



Classification of heart rate data using artificial neural network and fuzzy equivalence relation

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Abstract

The electrocardiogram is a representative signal containing information about the condition of the heart. The shape and size of the P-QRS-T wave, the time intervals between its various peaks, etc. may contain useful information about the nature of disease afflicting the heart. However, these subtle details cannot be directly monitored by the human observer. Besides, since bio-signals are highly subjective, the symptoms may appear at random in the time scale. Therefore, the signal parameters, extracted and analysed using computers, are highly useful in diagnostics. This paper deals with the classification of certain diseases using artificial neural network (ANN) and fuzzy equivalence relations. The heart rate variability is used as the base signal from which certain parameters are extracted and presented to the ANN for classification. The same data is also used for fuzzy equivalence classifier. The feedforward architecture ANN classifier is seen to be correct in about 85% of the test cases, and the fuzzy classifier yields correct classification in over 90% of the cases. © 2002 Pattern Recognition Society. Published by Elsevier Science Ltd. All rights reserved.

Keywords: Heart rate; Pattern recognition; ECG; Neural network; Fuzzy equivalence; Disease classification

1. Introduction

Electrocardiography deals with the electrical activity of the heart. Monitored by placing sensors at the limb extremities of the subject, electrocardiogram (ECG) is a record of the origin and propagation of the electric potential through cardiac muscles. It is considered a representative signal of cardiac physiology, useful in diagnosing cardiac disorders.

The state of cardiac health is generally reflected in the shape of ECG waveform and heart rate. It may contain important pointers to the nature of diseases afflicting the heart. However, bio-signals being non-stationary signals, this reflection may occur at random in the time scale. (That is,

the disease symptoms may not show up all the time, but would manifest at certain irregular intervals during the day.) Therefore, for effective diagnostics, the study of ECG pattern and heart rate variability signal (instantaneous heart rate against time axis) may have to be carried out over several hours. Thus, the volume of the data being enormous, the study is tedious and time consuming. Naturally, the possibility of the analyst missing (or misreading) vital information is high. Therefore, computer-based analysis and classification of diseases can be very helpful in diagnostics.

The present paper makes use of heart rate variability (HRV) as the base signal for analysis and classification of diseases. The heart rate is evaluated by measuring the time interval between the successive R-peaks (*R-R* interval) of the ECG waveform. It is known that almost all the useful frequency components in ECG signal falls below 40 Hz [1], and therefore sampled at the rate of 200 samples/s. The heart rate, plotted against the time scale provides the HRV signal,

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Encyclopedia of Information Science and Technology Mehdi Khosrow-Pour, Mehdi Khosrowpour, 2009 This set of books represents a detailed compendium of authoritative research based entries that define the contemporary state of knowledge on technology Provided by publisher

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[Information, Technology in Bio- and Medical Informatics, ITBAM 2010](#) Sami Khuri, Lenka Lhotská, Nadia

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Advanced Intelligent Computing Technology and Applications De-Shuang Huang,Prashan Premaratne,Baohua Jin,Boyang Qu,Kang-Hyun Jo,Abir Hussain,2023-07-30 This three volume set of LNCS 14086 LNCS 14087 and LNCS 14088 constitutes in conjunction with the double volume set LNAI 14089 14090 the refereed proceedings of the 19th International Conference on Intelligent Computing ICIC 2023 held in Zhengzhou China in August 2023 The 337 full papers of the three proceedings volumes were carefully reviewed and selected from 828 submissions This year the conference concentrated mainly on the theories and methodologies as well as the emerging applications of intelligent computing Its aim was to unify the picture of contemporary intelligent computing techniques as an integral concept that highlights the trends in advanced computational intelligence and bridges theoretical research with applications Therefore the theme for this conference was Advanced Intelligent Computing Technology and Applications Papers that focused on this theme were solicited addressing

