It automates tasks like exploratory data analysis, feature engineering and pre-processing, and model assessment. Once your organization approves a model, DataRobot offers multiple options for deployment, including native scoring, exportable prediction code, and REST APIs.

Enterprise-ready

DataRobot works with your data wherever it resides: relational databases, Hadoop, text files, and many other sources. It runs as a managed service in the Datarobot cloud, or – as for most enterprise clients – on clusters on-premise, in a virtual private cloud, or in Hadoop under YARN behind the protection of organizational security and HIPAA framework. In Hadoop, DataRobot uses native security, data provenance, and application management services. For low maintenance and easy integration, DataRobot uses the most current software development practices including microservices and containerization.



Automated Machine Learning Drives Healthcare Excellence



The widening availability of data and our capabilities to make use of that data is transforming the future of healthcare, and excellence in this new world depends on how quickly data-driven entrepreneurial organizations can build world-class machine learning capabilities.

DataRobot's automated machine learning platform is the solution, allowing organizations to develop the necessary skills while avoiding the three key challenges to implementing machine learning.

Enabling the AI-driven enterprise with automated machine learning. That's DataRobot.

**For more information on DataRobot, or to schedule a demo,
[visit www.datarobot.com](http://www.datarobot.com).**

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