Signal Detection Theory And Roc Analysis In Psychology And Diagnostics Collected Papers Scientific Psychology Series

Recognition memory is the ability to consciously appreciate that an item or event was previously presented or experienced. Signal detection theory has long provided one influential interpretation of recognition memory, and numerous investigations conducted over the last 50 years have sought to clarify the particulars of this account. Analyzing receiver operating characteristic (ROC) data can distinguish between two versions of signal detection theory, specifically, the equal and unequal variance models. The equal variance signal detection model is intuitively appealing, but the unequal variance signal detection model usually provides a better fit of the ROC data. Chapter 1 describes two experiments that provide a novel test of the unequal variance assumption. This new method of analysis required subjects to directly rate their memory strength on a fine-grained scale, and then the mean and standard deviations of the target and lure ratings were directly computed. Results from the new method support the unequal variance signal detection model. Though the unequal variance signal detection theory of recognition memory provides a useful way to conceptualize recognition, there is another long-standing theory of recognition known as dual process theory that seems to contradict it. This theory holds that two processes (familiarity and recollection) contribute to recognition decisions. A critical point of contention between standard dual process models and signal detection theory concerns the nature of the recollection process, specifically, whether it is continuous or categorical. Dual-process theories generally assume that recollection is categorical, but signal detection theory requires it to be continuous. Chapters 2 and 3 provide direct evidence that recollection is a continuous process. In Chapter 2, two versions of a source memory experiment were conducted. The continuous view of recollection was supported because the relationship between confidence and accuracy on this recollection-based task was graded. The results detailed in Chapter 3 further validate recollection as a continuous process. The method involved an associative recognition test, which purportedly tests recollection in the absence of familiarity. In this task, word pairs were studied and then at test, the pairs were either intact or rearranged. When the word pairs were strengthened, we observed the typical result of an increasingly curvilinear ROC. Evidence from various procedures converged to suggest that recollection is a continuous process. The three chapters support the unequal variance signal detection theory of recognition memory and the idea that two continuous processes aggregate to yield a continuous memory strength variable.

This dissertation contributes to a growing body of research that attempts to bridge the chasm between basic and applied memory research. Its basic approach is to use signal detection theory to analyze higher-level cognitive components that influence recognition memory. The work consists of three research papers that examine the effects of internal and external sources of memory on discriminability and response bias in order to better understand memory in the real world. Paper one provides new evidence supporting a basic assumption of reality-monitoring theory that certain cognitive operations are important for knowing whether or not a memory comes from an internal source. This research demonstrates that people are more susceptible to false memories after completing mindfulness training because their reality-monitoring accuracy is reduced. Paper two examines the verbal overshadowing effect (where people are worse at correctly identifying someone from a police lineup after providing a verbal description of a face) with receiver operating characteristic (ROC) analysis to determine if that well-known effect is due to differences in actual memorability rather than differences in response bias. This research indicates that internally-generated information can be confused with an external memory source when the internally-generated information is not sufficiently detailed. Paper three examines the cross-race effect wherein memory is worse for a person of a different race than a person of the same race. This research indicates that although memory is worse in terms of discriminability, high-confidence identifications are just as reliable for a cross-race face as for a same-race face.

Eyewitnesses play an important role in criminal cases when they can identify culprits. Estimates suggest that tens of thousands of eyewitnesses make identifications in criminal investigations each year. Research on factors that affect the accuracy of eyewitness identification procedures has given us an increasingly clear picture of how identifications are made, and more importantly, an improved understanding of the principled limits on vision and memory that can lead to failure of identification. Factors such as viewing conditions, duress, elevated emotions, and biases influence the visual perception experience. Perceptual experiences are stored by a system of memory that is highly malleable and continuously evolving, neither retaining nor divulging content in an informational vacuum. As such, the fidelity of our memories to actual events may be compromised by many factors at all stages of processing, from encoding to storage and retrieval. Unknown to the individual, memories are forgotten, reconstructed, updated, and distorted. Complicating the process further, policies governing law enforcement procedures for conducting and recording identifications are not standard, and policies and practices to address the issue of misidentification vary widely. These limitations can produce mistaken identifications with significant consequences. What can we do to make certain that eyewitness identification convicts the guilty and exonerates the innocent? Identifying the Culprit makes the case that better data collection and research on eyewitness identification, new law enforcement training protocols, standardized procedures for administering line-ups, and improvements in the handling of eyewitness identification in court can increase the chances that accurate identifications are made. This report explains the science that has emerged during the past 30 years on eyewitness identifications and identifies best practices in eyewitness procedures for the law enforcement community and in the presentation of eyewitness evidence in the courtroom. In order to continue the advancement of eyewitness identification research, the report recommends a focused research agenda. Identifying the Culprit will be an essential resource to assist the law enforcement and

legal communities as they seek to understand the value and the limitations of eyewitness identification and make improvements to procedures.

