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The International Federation for Medical Electronics was formed in 1958 to be a federation of societies having an interest or activity in medical electronics. The concept that it should be made up of societies affiliated for mutual advantages has matured with the participation of the Japan Society for Medical Electronics and Biological Engineering with 850 members. Over 70 percent of the membership have medical degrees, in contrast to medical electronics groups in America, where the members are predominantly engineers

and physical scientists. An opportunity to become more familiar with the Japanese activities in this field will be available in September 1965 when the 6th International Conference will be held in Tokyo after the International Physiological Congress, scheduled for 1-7 September. This schedule has been arranged to facilitate attendance at both conferences. Further information about the federation and future meetings can be obtained from the secretary, L. E. Flory, 167 Hamilton Ave., Princeton, N.J.

ROBERT L. BOWMAN

National Heart Institute,  
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## Information Systems: Learning, Adaptation, and Control

Approaches in the engineering and physical sciences to learning, adaptation, and control in information systems were the main topics of discussion at the 1963 Computer and Information Science Symposium held 17 and 18 June at the Technological Institute, Northwestern University. Related papers in mathematical techniques, artificial intelligence and learning, computers and control, and pattern identification were presented.

One of the most persistent problems in the theory of brain mechanisms has been the requirement for a model capable of storing and recapitulating the sequence of experience which may occur in the duration of a human life. Reviewing the present state of his research in cognitive systems, Rosenblatt (Cornell) presented a mathematical model for long-term sequential memory, which appears to be of sufficient capacity to record an entire life history of sensory experience with a high probability of permitting correct judgments and decisions to be made in retrospect. His model is also consistent in size and structural organization with the known constraints of the human nervous system. Following an intuitive geometric approach, Charnes (Northwestern) presented new proofs of the fundamental theorems of the perceptron-learning theory of Rosenblatt and Block. His discussions clarified the motivation and restrictiveness of the previous work. Block (Cornell) and Nilsson and Duda (Stanford Research Institute) studied the problem of determining a small number of features for a given set of patterns by considering a pattern on a discrete retina to be the set of active retinal points. They also developed an algorithm for finding features of restricted sets of patterns and considered the mechanization of this algorithm by adaptive neural networks.

Pattern identification plays an important role in the design of learning systems. Viewing pattern identification as a problem in statistical classification wherein an  $n$ -dimensional space is partitioned into category regions with decision boundaries, Cooper (Sylvania) discussed the concept of hyperplanes, hyperspheres, and hyperquadrics as decision boundaries. He introduced techniques for determining the actual optimum boundary from known samples and for efficiently reducing the

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dimensionability. Learning from experience may be considered as a process of computing estimates of probability measures from sample data during a conditioning phase. Based upon this point of view, Brick and Owen (Sylvania) treated an intelligent pattern recognizer as a learning and classification problem in a multidimensional characteristic, feature, or measurement space. They also introduced the concept of using nonparametric probability estimation techniques and Bayes' risk analysis for the investigation of pattern recognition and self-organization problems.

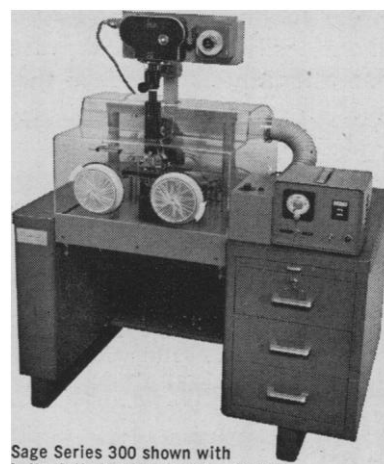
Leading the session on pattern identification, Gamba (Italy) discussed the concept of establishing probability weights for statistical inference and the principles involved in PAPA (automatic programmer and probability analyzer) and the papister. An interesting character recognition system using adaptive linear decision functions was reported by Griffin, King, and Tunis (I.B.M.) The system is made up of the transducer, processor, and categorizer. Their work emphasized the practical implementation of linear decision functions and their application to the recognition of the ABA E-13B magnetic character font, taking into account realistic component specifications and tolerances. Kamensky and Liu (I.B.M.) presented a theoretical and experimental study of a model for pattern recognition. They derived some equations for the performance of a recognition system as a function of the type of classifier used and the number and power of the measurements.

