



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

U. Rajendra Acharya<sup>a</sup>, P. Subbanna Bhat<sup>b</sup>, S.S. Iyengar<sup>c,\*</sup>, Ashok Rao<sup>d</sup>, Sumeet Dua<sup>e</sup>

<sup>a</sup>*Ngee Ann Polytechnic, 535 Clementi Road, Singapore, 599 409, Singapore*

<sup>b</sup>*Karnataka Regional Engineering College, Sarabahal, Srirangapatna, India 574 157*

<sup>c</sup>*Department of Computer Science, Louisiana State University, 298 Coates Hall, Baton Rouge, LA 70803, USA*

<sup>d</sup>*CEDT, IISc, Bangalore, India*

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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,

\* Corresponding author. Tel.: +1-225-578-1252; fax: +1-225-388-1465.

E-mail address: iyengar@bitnsc.lsu.edu (S.S. Iyengar).

# Classification Of Heart Rate Data Using Artificial Neural

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web besarnya tekanan hidrostatis tidak bergantung pada bentuk bejana dan jumlah zat cair dalam bejana tetapi tergantung pada massa jenis zat cair percepatan gravitasi bumi dan kedalamannya secara matematis tekanan hidrostatis disuatu titik misal didasar balok diturunkan dari konsep tekanan

*laporan praktikum penentuan massa jenis zat cair* - Oct 04 2023

web may 29 2017 penentuan massa jenis zat cair penanggung jawab ana andiana a1f015025 novia retno w a1f015035 kementerian riset teknologi dan pendidikan tinggi universitas jenderal soedirman fakultas pertanian purwokerto 2016 pendahuluan latar belakang massa jenis adalah pengukuran

*pdf praktikum menentukan massa jenis larutan zat cair* - Dec 26 2022

web praktikum menentukan massa jenis larutan zat cair praktikum fisika dasar sep 16 2021 buku praktikum fisika dasar disusun berdasarkan referensi yang relevan dan terbaru kajian dalam buku ini meliputi kompetensi dasar indikator materi pokok dan ujian kompetensi buku ini akan

laporan massa jenis dan specific gravity laporan praktikum - Mar 17 2022

web tujuan pada praktikum massa jenis dan specific gravity adalah sebagai berikut mengetahui perbandingan besar nilai massa jenis zat cair yang diperoleh pada praktikum mengetahui specific gravity zat padat dengan menggunakan hukum archimedes untuk benda yang tenggelam dan terapung

*laporan praktikum massa jenis zat cair belajar* - Sep 03 2023

web laporan praktikum massa jenis zat cair oleh nn6864 joni melakukan praktikum mengukur massa jenis zat cair zat cair yang diukur mempunyai massa 120 4 gram dan volume 20 cm 3 massa jenis zat cair tersebut sebesar gram cm 3 1 joni melakukan praktikum mengukur massa jenis zat cair