An investigation was carried out to evaluate diagnostic performance in medical radiology. A critical review of methods available for the assessment of image quality in terms of physical objective measurements and quantitative observer performance was followed by a series of experiments which applied the techniques of Receiver Operating Characteristics (ROC) to radiographic problems. An appraisal of the performance of six currently available imaging systems designed for chest radiography was performed using expert observers and an anthropomorphic phantom. Results showed a range of abilities to demonstrate pulmonary nodules (ROC areas of 0.866 to 0.961). The ROC outcomes for the imaging systems were shown to correlate well with signal to noise ratio (SNR) measurements for the images (0.78, p

The Foundations of Remembering presents a collection of essays written by top memory scholars in honor of Henry L. Roediger III. The chapters were originally delivered as part of the "Roddyfest" conference held in March 2005 to celebrate Purdue University's awarding of an honorary doctor of letters to Roediger in recognition of his many contributions to the field of psychology. Authors were given a simple charge: choose your own topic, but place your work in historical context. Roediger is fascinated by the intellectual lineage of ideas, so addressing historical "foundations" seemed a fitting tribute. The Chapters contained in this volume help to establish the foundations of remembering, circa the first decade of the 21st century, as perceived by some of the leading memory researchers in the world. Not surprisingly, each of the chapters touches on Roediger's research as well, largely because his work has helped to define and clarify many topics of interest to the memory field. The Foundations of Remembering is intended for a wide audience: students, scholars, and anyone interested in exploring the historical and conceptual roots of modern memory theory.

Continuous Signals and Systems with MATLAB is the first undergraduate text fully focused on continuous systems. It presents all of the material needed to master the subject and its related MATLAB problem-solving techniques. The authors cover all of the traditional topics and include chapters on system design, state-space techniques, linearizing nonlinear systems, and the design and analysis of analog filters. They also discuss the five representations of continuous systems and explain how to go from one representation to another.

Detection theory has been applied to a host of varied problems (for example, measuring the accuracy of diagnostic systems or reliability of lie detection tests) and extends far beyond the detection of signals. This book is a primer on the subject.

Detection Theory is an introduction to one of the most important tools for analysis of data where choices must be made and performance is not perfect. Originally developed for evaluation of electronic detection, detection theory was adopted by psychologists as a way to understand sensory decision making, then embraced by students of human memory. It has since been utilized in areas as diverse as animal behavior and X-ray diagnosis. This book covers the basic principles of detection theory, with separate initial chapters on measuring detection and evaluating decision criteria. Some other features include: *complete tools for application, including flowcharts, tables, pointers, and software; *student-friendly language; *complete coverage of content area, including both one-dimensional and multidimensional models; *separate, systematic coverage of sensitivity and response bias measurement; *integrated treatment of threshold and nonparametric approaches; *an organized, tutorial level introduction to multidimensional detection theory; *popular discrimination paradigms presented as applications of multidimensional detection theory; and *a new chapter on ideal observers and an updated chapter on adaptive threshold measurement. This up-to-date summary of signal detection theory is both a self-contained reference work for users and a readable text for graduate students and other researchers learning the material either in courses or on their own.

Helicopter Health Usage Monitoring Systems (HUMS) have potential for providing data to support increasing the service life of a dynamic mechanical component in the transmission of a helicopter. Data collected can demonstrate the HUMS condition indicator responds to a specific component fault with appropriate alert limits and minimal false alarms. Defining thresholds for specific faults requires a tradeoff between the sensitivity of the condition indicator (CI) limit to indicate damage and the number of false alarms. A method using Receiver Operating Characteristic (ROC) curves to assess CI performance was demonstrated using CI data collected from accelerometers installed on several UH60 Black Hawk and AH64 Apache helicopters and an AH64 helicopter component test stand. Results of the analysis indicate ROC curves can be used to reliably assess the performance of commercial HUMS condition indicators to detect damaged gears and bearings in a helicopter transmission.

