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Biological pattern recognition by neural networks

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ABSTRACT: Neural network analysis was proposed and evaluated as a method for image analysis of plankton data derived from automatic counting techniques. It was shown that a neural network with 2 layers of weights was capable of learning a large data set by the backward-error propagation method. Significant results were achieved in separating novel images of 2 co-occurring species of Ceratium spp. from the western North Atlantic Ocean.

INTRODUCTION

There is a growing concern amongst the marine scientific community about the diminishing numbers of competent plankton taxonomists remaining in, and being recruited to, research. This has led to a number of initiatives attempting to overcome this problem using automated pattern recognition techniques (Jeffries et al. 1984, Rolke & Lenz 1984, Steidinger et al. 1990). Certainly it is a generally held belief that the majority of plankton samples will eventually be sorted, counted and taxonomically analysed using automatic techniques. No definitive system has yet been built but it is highly likely that pattern recognition and image processing will be the method to achieve the processing of the data. There is also a growing requirement for discrimination and identification of video images collected from cameras mounted on remote vehicles and towed systems. Recognition of biological patterns by neural networks is a new concept and one which we suggest could play a role in achieving these ends.

The majority of previous attempts to use automated pattern recognition for taxonomic identification have utilised explicitly statistical techniques, whereby morphological measurements are made on sample data (either by hand or by some automatic image analysis technique), and the measurements submitted to discriminant analysis (Yerrenton 1967, Jeffries et al. 1980, 1984). Typically such techniques involve making a wide range of measurements, and using the statistical analysis to determine which measurements or combination of measurements allows the best discrimination to be made. Obtaining images clean enough to enable accurate measurement is itself quite problematic. A neural network approach was considered suitable for this type of problem for a number of reasons: (1) neural networks (strictly, artificial neural networks) are able to be taught, i.e. exposed to data and 'told' what the correct response (e.g. category) is for that stimulus, and do not need to be given a rule-base to determine behaviour; (2) they are able to form arbitrary input-output mappings, and so can be used in a wide variety of domains; (3) they have been shown to be largely resistant to noisy or imperfect inputs; (4) their massive operational parallelism means that hardware versions of networks can be made that perform very complex mapping tasks at great speed.

MATERIALS AND METHODS

Samples. To assess the possibilities of artificial neural networks' discriminating images of planktonic species, specimens of the genera Ceratium were used. Ceratium spp. are generally compressed in one plane and are ideal organisms for drawing or video imaging. They are also morphologically variable and specimens are at times difficult to separate, when there can be up to 20 different and distinct species of the genera occurring in one plankton sample. The 2 species selected were C. arcticum (Ehrenberg) Cleve, and C. longipes (Bailey) Gran., which have sympatric geographical distributions in the western Atlantic Ocean.

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Pattern Recognition In Biological Tech

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Pattern Recognition In Biological Tech:

Scientific and Technical Aerospace Reports ,1972 **Artificial Intelligence Technologies for Computational Biology** Ranjeet Kumar Rout,Saiyed Umer,Sabha Sheikh,Amrit Lal Sangal,2022-11-10 This text emphasizes the importance of artificial intelligence techniques in the field of biological computation It also discusses fundamental principles that can be applied beyond bio inspired computing It comprehensively covers important topics including data integration data mining machine learning genetic algorithms evolutionary computation evolved neural networks nature inspired algorithms and protein structure alignment The text covers the application of evolutionary computations for fractal visualization of sequence data artificial intelligence and automatic image interpretation in modern biological systems The text is primarily written for graduate students and academic researchers in areas of electrical engineering electronics engineering computer engineering and computational biology This book Covers algorithms in the fields of artificial intelligence and machine learning useful in biological data analysis Discusses comprehensively artificial intelligence and automatic image interpretation in modern biological systems Presents the application of evolutionary computations for fractal visualization of sequence data Explores the use of genetic algorithms for pair wise and multiple sequence alignments Examines the roles of efficient computational techniques in biology *Aerospace Medicine and Biology* ,1972 Geophysical Exploration Technology Ming Li,2014-02-06 Authored by one of the world s hydrocarbon exploration experts Geophysical Exploration Technology Applications in Lithological and Stratigraphic Reservoirs presents the latest technological advancements and cutting edge techniques in reservoir theory research and exploration Stratigraphic and lithological reservoirs play a critical role in increasing the production from oil reserves and new hydrocarbon sources Recent resource evaluations indicate that onshore stratigraphic and subtle reservoirs account for as much as 40% of the total remaining hydrocarbon sources globally As a result these reservoirs will be the most practical potential and prevalent fields for long lasting onshore exploration Intended as an aid in developing an understanding of the techniques of reservoir exploration this book presents the latest and most practical methods and technology in oil and gas exploration It can be used as a training book for lithological stratigraphic exploration and a reference for scientific and technological personnel in the oil and gas industry Authored by one of the world s foremost experts in stratigraphic and lithological reservoir exploration who has more than 30 years of experience in research and instruction Features more than 200 figures illustrations and working examples to aid the reader in retaining key concepts Presents the latest technological developments in reservoir exploration techniques Integrates theory and application arming readers with a rigorous yet practical approach to hydrocarbon exploration in stratigraphic and lithological reservoirs

