Medical diagnosis

Painting by numbers

BRINGING the worlds of medicine and information technology together means uniting researchers from all sorts of backgrounds. One force in this grand unification is the International Consortium for Medical Imaging Technology—ICMIT, initials which also do service for the consortium's founders, Imperial College in London and the Massachusetts Institute of Technology. After five years' development, it is soon to launch its first products.

The consortium's goal is to make all the various forms of data generated by diagnostic tests accessible in electronic form, from the breaths heard through the stethoscope to the luminous cross-sections produced by advanced body scanners. When the data are not in digital form, they are often hard to store and to find. Consultants who need to "read" a scan have to stand by the patient while the scan is performed, wasting their time. Even when the information is already digital, there are at present few standards that allow it to be shared. Machines from different manufacturers cannot talk to one another. Some manufacturers like it that way, because it locks their customers into their own range of products.

With the help of Sybase Systems, a California database company, ICMIT has developed its own database system, the ICMIT Dataserver, and translation systems that, until an agreed standard called DICOM 3 comes into effect, are needed to allow digital information from different medical instruments to be stored for comparison.

Once systems such as Sybase make interchangeable digital formats widespread in medical work, it will be possible for other technologies to start doing their thing. One of them is data compression. In a project sponsored by Hewlett-Packard and Toshiba, among others, ICMIT has developed a storage and retrieval program for still and moving ultrasound images of the heart; it will be unveiled at a meeting of the American Society of Echocardiography in Toronto later this year. At 30 frames a second, picturing a beating heart takes up seven megabytes or so for each beat: a record of a workout could clog up the hard disk of the smartest PC.

The answer here is to compress the data, but Forbes Dewey, ICMIT's American director, says that normal data compression is either too poor in quality or too expensive for the task. So Murat Kunt at the Ecole Polytechnique Fédérale in Lausanne, Gosta Granlund, of the Linkoping University in Sweden, and James Thomas at the Cleveland Clinic in America, all of whom work with ICMIT, have devised a more suitable program. It compresses data forty-fold by concentrating only on the moving objects in a picture. That, as Richard Kitney, Dr Dewey's British counterpart, points out, is more or less what the human eye and brain do anyway.

The compression system filters out noise and so improves the clarity of the final film. Other parts of the ICMIT scheme take image enhancement a lot further. One application is in spotting the bright white calcium spots that indicate malignancy in the fuzzy and confusing images produced by x-ray mammography. Royal London Hospital and its ICMIT partners have developed a program that helps.

That program brings out peaks of brightness and smooths out lesser details, thus revealing salient points. Other programs, like the one ICMIT has developed with sponsorship from Smith & Nephew, a supplier of surgical instruments, can make sense of some features on their own. Given a set of cross sections of a knee produced by magnetic-resonance imaging, it can build up a three-dimensional image, and distinguish between bone and softer tissue. Picture a doctor looking for a tear in the meniscus, the cushion between the knee joints—the sort of problem to which Smith & Nephew provides solutions. He can remove the bone and tendon that normally obscure his view from the image, and see the meniscus unobstructed. Diagnosis is then simple.

The goal is not just to make the most out of one set of data, but to be able to combine it with others. ICMIT has matched electrocardiograms, which measure the electrical activity of the pumping heart, to ultrasound images. A tracker on the EKG indicates the point of the cycle that the ultrasound imagery is displaying. The images can be frozen, fast forwarded or reversed in synch. The question now is whether doctors will be willing to reorganise their work in order to make use of the new technologies.