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Signal detection theory--as developed in electrical engineering and based on statistical decision theory--was first applied to human sensory discrimination 40 years ago. The theoretical intent was to provide a valid model of the discrimination process; the methodological intent was to provide reliable measures of discrimination acuity in specific

sensory tasks. An analytic method of detection theory, called the relative operating characteristic (ROC), can isolate the effect of the placement of the decision criterion, which may be variable and idiosyncratic, so that a pure measure of intrinsic discrimination acuity is obtained. For the past 20 years, ROC analysis has also been used to measure the discrimination acuity or inherent accuracy of a broad range of practical diagnostic systems. It was widely adopted by methodologists in the field of information retrieval, is increasingly used in weather forecasting, and is the generally preferred method in clinical medicine, primarily in radiology. This book attends to both themes, ROC analysis in the psychology laboratory and in practical diagnostic settings, and to their essential unity. The focus of this book is on detection and recognition as fundamental tasks that underlie most complex behaviors. As defined here, they serve to distinguish between two alternative, confusable stimulus categories, which may be perceptual or cognitive categories in the psychology laboratory, or different states of the world in practical diagnostic tasks. This book on signal detection theory in psychology was written by one of the developers of the theory, who co-authored with D.M. Green the classic work published in this area in 1966 (reprinted in 1974 and 1988). This volume reviews the history of the theory in engineering, statistics, and psychology, leading to the separate measurement of the two independent factors in all discrimination tasks, discrimination acuity and decision criterion. It extends the previous book to show how in several areas of psychology--in vigilance and memory--what had been thought to be discrimination effects were, in reality, effects of a changing criterion. The book shows that data plotted in terms of the relative operating characteristic have essentially the same form across the wide range of discrimination tasks in psychology. It develops the implications of this ROC form for measures of discrimination acuity, pointing up the valid ones and identifying several common, but invalid, ones. The area under the binormal ROC is seen to be supported by the data; the popular measures d' and percent correct are not. An appendix describes the best, current programs for fitting ROCs and estimating their parameters, indices, and standard errors. The application of ROC analysis to diagnostic tasks is also described. Diagnostic accuracy in a wide range of tasks can be expressed in terms of the ROC area index. Choosing the appropriate decision criterion for a given diagnostic setting--rather than considering some single criterion to be natural and fixed--has a major impact on the efficacy of a diagnostic process or system. Illustrated here by separate chapters are diagnostic systems in radiology, information retrieval, aptitude testing, survey research, and environments in which imminent dangerous conditions must be detected. Data from weather forecasting, blood testing, and polygraph lie detection are also reported. One of these chapters describes a general approach to enhancing the accuracy of diagnostic systems.

This lecture describes a theoretical framework for the behavioural sciences that holds high promise for theory-driven research and design in Human-Computer Interaction. The framework is designed to tackle the adaptive, ecological, and bounded nature of human behaviour. It is designed to help scientists and practitioners reason about why people choose to behave as they do and to explain which strategies people choose in response to utility, ecology, and cognitive information processing mechanisms. A key idea is that people choose strategies so as to maximise utility given constraints. The framework is illustrated with a number of examples including pointing, multitasking, skim-reading, online purchasing, Signal Detection Theory and diagnosis, and the influence of reputation on purchasing decisions. Importantly, these examples span from perceptual/motor coordination, through cognition to social interaction. Finally, the lecture discusses the challenging idea that people seek to find optimal strategies and also discusses the implications for behavioral investigation in HCI.

Seeing and reading this sentence may seem like a no brainer--but your perception is just a tiny part of what is happening in your brain and body right now (both are much busier than you might think). SENSATION AND PERCEPTION has helped many readers understand the ties between how we sense the world and how the body interprets these senses. A key strength of this book has always been the ability to illustrate concepts through examples and visuals. Dr. Goldstein walks you through an intriguing journey of the senses, combining clear writing, his extensive classroom experience, and innovative research to create a visual, colorful book. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

A Primer of Signal Detection Theory is being reprinted to fill the gap in literature on Signal Detection Theory--a theory that is still important in psychology, hearing, vision, audiology, and related subjects. This book is intended to present the methods of Signal Detection Theory to a person with a basic mathematical background. It assumes knowledge only of elementary algebra and elementary statistics. Symbols and terminology are kept at a basic level so that the eventual and hoped for transfer to a more advanced text will be accomplished as easily as possible. Intended for undergraduate students at an introductory level, the book is divided into two sections. The first part introduces the basic ideas of detection theory and its fundamental measures. Its aim is to enable the reader to be able to understand and compute these measures. It concludes with a detailed analysis of a typical experiment and a discussion of some of the problems which can arise for the potential user of detection theory. The second section considers three more advanced topics: threshold theory, the extension of detection theory, and an examination of Thurstonian scaling procedures.

