

Application of IBM Watson to Support Literature Reviews: A Preliminary Experience in Restorative Dentistry

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Abstract. Literature reviews are crucial in the choice of the best personalized material type and restoration type in restorative dentistry. We developed an IBM-Watson based system to support literature search for restorative dentistry, and compared its results to a literature search performed by a trained professional. We found that our system could assist the researcher in performing a literature review, but the grounding semantic model needs to be refined in order to provide more extensive results.

Keywords. Literature review, restorative dentistry, cognitive computing.

1. Introduction

Technology for restorative dentistry is becoming more and more advanced, and new techniques and materials have been introduced to obtain minimally invasive treatments and better outcomes[1]. When choosing the best solution for patients, clinicians should rely on the available growing evidence. In this scenario, a system supporting the process of literature review[2] will optimize the choice of materials for restorations, and, in turn, the patient's quality of life. To this end, we tested the ability of IBM Watson cognitive computing services to provide the ground engine for a system supporting dental inlays literature search process.

2. Methods

PubMed API were used to run the literature search. A concept model was developed and trained in IBM Watson Knowledge Studio using 42 annotated documents (review papers on dental inlays). The service uses proprietary natural language processing methodologies. The precision of the system (percentage of true positives on the overall positives recognized by the model) and the recall (percentage of true positives on the overall true from the ground truth) were used as performance measures of the model. The model was then implemented in IBM Watson Discovery in order to process PubMed abstracts and to retrieve the concepts, relationships, and specifications according to the semantic model. A user interface developed using Node-Red[3] allows the clinician to visualize the sentences (and abstracts) more relevant to the research question related to the restoration type, the material type, and the characteristics. The

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system was validated comparing the literature review automatically performed with the literature review performed by a trained clinician, in terms of number and relevance of papers retrieved.

3. Results

The semantic model included 15 main entities (among them, “restoration type”, “material type”, “character”, “comparator”, “value”) and 13 main relationships and achieved an overall precision of 93% and an overall recall of 80%. In Watson Discovery, a total of 165 documents (abstracts) were processed using the general PubMed query. The system was tested with the aim to identify the papers relevant to establish the longevity comparison between composite inlays and ceramic inlays. The first man-made search yielded a total of 24 unique papers, 8 of which were included. The first search made by IBM Watson yielded a total of 18 unique papers, 9 of which were included. The two searches obtained completely different results, with only 3 papers found by both the human researcher and IBM Watson, but all of them potentially fit to be included in a literature review.

4. Conclusions

These preliminary results show that IBM Watson could be used to assist the researcher in performing a literature review, but the model on which Watson is trained needs to be refined in order to provide more extensive results. These findings will help to further refine IBM Watson's abilities and getting closer to obtaining a Cognitive Computing Platform able to answer clinical questions made by Dental professionals



Figure 1. Text annotation in Watson Knowledge Studio with the defined semantic model.

References

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