An important advancement in modern control theory is the introduction of learning, adaptation, pattern identification, and artificial intelligence into control processes. The theories of automata, threshold logic, and statistical decision have found many important applications in modern synthesis of learning and control systems. Several papers emphasizing this new approach to control system design were presented at the symposium. Tou (Northwestern) and Ivanenko (U.S.S.R.) discussed the design of a learning system for control based upon pattern recognition principles. The design was treated as the problem of decision making on the basis of information obtained from the control process. The observed data was transformed into special types of multidimensional information pattern from which a

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proper decision was made. In a survey paper, Widrow and Smith (Stanford) emphasized the use of adaptive logic networks in optimum control and reviewed the applications of pattern classification principles to such control problems as weather forecasting, speech recognition, and vectorcardiogram diagnosis. Fu (Purdue) approached the learning control problems from the point of view of statistical decision and introduced the method of state-space partition for system design. A very interesting model which has the same input-output characteristic as a person solving simple physics problems was reported by Kuck and Krullee (Northwestern). The proposed system is a part of a larger system which accepts inputs in the form of descriptive statements in natural language. Their discussions placed emphasis upon the design of the subsystem which takes a descriptive formalism derived from natural language as its input and proceeds deductively to attempt a solution.

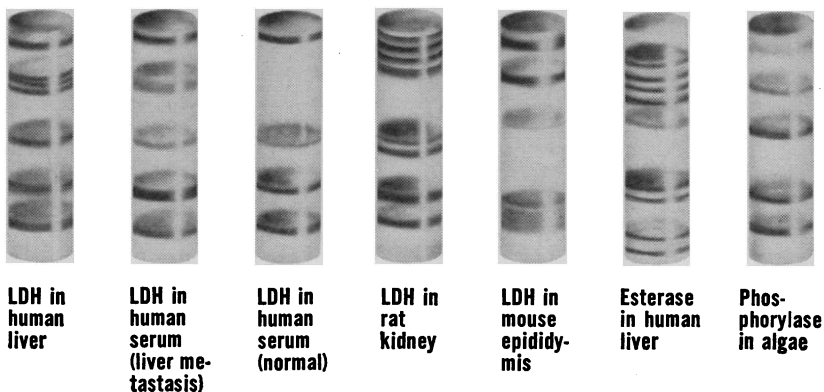
The theory of automata and semi-groups appears to provide a useful tool in the synthesis of learning systems and adaptive processes. Weeg (Michigan State) reviewed some general properties of an automaton and the structural properties of Rabin-Scott automata, and discussed the structure-preserving function of automata, input semi-groups associated with strongly connected automata, and divisible semi-groups. Klaczko (Germany) presented an interesting procedure for recognition of normalized, connected patterns by using a threshold-conditioned adaptive template. A software representation of a digital two-dimensional pattern is used as a template for pattern recognitions. Andrew (England) discussed some prerequisites of self-organization and general system properties conducive to self-organization. Mesarovic (Case) proposed a unified approach to learning and information theory in which he introduced the concept of uncertainty sets. In a review paper, Greene (Chicago) considered some problems in designing highly adaptive systems and the problem of identifying the behavioral structures. The interesting idea of simulation of a billion-gate computer by a thousand-gate computer was reported by Ledley (National Biomedical Research Foundation).

Highlights of the meeting were the keynote address "The next ten years," by the noted cybernetician W. Ross