'Behavioral Methods in Consciousness Research' is the first book of its kind, providing an overview of methods and approaches for studying consciousness. The chapters are written by leading researchers and experts, who describe the methods they actually use in their own studies, along with their pitfalls, problems, and difficulties.--Back cover.

Signal Detection Theory and ROC Analysis in Psychology and DiagnosticsCollected PapersPsychology Press

Detection Theory, Second Edition is an introduction to one of the most important tools for analysis of data where choices must be made and performance is not perfect. Originally developed for evaluation of electronic detection, detection theory was adopted by psychologists as a way to understand sensory decision making, then embraced by students of

human memory. It has since been utilized in areas as diverse as animal behavior and X-ray diagnosis.

This second of two volumes on Cancer Imaging covers the three major topics of imaging instrumentation, general imaging applications, and imaging of a number of human cancer types. Where the first volume emphasized lung and breast carcinomas, Volume 2 focuses on prostate, colorectal, ovarian, gastrointestinal, and bone cancers. Although cancer therapy is not the main subject of this series, the crucial role of imaging in selecting the type of therapy and its post-treatment assessment are discussed. The major emphasis in this volume is on cancer imaging; however, differentiation between benign tumors and malignant tumors is also discussed. This volume is sold individually, and Cancer Imaging, Volume 1 [ISBN: 978-0-12-370468-9] sells separately for $189 and also as part of a two volume set [ISBN: 978-0-12-374212-4] for $299. • Concentrates on the application of imaging technology to the diagnosis and prognosis of prostate, colorectal, ovarian, gastrointestinal, and bone cancers • Addresses relationship between radiation dose and image quality • Discusses the role of molecular imaging in identifying changes for the emergence and progression of cancer at the cellular and/or molecular levels

The previous edition of the International Encyclopedia of Ergonomics and Human Factors made history as the first unified source of reliable information drawn from many realms of science and technology and created specifically with ergonomics professionals in mind. It was also a winner of the Best Reference Award 2002 from the Engineering Libraries Division, American Society of Engineering Education, USA, and the Outstanding Academic Title 2002 from Choice Magazine. Not content to rest on his laurels, human factors and ergonomics expert Professor Waldemar Karwowski has overhauled his standard-setting resource, incorporating coverage of tried and true methods, fundamental principles, and major paradigm shifts in philosophy, thought, and design. Demonstrating the truly interdisciplinary nature of this field, these changes make the second edition even more comprehensive, more informative, more, in a word, encyclopedic. Keeping the format popularized by the first edition, the new edition has been completely revised and updated. Divided into 13 sections and organized alphabetically within each section, the entries provide a clear and simple outline of the topics as well as precise and practical information. The book reviews applications, tools, and innovative concepts related to ergonomic research. Technical terms are defined (where possible) within entries as well as in a glossary. Students and professionals will find this format invaluable, whether they have ergonomics, engineering, computing, or psychology backgrounds. Experts and researchers will also find it an excellent source of information on areas beyond the range of their direct interests.

Signal detection theory (SDT) has proven to be a robust and useful statistical model for analyzing human performance in detection and decision making tasks. As with many models extensions have been proposed in order capture and represent the real world to a greater degree. Multidimensional Signal Detection Theory (MSDT) has had success in describing and modeling complex signals, signals that are comprised by more than one identifiable component dimension. Fuzzy Signal Detection Theory (FSDT) has had success in modeling and measuring human performance in cases where there exist ambiguity in the signal or response dimension characteristics, through the application of fuzzy set theory to the definition of the performance outcome categories. Multidimensional Fuzzy Signal Detection Theory (MFSDT) was developed to accommodate simultaneously both the multidimensionality of a signal and the fuzzification of outcome categories in order to integrate the two extensions. A series of three studies were performed to develop and test the theory. One study's purpose was to develop and derive multidimensional mapping functions, the aspect of MFSDT where MSDT and FSDT were integrated. Two receiver operating characteristic (ROC) studies were performed, one simulated and one empirical. The results from both ROC analysis indicated that for perceptually separable and perceptually integral complex stimuli that MFDST is a viable methodological approach to analyzing performance of signal detection tasks where there are complex signals with ambiguous signal characteristics.

