Maastricht University

The radiological report

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Chapter 9:

Summary

This thesis titled "The Radiological Report: *A compromise between Structured Reporting and Natural Language Processing*", describes in two parts the search for how to improve the radiological report and the radiological reporting process.

PART ONE: Structured reporting in radiology

In the first part, the application of structured reporting (SR) is discussed. Although efforts are encouraged by international radiological organizations, it has not been sufficiently investigated whether SR actually improves the radiological report. This is mainly because in these studies standardization is combined with SR. In many studies, standardization is enforced by structured reporting; for example by requiring the reporter to fill in fields or to choose from a specific (drop-down) menu. However, it seems that particularly this standardization improves (the content of) the reports and that the influence of SR itself is still questionable. In particular, the lack of research into the different forms of SR means that there is still a lot of work to be done before drawing conclusions. What does seem to work is the mandatory nature of implementation of standardization. However, should this be done with SR?

PART TWO: Natural Language Processing

This second part examines how NLP can be used as a counterpart to SR in the search for improvement of the radiological report. NLP is a form of Artificial Intelligence (AI) that can search texts and "understand" to a certain level how words are related to each other, what a certain meaning of a word is and how sentences are constructed.

In this thesis, NLP is used to collect structured data that are included in the radiological report. An oncological classification can then be determined by analyzing this data. This facilitates the check if all necessary information is present in the report, also making it is possible to determine part of the TumorNodeMetastasis (TNM) stage. This application of NLP has been used to initially analyze reports of pulmonary CT scans at the T (tumor) stage only. Subsequently, this algorithm was translated into English so that it is also possible to analyze reports in English. Subsequently, the Dutch algorithm

was also expanded to determine the N (lymph node) stage in both CT reports and PET-CT reports.

The beauty of this research is that it shows that AI can be applied to search radiological records and thus offers the opportunity to improve them. Of course, there are still hurdles to be taken before this can be used flawlessly in practice, but the relatively easy training of currently small amounts of data in combination with the use of rules certainly seems promising. The use of a graphical user interface (GUI) also helps implementation in daily practice. This facilitates analysis of texts, also presenting this analysis and its outcome to the radiologist in a readable and reusable way.

For the future, finding more generic building blocks with NLP through Machine Learning is the next goal. Training textual passages on uncertainties, dimensions, correlations and recognizing important sections are common things that are important for many applications. The valorization of algorithms as described above in external institutions is also important, as there are certainly differences in reporting, vocabulary used, but possibly also in personal choices. The GUI in particular, as well as this valorization, will have to ensure that this NLP tooling can be embedded in clinical practice.