The Radiological Society of North America's Medical Image Resource Center: An Update

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The Radiological Society of North America (RSNA) has initiated a long-term project called the Medical Image Resource Center (MIRC). The overall goal of the effort is to create an on-line library of medical images and related information and to maintain and index a number of other medical image resources. The rationale for the project, a summary of the overall requirements and objectives, and a finally a brief description of the future plans for MIRC are presented.

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DESPITE THE INCREASING number of sites that provide access to medical images on the Internet, the probability of a successful search for specified medical images of a particular diagnostic entity or anatomic region from a particular modality for educational, research, or clinical decision support remains frustratingly and surprisingly low. While retrieval of text-based information such as the medical literature can be accomplished rapidly and reliably using indexes such as Medline, there is no such "meta" index of on-line medical images nor is there a comprehensive single library of medical images. Additionally, although many excellent mini-teaching and research collections provide images associated with certain focused subject matter on the Internet, these are not well indexed and are difficult to find and consequently underutilized.

This lack of a comprehensive image index or repository of images is particularly surprising given the wide variety of applications that could utilize such a service. Unfortunately, there are a number of major challenges to the creation of a large medical image repository and to rapid search and retrieval of these images. Medical images are often large (up to 8 to 30 Mbyte per image and up to 500 Mbyte or more per study) and require a good deal of storage space as well as lengthy transmission and retrieval times. There are few authoring toolkits available for preparation of images for a teaching or research library and these are often propriety and non-standards based. In general, picture archiving and communication systems (PACS) and other medical devices do not have software to facilitate uploading to or downloading medical images from the Internet. The process of

creating a research or teaching case and making it available on the Internet can consequently be a complex and daunting obstacle to sharing medical images with others. Recent public attention and legislative actions concerning patient privacy and information security have made it even more difficult to use electronic means to exchange images. There is currently no standardization of image file formats or protocols for exchange of teaching, research, or clinical trials' image files on the Internet and there is no generally accepted standard mechanism for indexing these various types of images. Also, unlike the case with the medical literature, there has been no successful project to create a meta-index of these various medical images contained in the existing on-line resources. Until now, there have not been any academic medical centers or organizations that have set aside resources necessary to create a repository or update an index to ensure accuracy of the data or maintain servers to deliver high speed and reliable access to medical images.

Investigators that participate in the collection, distribution, and analysis of images for local or multicenter clinical trials are typically forced to develop idiosyncratic solutions in order to make images available for research purposes. The creation of these "single-use" databases and specific communication solutions can add considerably to the cost of a research project. The development of a more standardized means of communicating, storing and reviewing these images could result in improved use of time and personnel, as well as a reduction in costs. The American College of Radiology Imaging Network (ACRIN; www.acrin.org) has developed a promising image acquisition

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and distribution system for its own clinical trials, but does not currently provide this service for other investigators.

The Radiological Society of North America (RSNA) has identified the need for a medical image library and has begun a multiyear effort to establish a Medical Image Resource Center (MIRC). Dr Gil Jost originally described the need for and proposed the basic concept of an image resource center during an RSNA strategic planning meeting. The goals of the MIRC include the development of an information model and technical framework for a medical image library and the creation of a repository of medical images and related text, and the development of basic authoring and viewing tools for MIRC in support of projects related to research, education, and clinical care. Although the emphasis will initially focus on radiographic images, the system will be designed to support a wide variety of electronic medical images.

The basic requirements for the MIRC have been defined. This process involved members of the RSNA's MIRC committee, as well as a subset of the members of the RSNA's Electronic Communication Committee with major input from the project manager, John Perry. The overall requirements for MIRC include the development of an image and related text library containing medical images and other educational material, which would be accessible via the Internet with the MIRC serving as a single point of access to the data. An additional requirement is that MIRC should be divided into several logical libraries with the ability to search across all or a subset of these for images and for educational materials from the RSNA meeting and other sources. In addition to providing storage for RSNA content, the MIRC should maintain and constantly update an index of other imaging libraries that use a compatible format using an "agent" or other mechanism. Although the images from these "MIRCLETS" (phrase coined by Dr David Channin) will appear in an RSNA MIRC database search, MIRC would not take responsibility for image, performance, or reliability quality control for these other "external" image libraries. Transfers of images would take place via a peer-to-peer model similar to the model used by the Napster website (www.napster.com) for interchange of compressed music files.

MIRC "files" are extensible markup language

(XML) documents that include descriptive text information, and references to images and other medical data. The XML schema for MIRC is well defined and will be made freely available to the medical imaging community. These files must be accessible and searchable via a web browser using specified libraries. The system must provide a means to identify users or guests and restrict access depending on the specific image library and the privileges of the user. Clinical trials will require an XML schema specific to the special requirements of the research project as defined by the project manager.

The MIRC will also need to provide certain tools to facilitate the use of the MIRC database. This would include a tool for the creation of teaching or research files, which would include a mechanism to ensure that the terms used in submission could be mapped to a radiologic lexicon. There will also need to be a tool to permit users to submit MIRC compatible images to the MIRC image repository (library). This tool will also need to "anonymize" the images in such a way that the images cannot be associated with patient names or other identification. An image file viewer will also be required to provide a mechanism to review the MIRC images. A management tool that could track access to the MIRC will also be important to provide feedback about how the MIRC is being used by the imaging community and to optimize its effectiveness and performance in the future.

The academic and vendor communities will, in all likelihood, further refine these tools and will develop new ones, especially those related to image review and searches. The EMERG research team, for example, directed by Dr Ric Harnsberger, has created a common teaching file definition and has developed associated teaching file creation and viewing software. They have also created a medical digital teaching file website (www.mdtf.com) to encourage "communication and cooperation between people and groups interested in creating a community supported digital teaching file software system that will be freely available to all medical academics." Additionally, tools will probably also be created by commercial vendors that will be integrated into their own commercial PACS or radiology information system (RIS), for example. The performance and reliability of the MIRC must be excellent in order to optimize its effectiveness. Strategies such as image compression and "just in

time" delivery mechanisms will be explored to maximize system performance.

The development of a radiologic lexicon that is freely available to the medical community that addresses radiology and medical imaging specific requirements such as the ability to describe the findings on an imaging study with terms such as "echogenicity" and "signal intensity," as well as pathologic and other abnormalities will be very important to the success of the MIRC project. Both the authoring tools and the search mechanism will require a least a basic lexicon to ensure consistency of terminology in the classification and retrieval of images and related data.

Finally, the RSNA plans to continue its efforts to provide electronic information and continuing medical education materials to its members on the Internet and to capture selected portions of the RSNA annual meeting for subsequent review on-line (www.rsna.org). During the next few years, paper and slide and poster media will be replaced with electronic forms of presentation. In order to achieve this goal, preliminary discussions are underway to create standard electronic presentation formats for educational exhibits and the RSNA's on-line journals that are consistent with the MIRC information model.

One of the biggest challenges in addition to the

technical and security issues will be in finding creative ways to encourage submission of high-quality material to the MIRC. Hopefully, the adoption of MIRC authoring tools by academic medical centers and vendors will facilitate this process by making it easy to submit cases to the MIRC and by creating compatible libraries that can be indexed by MIRC. The ultimate goal will be to utilize and disseminate the information model and technical framework and tools developed for MIRC in such a way that the medical community will have fast and reliable access to a wide variety and large number of medical images and related information via their personal computers, workstations, and electronic medical record workstations for educational, research, and clinical support. Hopefully, this will result in improved training and decision support for radiologists and other healthcare practitioners, increased participation in research projects with reduced costs of image acquisition, transmission, and storage for research, and finally, improved patient care.

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