Ontology of dental emergencies for diagnostic classification

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Abstract and objective

Computer assisted diagnosis systems are required to improve diagnosis and compliance with clinical guidelines. Expert systems have shown their limitations as they are difficult to maintain, to check consistency and to update knowledge. Current ontology editors like PROTÉGÉ and associated tools enable easy building and maintainance of knowledge bases and allow automated consistency checking with reasoners as Pellet. Can these tools be used for computer assisted diagnosis? This study aims at creating an ontology of dental emergencies and evaluate diagnostic classification possibilities of current generic reasoning tools.

Material and Methods

A literature review was made about 28 diseases encountered in dental emergencies. The Protégé ontology editor (one of the editors of the most exploited ontology) and the Pellet reasoned were used to build the ontology and check its consistency. The evaluation of the ontology was performed using the clinical reports(findings and associated diagnoses) from the electronic patient records filled at the dental emergency care center of Rennes[b]. Finding were manually entered in the ontology and automatic classification was made with Pellet reasonner in order to find the corresponding diagnosis(diagnoses).Testing the ontology for computer assisted diagnosis allowed us to highlight possibilities and shortcomings of OWL-DL reasoners for diagnostic classification tasks.

Results

After a summary of the literature about the diseases and their manifestations, the manually created ontology has 202 classes (28 diseases and 174 characters), 30 annotations (summaries therapeutic) and 377 restrictions (relations sign-Pathology). This ontology gives similar results (97% of cases) with those made by practitioners of the dental Care Center demonstrating the validity of knowledge modeled.

The manual validation enabled to highlight OWL-DL reasoning limitations which had to be worked around: not too many findings had to be used and generic concepts had to be preferred. One particular patient who has a particular pathology (1) does not necessarily show all the signs described in the literature: he can have less signs, (2) can have at the same time other signs (another ongoing disease): he can have more signs. In the clinical report, the patients findings can be described with more generic concepts (higher in the hierarchy) or more precise concepts (lower in the hierarchy) than the findings used in the formal definition of the disease in the ontology. An efficient automatic diagnostic classifier should propose diseases with approximately the same signs (with more signs or less signs and with more or less precise signs).

Discussion and Conclusion

A consistent and valid ontology of dental emergencies has been built. It is meant to model diseases and their clinical phenotypes.

Fuzzy reasoning or management of uncertainty (maybe through similarities calculation) is strongly needed in order to perform efficient diagnostic classification with generic ontology management tools.