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Modeling Clinical Guidelines for an Epilepsy-CDSS: The EDiTh Project

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Abstract. The knowledge transformation process involves the guideline for the diagnosis and therapy of epilepsy to an executable and computable knowledge base that serves as the basis for a decision-support system. We present a transparent knowledge representation model which facilitates technical implementation and verification. Knowledge is represented in a plain table, used in the frontend code of the software where simple reasoning is performed. The simple structure is sufficient and comprehensible also for non-technical persons (i.e., clinicians).

Keywords. Clinical Decision Support Systems, Computer-Assisted Decision Making, Knowledge Representation (Computer), Practice Guidelines as Topic

1. Introduction

Guideline-based Clinical Decision Support Systems (CDSS) use computer-interpretable guidelines (CIGs) to improve guideline-adherence and thus also quality of care [1]. The challenge is to transform medical knowledge into a comprehensible, modifiable CIG, testable by clinicians. This work aims to report a modular rule-based approach and the lessons learned from the EDiTh-Project. The purpose of the EDiTh-App is to support clinicians in seizure anamnesis, diagnostics, diagnosis, and therapy of epilepsy to improve guideline adherence.

2. Methods

With a group of international experts in Epilepsy, we identified two relevant guidelines: One categorizes the seizure type (ILAE) [2], and the other recommends the right therapy based on a classification of Epilepsy [3], updated by members of the guideline group.

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The gap between seizure classification (ILEA) and the classification of various kinds of epilepsy was closed by interviews with experts and literature. The knowledge was separated into 3 models (see Figure 1): To find the right seizures type, a decision tree was chosen; to find the right diagnoses based on the seizure anamnesis and the diagnostic findings, we use a decision table; we also use a decision table for the representation of the therapy, based on the diagnosis and other individual factors (age, sex).

Figure 1. Stages of the decision process of the EDiTh-App

3. Results

The decision tree and the decision tables are implemented as configuration CSV-files for the CDSS. The user-interface (a VUE.js web-application) and the inference engine (JavaScript CSV-parser) use both these configuration tables. The user is guided through the seizure anamnesis, document the diagnostic findings, confirm the diagnosis, and get the recommended therapy. All the user-entered data and the output of each step of the CDSS is then saved in a database (PostgreSQL, JAVA backend) to reuse and evaluate it.

4. Discussion and Conclusion

The proposed modeling strategy facilitates the creation of CIG by using a simple structure for the operationalization of clinical knowledge. Clinicians can directly participate in the knowledge engineering process, and the resulting operationalization is simple to validate. This eases the technical implementation, as proved by the EDiTh-Project. The CDSS will be evaluated in a clinical study under art. 82 MDR and for the evaluation of the process of knowledge modelling, further research is needed.

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