Artificial Intelligence with Uncertainty Deyi Li,Yi Du,2017-05-18 This book develops a framework that shows how uncertainty in Artificial Intelligence AI expands and generalizes traditional AI It explores the uncertainties of knowledge and intelligence The authors focus on the importance of natural language the carrier of knowledge and intelligence and introduce

efficient physical methods for data mining amd control In this new edition we have more in depth description of the models and methods of which the mathematical properties are proved strictly which make these theories and methods more complete The authors also highlight their latest research results **The Biology and Technology of Intelligent Autonomous Agents** Luc Steels,2012-12-06 The NATO sponsored Advanced Study Institute The Biology and Tech nology of Intelligent Autonomous Agents was an extraordinary event For two weeks it brought together the leading proponents of the new behavior oriented approach to Artificial Intelligence in Castel Ivano near Trento The goal of the meeting was to establish a solid scientific and technological foun dation for the field of intelligent autonomous agents with a bias towards the new methodologies and techniques that have recently been developed in Ar tificial Intelligence under the strong influence of biology Major themes of the conference were bottom up AI research artificial life neural networks and techniques of emergent functionality The meeting was such an extraordinary event because it not only featured very high quality lectures on autonomous agents and the various fields feeding it but also robot laboratories which were set up by the MIT AI laboratory with a lab led by Rodney Brooks and the VUB AI laboratory with labs led by Tim Smithers and Luc Steels This way the participants could also gain practical experience and discuss in concreto what the difficulties and achievements were of different approaches In fact the meeting has been such a success that a follow up meeting is planned for September 1995 in Monte Verita Switzerland This meeting is organised by Rolf Pfeifer University of Zurich *WADC Technical Report* United States. Wright Air Development Division,1960 **Companion Technology** Susanne Biundo,Andreas Wendemuth,2017-12-04 Future technical systems will be companion systems competent assistants that provide their functionality in a completely individualized way adapting to a user s capabilities preferences requirements and current needs and taking into account both the emotional state and the situation of the individual user This book presents the enabling technology for such systems It introduces a variety of methods and techniques to implement an individualized adaptive flexible and robust behavior for technical systems by means of cognitive processes including perception cognition interaction planning and reasoning The technological developments are complemented by empirical studies from psychological and neurobiological perspectives *Pattern Recognition in biological and technical systems* ,1971 *Cross-Disciplinary Applications of Artificial Intelligence and Pattern Recognition: Advancing Technologies* Mago, Vijay Kumar,Bhatia, Nitin,2011-12-31 The need for intelligent machines in areas such as medical diagnostics biometric security systems and image processing motivates researchers to develop and explore new techniques algorithms and applications in this evolving field Cross Disciplinary Applications of Artificial Intelligence and Pattern Recognition Advancing Technologies provides a common platform for researchers to present theoretical and applied research findings for enhancing and developing intelligent systems Through its discussions of advances in and applications of pattern recognition technologies and artificial intelligence this reference highlights core concepts in biometric imagery feature recognition and other related fields along

