Integration of Digital Images into Computer-Based Medical Training

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Diagnostic imaging represents an important resource for computer-based education. A concept how a database for teaching may be integrated into a radiology information system is presented: Diagnosing radiologists identify images suitable for educational purposes and send them to a central database. The images are complemented with MeSH codes. An automated conversion from the standard DICOM format to JPEG is implemented. The images can be easily accessed by case authors through a standard www-interface with complex search functionality. Finally the teaching database will facilitate the authoring process of cases by providing a broad variety of authentic image data.

OBJECTIVES
Large quantities of digital images that originate from diagnostic work-ups are typically stored in an archive after their actual clinical use. In a former project we built an authoring shell for case-based medical training (1). To construct an authentic case the authors need access to real-world clinical image data. Therefore, the image data as well as the identifying descriptors and the interpretive report should be kept in a centralized database.

The importance of radiological databases for teaching is undisputable. There are several radiological databases for teaching available, e.g. (2). To our knowledge none of them is closely integrated with routine diagnostic imaging.

The creation of such a computerized „teaching library“ and the specific strategy utilized for the selection and transfer of images at the the University of Munich are described.

METHODS
The application of a picture from the recording device to a case-tutorial was divided into the following steps:

1) The diagnosing radiologist gets the digital images from an image-providing device (CT, MR, digital X-Ray, DSA, Ultrasound, etc.). The data is normally presented in the DICOM format and contains certain information in its header, such as patient name and ID. During the diagnostic process the physician selects images relevant to medical teaching and transmits them to the image archive implemented as a relational SQL database.

2) The images are received by the computer which manages the database. The DICOM header information is stored in the database and is then complemented by patient information and diagnoses from the clinical information system. The image data itself is converted into a JPEG file for further use.

3) In regular intervals the recently added images are annotated with codes of the Medical Subject Headings (MeSH) by a physician through a MeSH-browsing application.

4) The case authors can access the database over a web browser, select pictures based on patient ID, diagnosis or MeSH code with Java based searching facilities and use them in their teaching cases.

At one medical center of the University of Munich we developed an application called „shashin“ (Japanese for ‘picture’) which accepts pictures in the DICOM format, extracts their header information and converts the picture information into the JPEG format. Furthermore we developed a MeSH browser which enables physicians to efficiently code the content of an image.

The next step for the implementation of the training archive will be the installation of a database, which summarizes all relevant information and provides facilities for an efficient search of the available images. Via CGIs, which can access the database by means of Java data base connectivity (JDBC), this information is finally delivered to the case authors without personal patient data.

CONCLUSIONS
Computer-based, problem-oriented teaching in medicine is becoming more and more important. It is of key importance to enable authors to use available authentic information from clinical databases for teaching with as little technical barriers as possible. The implementation of the training database described here will facilitate the creation of high-quality multimedia learning cases. However the creation of learning cases also needs an appropriate didactical processing of the image material (1, 3). An expansion of the training database for audio sequences, videos and 3D-simulations is intended and will be integrated into the concept with the increasing availability of these kinds of data in clinical information systems.

References