Medical imaging conference considers visual perception problems

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The Second International Conference on Visual Psychophysics and Medical Imaging was held on July 2 and 3, 1981, and attracted over 100 registrants. Participants from the United States and eight western European nations delivered 37 papers grouped into sessions addressing diagnostic imaging, visual perception, observer performance, image processing, and systems. There appeared to be common recognition that, as more sophisticated signals and electronic displays are added to the medical diagnostic repertoire, the human observer must be taken more into account.

Until recently, many have presumed differences between observers to be limited to whether or not they need corrective lenses. Much that is (presumed to be) known about the visual aspects of cognition, such as its spatial and temporal acuity or contrast sensitivity, is inappropriately removed from the limiting context of the experiment that generated the data, and rigorous verification is often impossible with living subjects. In a manner of speaking, the construction of an image to make possible a medical diagnosis is an admission of failure, since a more thorough knowledge of the signal and its interaction with tissue would allow the generation of output in the form of a number with coordinates or a display such as "disease present" (or absent). In a discipline characterized by substantial inertia, some imaging proposals merely seek to modify and transform existing techniques. Observer preference as a test of display adequacy is itself inadequate. Thus, many papers presented at the conference dealt with methods for reliable assessment of observer performance.

In the more mature technologies the capacity to improve signal strength is constrained by physical limits, but opportunities remain to better match displays to the human observer. Some efforts aimed in the past solely at image processing are now experiments in which image processing is combined with human operating characteristics. Papers presenting information on visual properties such as spatial filtering, phase sensitivity, and quantum efficiency of the eye were mixed with presentations on mathematical processing of radiographs, nuclear medicine images, and electrocardiograms.

One topic that generated substantial interest was the potential of new digital laser disks for mass storage of medical images. Though this technology is highly promising, a number of possible impediments, ranging from image acquisition time to the spatial and dynamic range limitations of electronic displays, must be overcome.

Electronic storage advances are occurring nearly simultaneously with progress in digital radiographic imaging-acquisition systems and in high-resolution television. This fortuitous circumstance may speed the acceptance of the technology, and because of its potential, other meetings are in the offing, including "Distributed Computerized Picture Information Systems for Medical Applications," this month at Newport Beach, California.

The printed proceedings of the visual psychophysics and medical imaging conference are available from the IEEE Service Center Single Publications Sales Unit, 445 Hoes Lane, Piscataway, NJ 08854; (201) 981-0060. The catalog number is 81CH1676-6.
Programming style based on abstract data types urged by Eurographics honorary chairman

Ware Myers, Contributing Editor

For the next generation of industrial robots to possess "intelligence" will necessitate "off-line programming systems in which generative graphics—picture generation—and cognitive graphics—picture understanding—are combined." This was W. K. Giloi's opening premise in an invited lecture to Eurographics '81 at Darmstadt, Federal Republic of Germany, on September 9. Giloi, a professor at the Technical University of Berlin, was honorary chairman of the conference.

To achieve a programming system of this capability, Giloi continued, we will need programming languages that provide for graphical data types. He believes that languages based on the abstract-data-type concept can meet this need. Moreover, to overcome the poor run-time efficiency of these languages on conventional computers, he urges that "innovative computer architecture" be developed.

**Intelligent robots.** Giloi expects a dramatic penetration of many realms of manufacturing during the 1980's by new classes of industrial robots that will deserve the appellation "intelligent."

Their intelligence will be based on advanced memory input systems, decision-making programs, and execution capabilities. The sensory systems will involve sophisticated signal processing and pattern recognition. Visual sensing, in particular, will use elaborate image-processing and analysis methods.

Programming of the robots will be carried out off line with the aid of computer simulation at graphics display terminals, Giloi predicts. The three-dimensional world of robot sensing and action is the same geometric space in which 3-D graphics exists. Thus, the language for programming robots will be a geometric language—but one with a new quality.

