AUDITORY AND VISUAL PATTERN RECOGNITION

Edited by
David J. Getty and James H. Howard Jr.

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AUDITORY and VISUAL PATTERN RECOGNITION

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Cambridge, Massachusetts

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Preface

The chapters in this volume represent edited versions of papers presented at a symposium on human pattern recognition and classification. The symposium was held at Bolt Beranek and Newman Inc. in Cambridge, Massachusetts on June 28-30, 1978. The broad objective of the symposium was to consider current issues in the area of human recognition of complex patterns.

The systematic scientific investigation of human perception began over 100 years ago, yet relatively little is known about how we identify complex patterns. A major reason for this is that historically, most perceptual research focused on the more basic processes involved in the detection and discrimination of simple stimuli. This work has progressed in a connectionist fashion, attempting to clarify fundamental mechanisms in depth before addressing the more complex problems of pattern recognition and classification. This extensive and impressive research effort has built a firm basis from which to speculate about these issues. What seems lacking, however, is an overall characterization of the recognition problem—a broad theoretical structure to direct future research in this area. Consequently, our primary objective in this volume is not only to review existing contributions to our understanding of classification and recognition, but to project fruitful areas and directions for future research as well.

In order to develop this overview, related research from several areas is reviewed. Our authors include scientists active in human auditory and visual research and others active in theoretical pattern recognition. It is our hope that this unique combination will provide a broader perspective on the important issues in this area than would be possible with a more narrowly-focused group.

For organizational purposes we have divided the volume into four major sections. This substantive division reflects the primary research interests of the

authors and includes separate sections on the perception of complex auditory patterns, complex visual patterns, theoretical approaches to pattern recognition, and multidimensional perceptual spaces.

The first section includes five chapters on human auditory perception. These examine existing work in auditory recognition to identify those issues on which progress has been made or is likely and those on which additional effort is clearly needed. For example, we may ask how an understanding of pitch perception will contribute to a more general theory of auditory classification? What role do higher-order cognitive factors such as selective attention and semantic analysis play in auditory recognition, and how can these factors be incorporated into a theory of auditory recognition? To what extent can our understanding of auditory recognition in general benefit from the extensive literature on human speech perception? Finally, we may ask how our basic understanding of auditory recognition can be used to enhance classification performance in applied listening contexts?

The second section reviews some examples of recent research in visual perception and visual information processing. The contribution of these chapters is to review the theoretical issues and constructs that have proven useful in visual research. To what extent are classification processes similar across the two modalities? Perhaps some common general principles underlie human pattern recognition regardless of modality? In what important ways do auditory and visual recognition processes differ?

Our third section considers work on the development and performance of automatic statistical classification systems. Although these chapters do not explicitly address the processes that underlie human recognition, experience suggests that the ultimate development of formal psychological theory in this area will likely benefit from the concepts and techniques employed in this research. What cues or features have proven optimal in these systems? What is the role of signal structure (i.e., the relations among stimulus components) in aural classification? To what extent are existing statistical and syntactic systems reasonable models of human recognition? To what extent are they unreasonable?

The fourth section includes papers on both auditory and visual information processing. What ties this work together is a common analysis in terms of multidimensional perceptual spaces. Here the psychological representation of a stimulus is viewed as a point or vector in a multidimensional feature space. What advantages and disadvantages does this approach to psychophysical scaling offer? How are we to interpret the abstract stimulus space extracted in a multidimensional scaling analysis? How does this representation relate to an observer's classification performance? What might this research tell us about feature extraction in human pattern recognition?

The symposium was funded jointly by the Engineering Psychology Programs of the U.S. Office of Naval Research and the Naval Ship Research and Development Center. We are pleased to acknowledge the support provided by John

O'Hare and Arthur Bisson, the project managers for the two agencies, respectively. Finally, our special thanks go to John A. Swets for providing an overview of the symposium at its conclusion, and to Mildred Webster for coordinating the planning of the meeting and managing its realization.

David J. Getty
James H. Howard, Jr.

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