Meetings

Application of Information Extraction Techniques to Human Scanning

The introduction of radioactive isotopes into human bodies as an essential tool for medical diagnosis is gaining widespread acceptance. In some cases, notably thyroid diagnosis by the uptake of radioactive iodine, precise information can be obtained from counters placed outside the body. However, in most other cases it is difficult to interpret the information which can be obtained from a study of the distribution of isotopes by detectors located outside the body—that is, by the technique of human scanning. Thus, we are in possession of a tool that appears to be powerful in concept but limited in immediate application. The conference on the application of information extraction techniques to human scanning, sponsored by the Radiation Study Section of the National Institutes of Health and held at Princeton, New Jersey, from 20 to 22 November 1961, was addressed to this specific problem: how to obtain the maximum amount of information through external scanning after administration of isotopes to man for purposes of diagnosis.

There are several possible avenues which should be explored. The first has to do with improvements in signal. One example is the use of positron emitters, which provide more accurate information about the position of the isotope in the body through the registration of coincidences from the diametrically opposed gamma rays which are emitted after positron annihilation. The use of short-lived isotopes makes it possible to increase the amount of isotope administered to the patient and thus yields a larger number of quanta in a given time of observation. The amplitude of the signal may also be increased by means of various chemical or physical tricks, such as incorporating isotopes in specific chemical compounds or attaching them to physical carriers such as microspheres. Either of these procedures might increase localization in specific parts of the body.

The second avenue of exploration is that of effecting improvements in data recording, as by increasing the efficiency of the counters themselves or developing techniques for collimating the signal and thus sharpening the directional response. Methods for decreasing noise which yield an increase in the signal-to-noise ratio also belong in this category. The third area of investigation which may lead to important advances is that of data processing and display. A great deal of attention has already been paid to the first two avenues; the third has received by far the least attention. This last problem was the primary concern of the meeting.

A limited group of 14 participants gathered at Princeton for 2½ days. The participants were chosen to include individuals with experience in the problem of human scanning; others with experience in the extraction of data from minimal information; and finally, others with experience in data processing and display. The meeting was designed to be informal and was kept small to encourage discussion. There were, however, a number of formal presentations. In the first of these, C. A. Tobias (University of California, Berkeley), G. L. Brownell (Massachusetts General Hospital), and E. C. Gregg (Western Reserve University, Cleveland) discussed isotope distribution in the human body as determined by scanning. In a series of papers on the extraction of information under difficult conditions, W. V. Mayneord (Institute of Cancer Research, London, England) discussed x-ray diagnosis in man; J. C. Lilly (Communications Research Institute of St. Thomas, Miami) spoke on recognition of patterns of electrical activity in animal brain: F. D. Drake (National Radio Astronomy Observatory, Greenbank, W. Va.) discussed the search for communication originating from extraterrestrial human beings; P. E. Green (Lincoln Laboratory, Lexington, Mass.) reported on extraterrestrial radar reflections; and W. A. Rosenblith (Massachusetts Institute of Technology, Cambridge) spoke on recognition of patterns of electrical activity in the human brain. Finally there was a round-table discussion on information theory, led by R. M. Fano and W. F. Schreiber (Massachusetts Institute of Technology).

Other participants were the members of the arrangements committee (A. K. Solomon, chairman; H. L. Friedell; and Henry Quastler); an additional member of the study section, H. E. Johns; and two rapporteurs, D. A. Goldstein and T. F. Weiss.

The discussion was vigorous and lively throughout the meeting. During the first day, effective channels of communication were established between the various participants. There appeared to

be reasonable agreement about the nature of the problem and the contributions that might come from the diverse fields represented. Part of the first day and most of the second were devoted to a presentation of specific methods by which the signal-to-noise ratio might be increased in a variety of systems. The latter part of the second day was devoted to contributions that might arise from the use of advanced information-extraction techniques. The third day was spent in the round-table discussion. When the meeting ended, there was a general feeling among the participants that it had been successful and useful.

Three particularly important suggestions were made. The first concerned the application of techniques for signal modulation in order to provide noise-free amplification and more efficient detection. Though this technique has long been known, and is widely used in radar, Drake's discussion of it in connection with 21-centimeter radio astronomy (the Dicke radiometer) led to the suggestion that it might be particularly applicable to human scanning. The pinhole camera appeared, on first view, to be relatively adaptable to mechanical modulation by a lead shutter.

