

**Constructing FHNNs to Detect CVDs through
Hemodynamic Parameters Derived from
Sphygmogram**

by

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Abstract

CONSTRUCTING FHNNS TO DETECT CVDS THROUGH
HEMODYNAMIC PARAMETERS DERIVED FROM
SPHYGMOGRAM

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Nowadays, cardiovascular diseases (CVDs) become great threat to human's lives aggressively. A good way to prevent CVDs or further eroding is early discovery, early interposing; this bechances the e-home healthcare. E-home healthcare requires convenient, low-costing and non-invasive method to monitor health status. Comparing with electrocardiogram (ECG) and photoplethysmogram (PPG), sphygmogram (SPG) owns the advantages of easy to sample, with bigger signal to noise ratio (SNR) and having rich physiological information. Complying with the Chinese medicine and hemodynamic theory, SPG owns potential to monitor the health status of cardiovascular system.

The Chinese medical interpretation of SPG is still a little bit mysterious, and then hemodynamic analysis emerges for its elasticity theory base and objectivity. Using formulas and empirical values, a SPG can be converted to a group of hemodynamic parameters (HDPs). These HDPs have specific meaning to represent some aspect of cardiovascular status.

The essential part of CVDs diagnosis is constructing mapping relationship between HDPs and CVDs. Some early researches have explored such a relation and developed rule-based CVDs diagnostic prototyping systems, although the explicit knowledge has not been fully discovered till now. Based on the explored mapping relationship, it is

necessary to further develop effective schemes for CVDs diagnosis and decision-making support systems.

The fundamental objective of noninvasive sphygmogram analysis via artificial intelligence is to detect ‘abnormal’ health conditions, and further to indicate what CVD does patient have. It is desired to elucidate the branches of ‘abnormal’ health conditions first, for example, coronary heart disease, hypertension, hyperlipemia and others. A high accurate method to indicate specific CVD is needed for further detection in details.

For the realistic patients and clinical cases, it is common to be bogged by mixed cardiovascular diseases. As a matter of fact, it has been recognized that over-lapped ranges of HDPs is the obstacle in clinical diagnosing. Ceased effectiveness of binary discriminating method calls for multiple diseases diagnosis ability. The more concrete disease can be pointed out, the more meaningful to prevent and control in detail.

It is common to test the proposed methods or schemes by simulation or ready database; while still far from real situations. On contrary, our proposed method is examined by site-sampled data. Obviously, only through real clinical sampling and testing, can a method be accepted and verified. To test constructed framework, compare the accuracy with other conventional schemes, empirical sampling and clinical testing are carried out at the end.

Key words: Artificial Intelligence, Fused Hierarchical Neural Networks, Diagnosis, Cardiovascular Diseases, Sphygmogram, e-home healthcare

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LIST OF ABBREVIATIONS

AI: Artificial Intelligence

ANNs: Artificial Neural Networks

ANOVA: Analysis of Variance

BP: Blood Pressure

CVD: Cardiovascular Disease

CHD: Coronary Heart Disease

ECG: Electrocardiogram

ES: Expert System

FFNNs: Fuzzy Feed-forward Neural Networks

FHNNs: Fused Hierarchical Neural Networks

FL: Fuzzy Logic

HDP: Hemodynamic Parameter

HFNNs: Hierarchical Fuzzy Neural Networks

HL: Hyperlipemia

HT: Hypertension

LVQ: Learning Vector Machine

NNs: Neural networks

PNNs: Probabilistic Neural Networks

SA: Statistical Analysis

SPG: Sphygmogram

SVM: Support Vector Machine

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DEDICATION

The author wishes to dedicate this thesis to my mother.

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