This added quality is the image-analysis component. The visual feedback to the programmer results not only from his own actions—generating graphics—but also from the way the robot's vision system perceives its surroundings—cognitive graphics. It is the combination of the cognitive component with the conventional picture generation component that, in Giloi's analysis, calls for languages "that genuinely comprise graphical data types."

**Abstract data types.** The notion of abstract data types is relatively recent.

"Too often the people who introduce computer-aided design and computer graphics to an organization disregard the social consequences and the human factors," Jakob Vlietstra of Philips' Product Development Coordination Bureau told over 650 participants at the opening session of Eurographics '81. As conference chairman, Vlietstra gave one of two invited lectures, devoting most of his time to outlining what might be done to counter the problem.

Wolfgang K. Giloi, honorary conference chairman, extolled the value of the abstract-data-type programming style for developing a graphics application language, a tool that will soon be needed for programming intelligent robots.
Giloi defines the concept as "a collection of data objects of a certain type and a collection of functions applicable on objects of the type." The polygon is an example of a graphical data type. Within this type there are many instances of polygons. Various functions are applicable to the type, such as create polygon, display polygon, rotate polygon, etc.

Giloi cites several languages that use the abstract-data-type concept: Aplhard, Mesa, and particularly Clu, developed by the MIT Laboratory for Computer Science. With a language based on this concept, a user begins by specifying a set of abstract data types, such as polygon, coordinate, gray scale matrix, etc. Then he hierarchically decomposes this first level of data types into a second, simpler level, and eventually into data types available in the programming language he is using. It is Giloi's belief that very high-level programming languages based on this concept will enable a user to define data types oriented to his own application.

Innovative architecture. The major objection to languages based on the abstract-data-type concept, Giloi said, is that implementation on a conventional computer leads to poor run-time efficiency because of the overhead involved. For this reason Project Starlet at the Technical University of Berlin has designed a computer, the Starlet, that provides "hardware support for the construction and handling of arbitrary, user-defined, abstract data types." Its machine language has many features in common with Clu.

Starlet is currently under construction. Because it supports the abstract-data-type programming style and, according to Giloi, processes arrays and handles data structures in general outstandingly well, he expects it to be "an ideal tool for the new kind of combined generative and cognitive computer graphics" needed to program the robots of a few years hence.

Computer-animated film teaches sorting techniques

Internal sorting techniques or algorithms are methods by which a programmer sorts sequences of data stored in main computer memory into a desired order. Some are easy to understand but inefficient in terms of computation time; others are more efficient but difficult to understand. Sorting Out Sorting, produced by the Computer Systems Research Group at the University of Toronto, is an entirely computer-generated color film/video-tape that uses animation to teach a variety of sorting techniques.

Designed and directed by Ronald Baecker, the film presents nine sorting techniques, grouped into three classes: insertion sorts, exchange sorts, and selection sorts. The narrative soundtrack explains each technique as it is animated. Techniques are compared for efficiency by means of animated color graphs of their respective resource requirements and "races" of an entire group of techniques at work on identical sets of unsorted data. The portrayal of algorithms through computer animation combines an explanation of how they work with an intuitive demonstration of why they work.

The 30-minute-long film is designed to be useful for all levels of computer science instruction. In a beginner's course, it dramatizes the fundamental concepts of efficiency and simplicity. For an advanced course, whether a course on sorting and searching, on data structures, or on efficiency and optimization, it makes complex algorithms easy to understand.

Sorting Out Sorting is available on 16mm film, and ½" or ¾" videotape cartridge (for videotape, specify ¾", ½" Beta, or ½" VHS). The price of the film is $350 (US$315), plus shipping and handling; videotape is $225 (US$200), plus shipping and handling. Rental is also available.

A teacher's guide comes with the film. Direct all orders and inquiries to the Distribution Office, University of Toronto Media Centre, 121 St. George St., Toronto, ON, Canada M5S 1A1; phone (416) 978-6565.

ACM workshop to examine graphical input standards

ACM Siggraph has announced the Workshop on Graphical Input Interaction Techniques, to be held June 2-4, at the Battelle Conference Center in Seattle, Washington.

