Case Study: Life Sciences

How Unstructured Data Analysis Can Lead to Healthier Patient Behavior

Machine learning with natural language processing helps a biotechnology company better serve the patients who use its products.

For a biotechnology giant, patient support is at the center of its business. Now natural language processing (NLP) is enabling the company to expand that support in ways it hopes will lead to better patient outcomes.

During a five-month partnership, our team applied machine learning and NLP to years of call notes the company had collected. Through the use of sentiment analysis and predictive modeling, the company gained a better understanding of the factors that influence patients to start and continue therapy. The project also generated key insights into its customer-service processes and led to new KPIs, workflow improvements and coaching opportunities for improved patient engagement.

At a Glance

To improve the patient journey, a global biotechnology company sought to analyze the free-text notes taken by its patient services division. Through application of machine learning to natural language processing, we helped our client gain insight into factors that motivate patients to start, discontinue and switch use of medications.

Outcomes

- Uncovered 30 meaningful insights and nine recommendations.
- Partnered with stakeholders to create taxonomies and ontologies.
- Predictive modeling identified patient types as well as the brands for which patients were more sensitive to factors such as co-pay assistance.

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Getting to the Heart of Patient Conversations

The objective of the biotech company's patient services division is to assist individuals in the complex process of gaining access to their medicine. The division managers document their interactions with payers, patients and providers and take extensive notes.

Except anecdotally, the notes hadn't been mined for insight. The billion-dollar company needed a way to sift through the notes' free-text format to isolate trends and patterns, and learn more about how to improve customer care and patient outcomes.

With NLP's ability to extract meaning from everyday language and words, it could open a window into the call notes. It could answer key questions for the company such as how do patient experiences differ by group and subgroup, and which factors influence patients to continue treatment?

Breaking New Ground

The NLP project covered important new ground for the company. For one thing, while the project's upside was significant, it was also uncertain: There were no guarantees what patterns might be found in the unstructured data. For another, it was the first time the company had collaborated across the organization on a project.

By gaining support from internal stakeholders, including legal and privacy departments, the company ensured the project RFP addressed all concerns. This preparation helped to build support for and embed integrity in the project.

The detailed RFP sought predictive modeling of unstructured and structured data, and technology improvements such as cloud enhancements.

After reviewing the written RFP submissions, the company invited several respondents to make presentations.

How the project worked

We followed a well-defined approach to go from inputs to insights

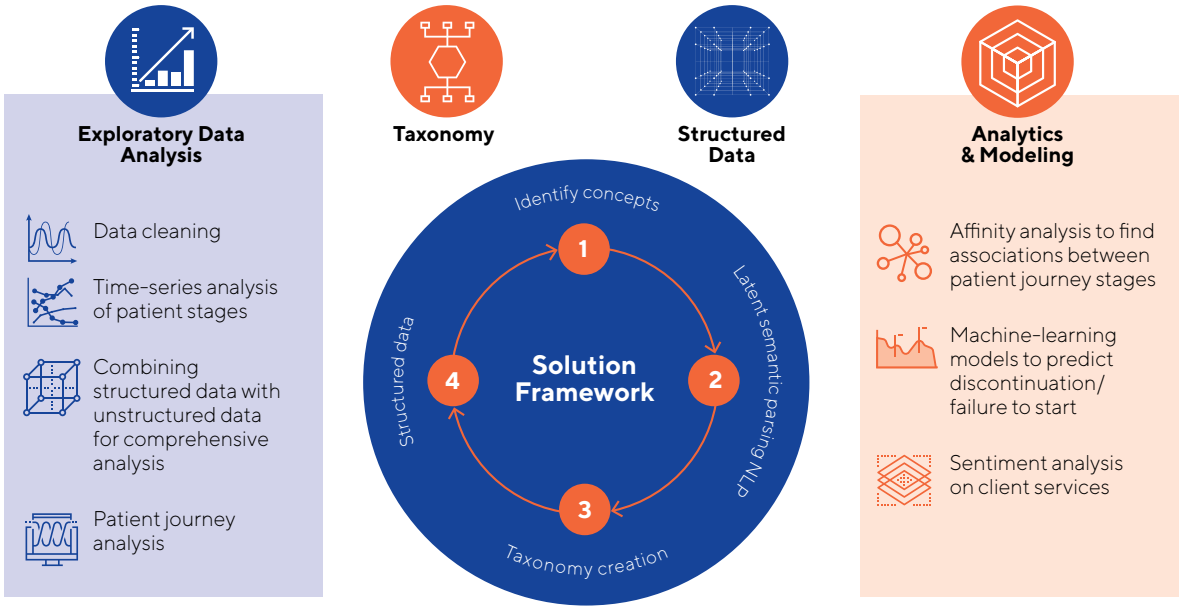

Figure 1

A Journey of Collaboration

To establish a solid foundation, our team spent two months working closely with the company's stakeholders, developing hypotheses and performing data validation.

In a series of workshops, we collaborated with our client to better understand products and disease states by identifying the word phrases that occur most frequently in the free-text notes. Using that information, our team built the custom taxonomies and ontologies required to inform the NLP engine. We then identified two dozen data hypotheses to explore.

Protection of patients' privacy was key. The company stripped all personally identifiable information — names and other details — from the data it shared with us for data mining.

To perform the data mining, our team used open source languages R and Python — the go- to toolsets for data scientists — and IBM SPSS business modeling software. With R and Python, the team converted the ontology into a format that enables NLP to probe the call notes and classify conversations by topics, such as billing, side effects and locating nearby physicians.

Over the next three months, we continued a close collaboration, advancing the project with monthly steering committee meetings and regular check-ins to match milestones. When the project wrapped up, we delivered 138 pages of analytical insights, including nine key recommendations.

Sharing the Findings: The Importance of Storytelling

Communication of the project's findings to client stakeholders and senior leadership was as important as the insights it delivered. Our teams spent time creating a narrative that made the complex techniques more understandable and actionable. The presentation book included 40 pages.

We hosted a series of workshops with their key stakeholders to better understand the company's products, as well as disease states. Together, we identified the words and phrases that occur most frequently in the data, and built the custom taxonomies and ontologies required to inform the NLP engine. We then highlighted two dozen data hypotheses to explore.

The pilot results have helped the company double-down on its mission of improving patient outcomes. It gained greater insight into the patient journey and the information it needs to grow its business.

Important business outcomes and patient benefits include:

- **Improved patient support.** Predictive modeling identified patient types as well as the brands for which patients were more sensitive to factors such as co-pay assistance.
- **Correlation of more complete notes with higher shipments.** Patient notes that documented actions, reactions and follow-up correlated with more frequent shipments of product. For the company, the finding reinforces the importance of establishing close connections with patients as a motivator for continuing therapy.
- **Development of new KPIs.** The project highlighted how customer experience is affected by the time spent at each point in the patient journey, such as initiation of therapy and confirmation of co-pay assistance. It identified tipping points in the patient journey that could lead to patients discontinuing therapy.

Looking Ahead

The company's connection of the NLP pilot to overall strategic goals helped ensure the project's overall success. The company is now implementing the project's recommendations throughout the organization and showcasing the value of new techniques to enhance patient engagement.

Next steps include more complete documentation of patient interaction and coaching managers in more thorough note taking. The company also hopes to explore how NLP might benefit other functions such as sales and marketing. Together, the partnership demonstrated how to use NLP at scale and speed to allow for more complete interpretation of patient sentiment and greater correlation with patient satisfaction.

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