theories methodologies and applications in science and technology Emerging Research in Computing, Information, Communication and Applications N. R. Shetty, N.H. Prasad, N. Nalini, 2015-08-21 This proceedings volume covers the proceedings of ERCICA 2015 ERCICA provides an interdisciplinary forum for researchers professional engineers and scientists educators and technologists to discuss debate and promote research and technology in the upcoming areas of Computing Information Communication and their Applications The contents of this book cover emerging research areas in fields of Computing Information Communication and Applications This will prove useful to both researchers and practicing engineers **Intelligent Engineering Systems Through Artificial Neural Networks** Cihan H. Dagli, 1993 IEEE International Symposium on Circuits and Systems IEEE Circuits and Systems Society, 2003 These volumes relate to matters discussed during the 2003 IEEE International Symposium on Circuits and Systems such as analogue circuits and signal processing communications multimedia systems and applications general and nonlinear circuits and systems and neural networks and systems Electrical & Electronics Abstracts ,1997 **Journal of Biomechanical Engineering** ,2005 Advanced Methods and Tools for ECG Data Analysis Gari D. Clifford, Francisco Azuaje, Patrick McSharry, 2006 This practical book is the first one stop resource to offer a thorough up to date treatment of the techniques and methods used in electrocardiogram ECG data analysis from fundamental principles to the latest tools in the field The book places emphasis on the selection modeling classification and interpretation of data based on advanced signal processing and artificial intelligence techniques **ANZIIS ...** ,2001 **International Conference on Artificial Neural Networks** ,1993 **Library & Information Science Abstracts** ,2006 **Revolutionizing Cardiac Muscle Detection. Harnessing the Power of Machine Learning** Yenni Rajasekhar, 2024-01-10 Bachelor Thesis from the year 2023 in the subject Medicine Biomedical Engineering language English abstract This analysis explores advanced deep learning techniques for stock price prediction assessing transfer learning based DTRSI CNNs and collaborative networks with sentiment analysis DTRSI effectively addresses overfitting outperforming traditional models CNNs excel in predicting stock trends across time frames while collaborative networks combining sentiment analysis and candlestick data show promise particularly for specific stocks over longer periods The study investigates the relevance of sentiment analysis from platforms like Twitter and StockTwits in predicting market movements It introduces an innovative active deep learning approach for stock price forecasting considering data size and sector impact Emphasizing LSTM based models it highlights their potential to enhance stock price forecasting offering insights for traders and investors by consolidating diverse prediction methods This research lays the groundwork for future studies optimizing trading systems via data integration and advanced neural network architectures Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society IEEE Engineering in Medicine and Biology Society. Annual Conference, 1994 *The Engineering Index Bioengineering and Biotechnology Abstracts* ,1990 **Fuster and Hurst's The Heart, 15th Edition** Valentin Fuster, Jagat Narula, Prashant

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Table of Contents Classification Of Heart Rate Data Using Artificial Neural

1. Understanding the eBook Classification Of Heart Rate Data Using Artificial Neural
 - The Rise of Digital Reading Classification Of Heart Rate Data Using Artificial Neural
 - Advantages of eBooks Over Traditional Books
2. Identifying Classification Of Heart Rate Data Using Artificial Neural
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Classification Of Heart Rate Data Using Artificial Neural
 - User-Friendly Interface
4. Exploring eBook Recommendations from Classification Of Heart Rate Data Using Artificial Neural
 - Personalized Recommendations
 - Classification Of Heart Rate Data Using Artificial Neural User Reviews and Ratings

- Classification Of Heart Rate Data Using Artificial Neural and Bestseller Lists
- 5. Accessing Classification Of Heart Rate Data Using Artificial Neural Free and Paid eBooks
 - Classification Of Heart Rate Data Using Artificial Neural Public Domain eBooks
 - Classification Of Heart Rate Data Using Artificial Neural eBook Subscription Services
 - Classification Of Heart Rate Data Using Artificial Neural Budget-Friendly Options
- 6. Navigating Classification Of Heart Rate Data Using Artificial Neural eBook Formats
 - ePub, PDF, MOBI, and More
 - Classification Of Heart Rate Data Using Artificial Neural Compatibility with Devices
 - Classification Of Heart Rate Data Using Artificial Neural Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Classification Of Heart Rate Data Using Artificial Neural
 - Highlighting and Note-Taking Classification Of Heart Rate Data Using Artificial Neural
 - Interactive Elements Classification Of Heart Rate Data Using Artificial Neural
- 8. Staying Engaged with Classification Of Heart Rate Data Using Artificial Neural
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Classification Of Heart Rate Data Using Artificial Neural
- 9. Balancing eBooks and Physical Books Classification Of Heart Rate Data Using Artificial Neural
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Classification Of Heart Rate Data Using Artificial Neural
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Classification Of Heart Rate Data Using Artificial Neural
 - Setting Reading Goals Classification Of Heart Rate Data Using Artificial Neural
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Classification Of Heart Rate Data Using Artificial Neural
 - Fact-Checking eBook Content of Classification Of Heart Rate Data Using Artificial Neural
 - Distinguishing Credible Sources

13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development
 - Exploring Educational eBooks
14. Embracing eBook Trends
 - Integration of Multimedia Elements
 - Interactive and Gamified eBooks

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