Natural Language Processing and Understanding in Clinical Practice

Lawrence N Tanenbaum, MD, FACR, and Suzie Bash, MD

Affiliations: Radnet Inc. Drs Tanenbaum and Bash are also members of the Applied Radiology Editorial Advisory Board.

Rooted in the capability to automatically identify and extract information from the medical record, applications based on natural language processing and understanding (NLP/U) are becoming abundant throughout the imaging enterprise.

A functionality that facilitates conversion of text into a structured representation, NLP/U enables computers to derive meaning from human natural language input. Tools leveraging NLP/U can interrogate digital health data, including free text radiology reports, greatly impacting clinical decision support and utilization by guiding clinicians to the optimal workup based on the medical record and clinical circumstances.

By extracting history and indications, as well as relevant prior imaging findings, NLP/U can identify and highlight key issues to be addressed at the imaging encounter itself. This can reduce the need for radiologist pre-scan involvement and guide technologists to the optimal scanning protocol (sequences or even radiation dose levels), thus improving standardization, efficiency, and quality while reducing patient re-calls. By highlighting both clinical concerns and the content of prior reports, NLP/U should improve reader workflow and report pertinence.

NLP/U-based alerts noting failure to comment on lesions cited in prior reports, laterality discrepancies and discordances between the report body and the report impression can have a powerfully positive impact on quality. AI-based image interrogation tools are increasingly active in imaging practices, triaging urgent exams and highlighting potential findings for the radiologist. Combined with NLP/U, discordance between the dictated report content and AI-detected lesions can be signaled to the reader before transmission to the enterprise.

These combined tools can powerfully extend the scope of peer learning and quality improvement in the practice. Limiting alerts to those of clinical relevance is an additional benefit that should increase the appeal of this functionality.[1]

NLP/U-based technology can have additional impact in reporting; eg, by providing synoptic versions of free text reports as well as suggesting report impressions from free-text report bodies. The ability to prepopulate reports with complex measured values is already a feature of quantitative products for brain and spine analysis.

The 21st Century Cares Act requires that imaging reports be both readily accessible to patients and readable at the eighth-grade level. Radiology reports are rarely understandable by the average adult. (www.Agamonhealth.com, marketing communication). Translating them into easier-to-understand formats empowers patients and should lead to informed decision making and increased satisfaction with the imaging process and facility. In theory, reports could be customized, with auto-generated versions tailored to individual specialists.

NLP/U can also be the solution to the tension over structured reporting in imaging. Structure can sometimes improve clarity and completeness of communication. Most healthcare data is unstructured and difficult to access in data mining for operations and research. Forced structure can interfere with the completeness of human expression and have negative (and positive) impact on efficiency.

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In theory, NLP/U can create a structured report from free text, convert information in templates into prose, and effectively mine data from free-text reports.

The interaction of NLP/U and imaging reports can improve follow-up. Tools are already being used in clinical practice to highlight variations between directions dictated into reports and practice-accepted, evidence-based guidelines, improving standardization between readers, consistency, and value.
In a retrospective study of three million reports, only 45% of patients comply with report recommendations for follow-up imaging (www.Agamonhealth.com, marketing communication).

Tools leveraging report scraping capabilities, which compare follow-up recommendations with procedure scheduling and completion, are currently increasing compliance (www.whiterabbit.ai– marketing communication). Similar tools can enhance and confirm communication of findings within the healthcare enterprise and with patients, improving value and reducing the likelihood of lawsuits .

The coding process is intricately linked with reporting. NLP/U is already improving revenue cycle management, optimizing exam concordance, and lowering payer rejection rates. The use of AI in this context greatly reduces labor requirements – no small feat in this peri-pandemic period.

Natural language processing and understanding is a rising AI-based functionality that is already making a positive impact throughout the imaging enterprise, increasing quality, consistency, efficiency, and value.

Expect these tools to become increasingly important as they are developed and validated.

Reference

1) Yen A, Pfeffer, Y; Blumenfeld A; et al. Use of a dual artificial intelligence platform to detect unreported lung nodules. *J Comp Assist Tomog.* 2021; 45(2): 318-322. doi: 10.1097/RCT.0000000000001118