The purposes of the workshop are to identify the problems associated with standard, device-independent graphical input techniques, to survey input methods in existing systems, and to discover generally applicable principles for organizing device-independent graphical input software so that standards may be developed.

Participation will be by invitation. Persons wishing to be considered should submit, by March 1, four copies of a 300-word statement of interest. The statement should include an abstract of a proposed paper in the submittor's areas of interest or research. Suggested topics include, but are not limited to, graphical input metalanguages, classification of graphical input devices, human factors in graphical input techniques, and organization of input software. Key papers will be invited from the abstracts, and prospective attendees will be notified of acceptance by April 1. The papers themselves will be due on May 1.

The workshop participants will collectively prepare a position paper on standard device-independent graphics input techniques. This paper, along with the invited papers, will be published in Computer Graphics, Volume 16, Number 4 (October 1982). Financial support for attendees is available and will be awarded based on need.

Send statements of interest to Griffith Hamlin, Siggraph Workshop Technical Chairman, Los Alamos National Laboratory, PO Box 1663, Mail Stop 272, Los Alamos, NM 87545; (505) 667-4196.

ANSI adopts IGES for CAD/CAM systems

The Initial Graphics Exchange Specification, developed by an industry-government coalition (managed by the National Bureau of Standards) to facilitate the exchange of graphics and design data between disparate CAD/CAM systems, has been adopted as a standard by the American National Standards Institute. ANSI Subcommittee Y14.26 included IGES as three parts of the five-part standard Y14.26M, "Digital Representation for Communication of Product Definition Data," which was adopted on September 21, 1981. ANSI plans to advance Y14.26M for use as an international standard. A workshop on IGES was held at NBS December 14-16. Call (301) 921-3691 for details.

January 1982
Richard E. Merwin Memorial Fund Committee formed

As announced in the October IEEE CG&A, a memorial fund has been established in the name of former Computer Society President Dick Merwin to support research and education in the fields of computer science and engineering. According to Dick B. Simmons of Texas A & M, chairman of the Richard E. Merwin Memorial Fund Committee, contributions are coming in steadily, and the committee is developing recommendations for an appropriate memorial project.

Report predicts business CG market to increase 15-fold during 1980's

The business computer graphics market, $396 million in 1981, will increase 40 percent annually during the 1980's, reaching $1.6 billion in 1985 and $5.8 billion—a 15-fold increase—by 1989, according to Computer Graphics in Business Applications (1980-1989), a new study by Frost & Sullivan, Inc. The 220-page report says that by the end of the decade business graphics will represent 40 percent of the total "commercial" computer graphics market, an increase of 12 percent. Frost & Sullivan defines the commercial component of the CG market as those applications that lie between high-cost military specification equipment and low-cost consumer devices. Market growth, however, will vary considerably, depending on product or service (see table).

The study also examines the market by user industries, turning up some surprises in the process. For instance, computer graphics is least accepted by the financial community, a finding the study attributes to concern with "lack of standard graphic formats for reporting financial data." Revenues generated by this sector, which currently represent 18 percent of total business computer graphics sales, will decline to less than nine percent by decade's end. The transportation sector will also see revenues decrease in proportion to the total market.

The manufacturing sector, however, which already generates the largest share of computer graphics revenues, will gain additional ground. A Frost & Sullivan survey concluded that some 80 percent of questionnaire respondents who do not now use computer graphics "plan to do so in the future." The report also notes that business graphics and CAD/CAM, traditionally distinct, may be linked by computerized slide-making or photocomposition systems.

Computer Graphics in Business Applications predicts that screen resolutions of 1000 lines will not sell well for business use because of price, that hard copy will be produced predominantly in color, and that voice input uses will increase. It observes that for business computer graphics to become as ubiquitous as the office copier and dictation machine, a turnkey system would have to cost less than $15,000, and envision a boom market for personal computer systems applied to business graphics.

The report, number A715, is available for $1000 from Frost & Sullivan, 106 Fulton St., New York, NY 10038; (212) 233-1080.


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