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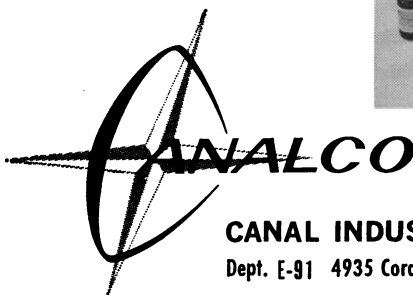
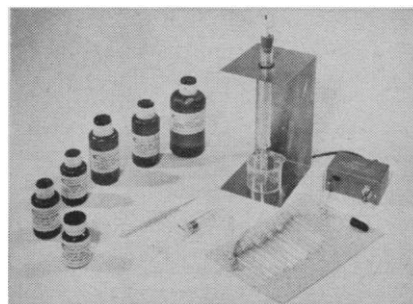
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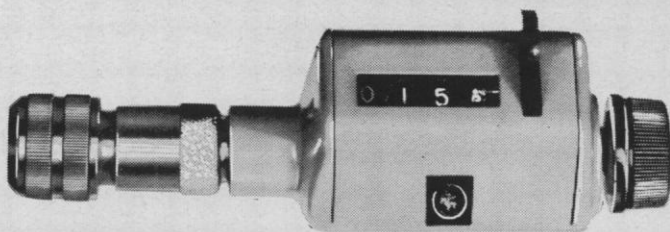
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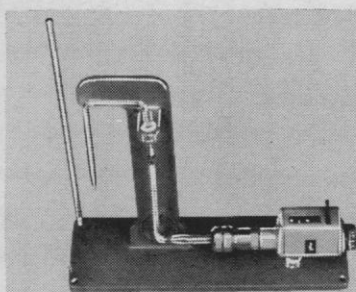
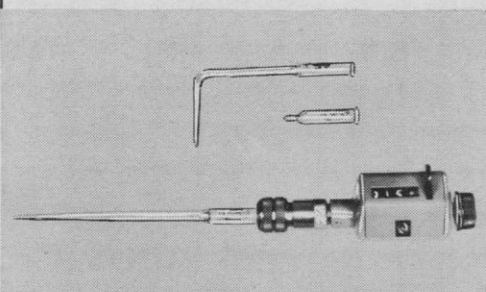
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Ashby and a lecture on dynamic programming, learning, and adaptive processes by Richard Bellman (Rand Corporation). Bellman pointed out some of the major problems in the study of learning and adaptation processes and some of the ways in which dynamic programming furnishes a natural bridge between classical and modern theories.

The symposium was cosponsored by the Technological Institute of Northwestern University and the Information Systems Branch of the Office of Naval Research. The co-chairmen were Julius T. Tou (Northwestern) and Richard H. Wilcox (ONR). In order to reach a much wider audience and to provide a source of permanent reference, the proceedings, edited by Tou, will be published in September by the Spartan Book Company.

JULIUS T. TOU

Computer Sciences Laboratory,  
Technological Institute, Northwestern  
University, Evanston, Illinois

## Forthcoming Events

### September

22-25. **Petroleum Mechanical Engineering Conf.**, Tulsa, Okla. (A. B. Conlin, Jr., 345 E. 47 St., New York 17)

22-25. **National Power Conf.**, Cincinnati, Ohio. (A. C. Hartranft, 1000 Chestnut St., Philadelphia, Pa.)

22-28. **Pan American Child Congr.**, 12th, Buenos Aires, Argentina. (Inter-American Children's Inst., 8 de Octubre No. 2882, Montevideo, Uruguay)

23-24. **Soc. of Plastics Engineers**, Worcester, Mass. (C. Campbell, 65 Prospect St., Stamford, Conn.)

23-25. **Tobacco Chemists**, 17th research conf., Montreal, Canada. (N. A. MacRae, Canada Dept. of Agriculture, Central Experimental Farm, Ottawa, Ont.)

23-27. **Aeronautic and Space Engineering and Manufacturing**, meeting and display, Los Angeles, Calif. (Soc. of Automotive Engineers, 485 Lexington Ave., New York 17)

23-27. **Telemetering**, 1st intern. conf., London, England. (F. G. McGavock, Box 5067, Pasadena, Calif.)

24. **Chemical Safety**, 7th workshop, New Orleans, La. (Manufacturing Chemists' Assoc., Inc., 1825 Connecticut Ave., NW, Washington, D.C.)

26-1. **Astronautics**, 14th intern. congr., Paris, France. (International Astronautical Federation, 12 rue de Gramont, Paris 2)

26-27. **Air Pollution Control Assoc.**, 3rd technical meeting, West Coast section, Monterey, Calif. (R. L. Weimer, 434 S. San Pedro St., Los Angeles 13, Calif.)

27-28. **Western Industrial Health**, 7th conf., San Francisco, Calif. (W. G. Bogan, Employers Mutual of Wausau, 114 Sansome St., San Francisco)