FOURTH - IR
APPLIED INTELLIGENCE

Decreasing Readmission Rates for CABG Patients Through Predictive Modeling

4th-IR collaborated with the cardiac team at a medical center in Michigan, USA, combining advanced machine learning with a deep understanding of clinical and business issues to create a model that more than doubled predictive accuracy.

"By far more accurately predicting CABG patients who were at high risk for readmission, we could increase quality of care and the quality of life of our patients, and at the same time reduce costs for the medical center."

– Medical Center Project Lead

Company Info:

Name: Medical Center

Location: Michigan, USA

Industry: Healthcare

Challenge

Unnecessary readmission is a serious challenge for hospitals discharging patients who have recently undergone Coronary Artery Bypass Graft (CABG) surgery. Readmissions can be costly in terms of time, labor, insurer payouts, and reputation. In fact, the Centers for Medicare & Medicaid Services (CMS) penalizes hospitals for 30-day readmissions. While some readmissions are due to medical complications, many can be avoided by interventions either at discharge or through post-operative monitoring. Although the medical field has developed metrics for predicting readmission – for example, the LACE method – these methods are not data-driven, nor particularly effective.

Solution

Using advanced machine learning, the 4th-IR team developed a far more accurate predictive model that was also intuitive to use – delivering information that was easily understood by medical teams. The model became a powerful tool in creating better procedures for discharged cardiac patients – procedures that protected patients and reduced costs and risks.

Results

Machine Learning Meets Process Re-engineering

Solution development began in collaboration with the medical team to understand the medical challenges they were facing and the healthcare and business implications of CABG patient readmission for the medical center.

Training the predictive model

The 4th-IR team studied CABG cases performed at the center over a 2-year period. Approximately 12 percent of these patients had been readmitted. Not only was this costly to the medical center, it was not always the best care option for the patient.

The 4th-IR team created a Readmission Risk Index by training a set of world-class algorithms to learn readmission predictor patterns with insights gleaned from the data set. The goal was to reduce false positives – but without missing true positives – a dilemma facing most models. The team addressed the complexity of the challenge by factoring in approximately 70 different patient traits. Using two predictive models in tandem, the team was able to achieve the desired ratio of true positives to false positives.

The 66 percent accuracy would have prevented a majority of the patients from being unnecessarily readmitted in the timeframe of the data set studied. In addition, the model gave the medical team a far better ability to track patients who truly were at risk to be readmitted. Better healthcare. Better business.

Intuitive Interactive Tools for Smarter Decisions

4th-IR first developed a web-based slider tool that showed the distribution and the balance between false positives and false negatives, given different patient variables. The balance between false positives and false negatives impacts business decisions and the associated costs of incorrectly deciding to readmit or not. In the background was a complex set of statistical models feeding the tool. All the medical team needed to know, however, was the predicted balance that would help them weigh costs, logistics and patient health.

The 4th-IR team developed a customizable iPad app that enables a clinician to generate a readmission risk score at the time of discharge. The app not only shows if the patient is high risk for readmission, it also gives the top five contributors to their risk score. This allows the clinical team to adjust follow-up procedures based on the patient's risk profile.

Intelligent Ecosystem Improves Care and Controls Costs

Based on recent successes in predicting CABG readmissions, the 4th-IR team continues to enhance the solution set to identify readmission precursors and opportunities for proactive remediation of readmissions. The end result is not just a predictive model, but an entire intelligent ecosystem.
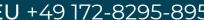
In addition to risk identification obtained from the data, the 4th-IR team incorporated tele-health monitoring equipment to track specific bio-metric functions. The ecosystem applies cutting-edge artificial intelligence for monitoring the healing of the surgical incisions and sutures via image detection. Incorporating multiple data sources, including smart devices and patient-entered data, into a highly tailored descriptive patient model allows physicians to deliver better healthcare, and administrators to reduce costs and risks.

The infrastructure to monitor patients and assess risks for CABG procedures can be used to monitor and assess other readmission challenges. The tools developed for this project are being re-applied throughout the hospital, addressing the medical center's risk reduction and precision medicine and quality of care.

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