A Tool for the Computer-Assisted Creation of QMR Medical Knowledge Base Disease Profiles

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Abstract

QMR-KAT is a computer-based tool which assists physicians in the construction of the QMR medical knowledge base. Each QMR disease profile results from an in-depth analysis of the published medical literature, and from consultations with expert clinicians.

QMR-KAT is an interactive knowledge acquisition program which facilitates the creation of new disease profiles, records the supporting evidence for each disease profile entry, and enforces consistency with the existing knowledge base. The program has been used in the creation of all new QMR disease profiles over the past two years. It has also beed used to support a study on the reproducibility of knowledge base construction.

QMR-KAT [1] is a computer-based tool which assists physicians in the construction of the QMR medical knowledge base. The QMR knowledge base contains the detailed description of more than 600 diseases seen during the practice of internal medicine. Each disease description, known as a *disease profile*, is the result of an in-depth analysis of the published medical literature, and of consultations with expert clinicians.

QMR-KAT is an interactive knowledge acquisition program which facilitates the creation of new disease profiles, records the supporting evidence for each disease profile entry, and enforces consistency with the existing knowledge base. A disease profile created through QMR-KAT contains the following components:

- Identifying information, such as the name of the disease being profiled, the principal creator, and the completion date.

- Disease profile information, i.e., numerical data and finding names which will comprise the finished QMR disease profile.

- Supporting evidence, in the form of bibliographic citations and brief summaries of the published medical literature that was used in the creation of the disease profile.

- User annotations, in the form of comments which can be added to any portion of the disease profile.

Internally, each type of information is handled separately, but the user interface is completely uniform and the same commands operate on every component of a disease profile.

To be effective, a knowledge acquisition tool must shield its users from the many details of the knowledge engineering process. QMR-KAT does so by relying on built-in knowledge of the structure of the QMR knowledge base. It only presents the user with valid choices, thus eliminating many of the errors commonly seen in manually-prepared disease profiles. Even physicians who are not intimately familiar with the structure of the QMR knowledge base can create disease profiles quickly and effectively.

Routine aspects of disease profile creation, such as consistency checking, are also handled automatically. QMR-KAT constantly enforces consistency between newly entered information and information that is already present in the knowledge base. This enforcement happens incrementally every time the user modifies the disease profile.

In addition to preventing clerical errors and enforcing consistency, the program incorporates more advanced features which support quantitative decisions. For example, in a previous study [3] we found that profile creators often made mistakes in the determination of QMR frequency numbers. We then developed a heuristic which computes frequency numbers based on excerpts from the literature [2]. That heuristic is now part of QMR-KAT, and can be used to suggest frequency number assignments to the physician creating a disease profile.

Another important goal of the program is to facilitate long-term maintenance of the QMR knowledge base. This ongoing activity keeps the knowledge base up to date with new advances in medicine. Several functions in QMR-KAT are designed specifically to support knowledge base maintenance. In particular, it is possible to extract existing disease profiles from the knowledge base, and update and modify them as required. The supporting evidence associated with QMR-KAT disease profiles makes it easy to justify the original choices, and to locate the original references. At the time of this writing, we are implementing the ability to re-use the original literature search strategies. This will allow knowledge base maintainers to locate new publications which may have appeared since a disease profile was last updated.

QMR-KAT has been used in the creation of all new QMR disease profiles over the past two years. Most profile creators were physicians unfamiliar with the internal structure of the knowledge base. The users' reactions have been positive. Most users reported that the interface of the system is very intuitive, and fits well with their own work style. The program has also beed used to support a study on the reproducibility of knowledge base construction. In this study, different physicians worked independently to create profiles for the same disease, allowing us to compare the results of their efforts.

The creation of new disease profiles with QMR-KAT has completely replaced the methods that were used previously. The success of the program is due largely to a simple user interface, elimination of clerical errors, incremental consistency checking, and built-in knowledge of the details of the underlying knowledge base.

Bibliography

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