with their applicability *The 2020 International Conference on Machine Learning and Big Data Analytics for IoT Security and Privacy* John MacIntyre,Jinghua Zhao,Xiaomeng Ma,2020-11-03 This book presents the proceedings of The 2020 International Conference on Machine Learning and Big Data Analytics for IoT Security and Privacy SPIoT 2020 held in Shanghai China on November 6 2020 Due to the COVID 19 outbreak problem SPIoT 2020 conference was held online by Tencent Meeting It provides comprehensive coverage of the latest advances and trends in information technology science and engineering addressing a number of broad themes including novel machine learning and big data analytics methods for IoT security data mining and statistical modelling for the secure IoT and machine learning based security detecting protocols which inspire the development of IoT security and privacy technologies The contributions cover a wide range of topics analytics and machine learning applications to IoT security data based metrics and risk assessment approaches for IoT data confidentiality and privacy in IoT and authentication and access control for data usage in IoT Outlining promising future research directions the book is a valuable resource for students researchers and professionals and provides a useful reference guide for newcomers to the IoT security and privacy field *Parallel Image Analysis* Akira Nakamura,Maurice Nivat,Ahmed Saoudi,Patrick S.P. Wang,Katsushi Inoue,1992-12-02 This volume contains the papers selected for presentation at the Second International Conference on Parallel Image Analysis ICPIA 92 held in Ube Japan December 21 23 1992 The conference topics are data structures parallel algorithms and architectures neural networks computational vision syntactic generation and recognition and multidimensional models The first meeting with these topics was theInternational Colloquium on Parallel Image Processing which took place in Paris in June 1991 The aim of the meetings is to bring together specialistsfrom various countries who are interested in the topics and to stimulatetheoretical and practical research in the field of parallel image processingand analysis The volume contains three invited papers a summary of a tutorial lecture and twenty selected and refereed communications *Publications of the National Institute of Standards and Technology ... Catalog* National Institute of Standards and Technology (U.S.),1971 **Systems Medicine** ,2020-08-24 Technological advances in generated molecular and cell biological data are transforming biomedical research Sequencing multi omics and imaging technologies are likely to have deep impact on the future of medical practice In parallel to technological developments methodologies to gather integrate visualize and analyze heterogeneous and large scale data sets are needed to develop new approaches for diagnosis prognosis and therapy Systems Medicine Integrative Qualitative and Computational Approaches is an innovative interdisciplinary and integrative approach that extends the concept of systems biology and the unprecedented insights that computational methods and mathematical modeling offer of the interactions and network behavior of complex biological systems to novel clinically relevant applications for the design of more successful prognostic diagnostic and therapeutic approaches This 3 volume work features 132 entries from renowned experts in the fields and covers the tools methods algorithms and data analysis workflows used for integrating and analyzing multi dimensional data

routinely generated in clinical settings with the aim of providing medical practitioners with robust clinical decision support systems Importantly the work delves into the applications of systems medicine in areas such as tumor systems biology metabolic and cardiovascular diseases as well as immunology and infectious diseases amongst others This is a fundamental resource for biomedical students and researchers as well as medical practitioners who need to need to adopt advances in computational tools and methods into the clinical practice Encyclopedic coverage one stop resource for access to information written by world leading scholars in the field of Systems Biology and Systems Medicine with easy cross referencing of related articles to promote understanding and further research Authoritative the whole work is authored and edited by recognized experts in the field with a range of different expertise ensuring a high quality standard Digitally innovative Hyperlinked references and further readings cross references and diagrams images will allow readers to easily navigate a wealth of information XIII Mediterranean Conference on Medical and Biological Engineering and Computing 2013 Laura M. Roa Romero,2013-10-01 The general theme of MEDICON 2013 is Research and Development of Technology for Sustainable Healthcare This decade is being characterized by the appearance and use of emergent technologies under development This situation has produced a tremendous impact on Medicine and Biology from which it is expected an unparalleled evolution in these disciplines towards novel concept and practices The consequence will be a significant improvement in health care and well fare i e the shift from a reactive medicine to a preventive medicine This shift implies that the citizen will play an important role in the healthcare delivery process what requires a comprehensive and personalized assistance In this context society will meet emerging media incorporated to all objects capable of providing a seamless adaptive anticipatory unobtrusive and pervasive assistance The challenge will be to remove current barriers related to the lack of knowledge required to produce new opportunities for all the society while new paradigms are created for this inclusive society to be socially and economically sustainable and respectful with the environment In this way these proceedings focus on the convergence of biomedical engineering topics ranging from formalized theory through experimental science and technological development to practical clinical applications **Technical Abstract Bulletin** ,1964 **Catalog of National Bureau of Standards Publications, 1966-1976: Key word index** United States. National Bureau of Standards. Technical Information and Publications Division,1978 **Catalog of National Bureau of Standards Publications, 1966-1976** United States. National Bureau of Standards. Technical Information and Publications Division,1978 *Neural Modeling and Neural Networks* F. Ventriglia,2013-10-22 Research in neural modeling and neural networks has escalated dramatically in the last decade acquiring along the way terms and concepts such as learning memory perception recognition which are the basis of neuropsychology Nevertheless for many neural modeling remains controversial in its purported ability to describe brain activity The difficulties in modeling are various but arise principally in identifying those elements that are fundamental for the expression and description of superior neural activity This is complicated by our incomplete knowledge

of neural structures and functions at the cellular and population levels The first step towards enhanced appreciation of the value of neural modeling and neural networks is to be aware of what has been achieved in this multidisciplinary field of research This book sets out to create such awareness Leading experts develop in twelve chapters the key topics of neural structures and functions dynamics of single neurons oscillations in groups of neurons randomness and chaos in neural activity statistical dynamics of neural networks learning memory and pattern recognition **Semantic Mining Technologies for Multimedia Databases** Tao, Dacheng,Xu, Dong,Li, Xuelong,2009-04-30 Provides an introduction to recent techniques in multimedia semantic mining necessary to researchers new to the field

Unveiling the Power of Verbal Beauty: An Emotional Sojourn through **Pattern Recognition In Biological Tech**

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