

Natural Language Processing in Health Care

Educational Briefing for Non-IT Executives

Executive Summary

Electronic health records (EHRs) and patient-centric applications capture a wealth of new information that can be used not only for patient treatment, but also for operational efficiency and advances in the practice of medicine. To date, most of the analysis of this data has focused on structured data captured in forms and fields, but there is a much broader universe of unstructured data that can also deliver analytical value. This unstructured data can be found in clinical notes, sensors in wearables, patient-reported data, and genomics, as well as data related to social determinants of health (e.g., socioeconomic, environmental, behavioral). Natural language processing (NLP) provides a set of techniques for distilling structured data from textual notes or speech.

What is NLP and how is it used?

NLP allows computers to analyze, understand, and derive meaning from text and speech similar to humans. NLP is part of the larger artificial intelligence (AI) landscape, drawing from fields including computational linguistics and machine learning in its algorithms to handle unstructured data. NLP has a variety of functions, such as:

- Summarization and identification of key concepts in bodies of text (e.g., academic journals, clinical notes)
- Transcription of unstructured information in a patient's record into structured fields in the EHR
- Generation of narrative text from structured data
- Text classification (e.g., type of document)
- Free-text queries / information retrieval
- Extraction of relevant patient data and clinical knowledge for clinical decision support
- Speech-to-text / text-to-speech functions
- Image conversion to editable and searchable formats (e.g., converting a PDF to a text file)
- Language translation
- Spelling and grammar corrections
- Customer interaction and service (e.g., chatbots, virtual assistants)
- Sentiment analysis (e.g., identifying favorable or unfavorable feedback from patients)

NLP Challenges



Clinical text can include shorthand, incomplete sentences, assumed context, typos, and a wide range of acronyms and abbreviations.



Words often have meanings based on context (e.g., the meaning of "cold"); machines also struggle with ambiguity (e.g., waiting "forever" to see the doctor).



AI systems can follow a set of rules to search for answers, but do not understand the answers they generate.

Why is it important?

A wide range of health system improvement activities relies on the availability of data, including accurate patient risk prediction, clinical decision support, customer relationship management, and quality improvement, but a significant portion of the relevant data is represented only in free text. NLP technology helps to convert physician notes, patient narratives, academic journals text, radiology and lab interpretations, and other unstructured data into actionable information, whether at the point of decision making or for back-end analytics applications.

NLP is also a crucial component of AI, wherein a computer can interact with a human in a natural way through both speech and text (e.g., talking to robots, interacting with smart devices in the broader internet of things [IoT]).

How does NLP affect health care providers and IT leaders?

Greater efficiency

- NLP can free up clinicians to support higher-value work with its ability to automate reviews of clinical literature, assist with clinical documentation and order entry, allow providers to dictate their notes during patient visits, answer free-text queries from databases, improve billing accuracy, quickly scan patient histories to provide relevant facts, and more.

Improved patient care

- Data derived from NLP technology can support improved risk stratification of patients, more accurate and effective clinical decision support (e.g., flagging data for review, incorporating social determinants of health into treatment recommendations), and more comprehensive quality and outcomes measurement.

Enhanced customer interaction and service

- NLP is an essential element of chatbots, virtual assistants (e.g., Cortana, Alexa), and advanced customer relationship management processes. NLP can help with prescreening patient conditions on mobile or self-service check-in, assisting patients in hospital rooms, or providing better customer support on websites or on the phone. NLP can also analyze social media sites or surveys to catch complaints or gather insight into customer behavior.

Questions That Hospital Executives Should Ask Themselves

- 1 How can we improve and optimally integrate NLP into clinicians' workflow?
- 2 How does NLP fit into our strategic goals around machine learning or other AI technologies?
- 3 What are some low-risk areas where we can test NLP approaches to demonstrate value?

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