Evaluation of Diagnostic Systems: Methods from Signal Detection Theory addresses the many issues that arise in evaluating the performance of a diagnostic system, across the wide range of settings in which such systems are used. These settings include clinical medicine, industrial quality control, environmental monitoring and investigation, machine and metals inspection, military monitoring, information retrieval, and crime investigation. The book is divided into three parts encompassing 11 chapters that emphasize the interpretation of diagnostic visual images by human observers. The first part of the book describes quantitative methods for measuring the accuracy of a system and the statistical techniques for drawing inferences from performance tests. The subsequent part covers study design and includes a detailed description of the form and conduct of an image-interpretation test. The concluding part examines the case study of a medical imaging system that serves as an example of both simple and complex applications. In this part, three mammographic modalities are used: industrial film radiography, low-dose film radiography, and xeroradiography. The case study focuses on the overall reliability of accuracy indices made by its main components, that is, the variabilities across cases, across readers, and within individual readers. The supplementary texts provide study protocols, a computer program for processing test results, and an extensive list of references that will assist the reader in applying those evaluative methods to diagnostic systems in any setting. This book is of value to scientists and engineers, as well as to applied, quantitative, or experimental psychologists who are engaged in the study of the human processes of discrimination and decision making in either perceptual or cognitive tasks.

Exactly what is the state of the art in statistics as we move forward into the 21st century? What promises, what trends does its future hold? Through the reflections of 70 of the world's leading statistical methodologists, researchers, theorists, and practitioners, Statistics in the 21st Century answers those questions. Originally published in the Journal of the American Statistical Association, this collection of vignettes examines our statistical past, comments on our present, and speculates on our future. Although the coverage is broad and the topics diverse, it reveals the essential intellectual unity of the field as we see the same themes recurring in different contexts. We see how the development of statistics has been driven by the unprecedented and still growing range of applications, by the explosion in computer technology, and by the new types of data that continue to emerge and advance the discipline. Organized around major areas of application and leading up to vignettes on theory and methods, Statistics in the 21st Century forms a landmark record of the progress and perceived future of the discipline. No student, researcher, or practitioner of statistics should miss this extraordinary opportunity to view the past, present, and future world of statistics through the eyes of its foremost thinkers.

Includes established theories and cutting-edge developments. Presents the work of an international group of experts. Presents the nature, origin, implications, and future course of major unresolved issues in

the area.

Recent technological advances in sensor manufacturing enable the use of separate spectral bands; e.g., MWIR and LWIR, to generate spatially registered imagery. Human factors experiments can be used to test whether a sensor can improve operator performance for detecting or recognizing a target. Although human factors experiments are of tremendous value, these tests are time consuming and resource intensive. In order to reduce costs associated with collecting behavioral data, an alternative approach is discussed. We propose using signal detection theory, to compliment and reduce the amount of classical human performance testing. As a test case we have studied whether multi-spectral sensors are significantly better than single band sensors. Scribner, Satyshur, and Kruer (1993) demonstrated that a two- dimensional matched filter (spatial) optimized for a specific target and background power spectra, can be used to estimate an observer's ability to detect the target embedded in a cluttered background. Three different background images were used with, and without, a target present. False alarm and target detection probabilities were computed and results were plotted on a Receiver Operating Characteristic (ROC) curve. The matched filter ROC curves were then compared to behavioral ROC curves. Results showed that the matched filter ROC curves were similar to behavioral ROC curves with color fusion and long-wave infrared showing the highest sensitivity and mid-wave and short-wave infrared scenes were significantly less sensitive. These results indicate that the matched filter analysis may be used to model human behavior.

Tremendous advances in all disciplines including engineering, science, health care, business, avionics, management, and so on, can also be attributed to the development of artificial intelligence paradigms. In fact, researchers are always interested in desi- ing machines which can mimic the human behaviour in a limited way. Therefore, the study of neural information processing paradigms have generated great interest among researchers, in that machine learning, borrowing features from human intelligence and applying them as algorithms in a computer friendly way, involves not only Mathem- ics and Computer Science but also Biology, Psychology, Cognition and Philosophy (among many other disciplines). Generally speaking, computers are fundamentally well-suited for performing au- matic computations, based on fixed, programmed rules, i.e. in facing efficiently and reliably monotonous tasks, often extremely time-consuming from a human point of view. Nevertheless, unlike humans, computers have troubles in understanding specific situations, and adapting to new working environments. Artificial intelligence and, in particular, machine learning techniques aim at improving computers behaviour in tackling such complex tasks. On the other hand, humans have an interesting approach to problem-solving, based on abstract thought, high-level deliberative reasoning and pattern recognition. Artificial intelligence can help us understanding this process by recreating it, then potentially enabling us to enhance it beyond our current capabilities.