Very interesting suggestions also emerged from the detailed discussion of data processing and display. It was generally agreed that this was a two-step process, and that data recording and storage should be entirely separated from data processing. In the first instance, all possible data should be recorded and stored, with no clipping or suppression of any sort. After this, the stored data should be examined without haste in order to determine the best method of display. It appeared that much might be gained from recording the data in such a way that they would be adaptable for treatment by computers. It also appeared important, in designing the display, to make optimal use of those characteristics of the human eye which have been shown to be of aid in discriminating signal from noise. One example is the unique ability of the human eye to enhance contrast.

It was clear that it is desirable to arrange for further close collaboration between scientists engaged in obtaining and recording data through human scanning and others whose major field is data processing and display. To this end it was suggested that a special course in computer techniques be arranged for scientists who are now engaged in human scanning. This course

would be designed to show how data may be recorded so that the record is readily adaptable to the more sophisticated computer treatments. It might also provide some knowledge of digital-computer characteristics and some practical experience in the use of computers, enabling those who took the course to collaborate more closely with scientists in the field of information extraction.

Further information on the course and the meeting may be obtained from Dr. Hymer L. Friedell, Department of Radiology, Western Reserve University, Cleveland, Ohio. A more detailed report, prepared by the two rapporteurs, may also be obtained from Dr. Friedell.

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Forthcoming Events

July

1–4. European Chest Surgery Congr., annual, Stockholm, Sweden. (C. Crafoord, Karolinska Institute, Stockholm 60)

1–4. European Soc. of Cardiovascular Surgery, Stockholm, Sweden. (G. Arnuff, 1, pl. Gailleton, Lyons, France)

1–4. Oral Surgery, intern. conf., London, England. (D. C. Trexler, American Soc. of Oral Surgeons, 840 N. Lake Shore Dr., Chicago 11, Ill.)

1–5. Operational Research, intern. conf., Oslo, Norway. (Sir A. Goodeve, International Federation of Operational Research Societies, 11 Park Lane, London, W.1, England)

1–7. Rehabilitation, European natl. conf. and course, Cambridge, England. (I. R. Henderson, British Council for Rehabilitation, Tavistock House, Tavistock Sq., London, W.C.1)

1–7. Science in General Education, conf., Basutoland, S. Africa. (Institute of Education, Univ. College of Pius XII, Basutoland)

2–4. High-Resolution Nuclear Magnetic Resonance Spectroscopy, symp., Boulder, Colo. (M. T. Rogers, Dept. of Chemistry, Michigan State Univ., East Lansing)

2–4. Structure of Solid Metallic Solutions, intern. colloquium, Orsay, France. (Prof. Guinier, National Scientific Research Center, 16 rue Pierre Curie, Paris 5°, France)

2–5. International Federation of Societies of Cosmetic Chemists, London, England. (A. Herzka, Pressurized Packaging Consultants, Ltd., Ashbourne House, Alberon Gdns., London, N.W.11)

2–6. Biological Effects of Ionizing Radiation at the Molecular Level, symp., Brno, Czechoslovakia. (International Atomic Energy Agency, 11 Kaerntnerring, Vienna 1, Austria)

2–6. Ionosphere, conf., London, England. (Administrative Assistant, Institute of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1)

2–6. Northern Forest Congr., Oslo, Norway. (T. Austin, Nordiske Skogkongress, Akersgaten 42, Oslo)

2–7. Magnetic and Electric Resonance and Relaxation, intern. conf., Eindhoven, Netherlands. (D. J. Kroon, Philips Research Laboratories, Eindhoven)

2–7. National Education Assoc. of the United States, Denver, Colo. (W. G. Carr, 1201 Sixteenth St., NW, Washington 6, D.C.)

2–11. South African Chemical Institute, Johannesburg, S. Africa. (Secretary, SACI, P.O. Box 3361, Johannesburg)

2–14. Biology of Tuna and Related Species, intern. mtg., U.N. Food and Agriculture Organization, La Jolla, Calif. (J. L. McHugh, Bureau of Commercial Fisheries, Washington 25, D.C.)

3–7. Acta Endocrinologica Congr., Geneva, Switzerland. (R. Borth, Laboratoire de la Materinité, Hôpital de Genève, Geneva)

3–13. Malariology, inter-African conf., Yaounde, Cameroun, Africa. (World Health Organization, Palais des Nations, Geneva, Switzerland)

4–11. High-Energy Physics, intern. conf., Geneva, Switzerland. (E. W. D.