

UNIVERSITI TEKNOLOGI MARA

**DEVELOPMENT OF NOISE
INDUCED HEARING LOSS
PREDICTION MODEL USING
ARTIFICIAL NEURAL NETWORK**

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ABSTRACT

Noise Induced Hearing Loss (NIHL) was the highest reported cases of occupational disease in 2016. Despite the high incidence reported, studies in the method of predictive modelling causes were limited. Hence, this research proposed the development of Artificial Neural Network (ANN) as a tool to identify and predict risk factors contributed to NIHL. ANN was chosen in this study since it was proven to predict few diseases including coronary heart disease, diabetes, liver cancer and otitis media disease. There are a lot of prediction techniques available in computational models, but this project explored on the Feed Forward Backpropagation Networks as it has been used in predicting complex diseases. This model using a design approach of 24 inputs and 5 binary output layers. The 24 input layers encompassed 12 risk factors and 12 audiogram variables. It also embedded with 10 hidden layers in the prediction models using Levenberg-Marquardt algorithm as a transfer function from input vectors to the five binary outputs. The binary output vectors referred are according to the World Health Organization (WHO) standard, which are classified as either normal, mild, moderate, severe, and profound. The study was focus on examining 355 secondary data extracted from NIHL confirmed cases provided by the Department of Occupational Safety and Health (DOSH), Selangor State. The data were randomly divided into two arms using the Random Selection Method; 300 for MATLAB and 55 for validation through web application after the prediction model was developed. The 300 cases were categorized into three big groups; 70% were used as samples to train the ANN to predict the output according to the WHO standard, and 15% each were used as data for validating and testing the output respectively. The average performance of ANN prediction model through 10 times test was 90.46%. In the final stage the ANN prediction model code was converted into python code to be used in the NIHL web application as inference engine. The inference engine was used a system to perform the prediction in web based application. The system was injected with 55 new data into web based application for monitoring and validating the overall process of the system. Since the prediction model for NIHL using ANN was successfully provided high accuracy prediction results, this innovation was able to be an intelligent system in assisting the screening process for suspected patients before referring them to the NIHL expertise and Occupational Health Doctor (OHD). The contribution of this research has support the Occupational Safety and Health Master Plan 2015-2020 which were to improve preventive culture in the country and create a solution to the statutory body or authorities especially DOSH to solve their manpower shortage problem.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

This section sets forth the rationale, significance and objectives of the study. It includes research background, problem statement, research objectives, research questions, research hypothesis and significance of the study, limitations, scope of the study as well as definitions and terms for clinical words used in this study.

1.2 Research Background

Noise is a form of pollutants that is terrorizing the occupational health experts for many decades due to the adverse side-effects on the workers in the industry [1]. The Department of Occupational Safety and Health (DOSH) Malaysia annual report showed a consistent increase trend of Noise-Induced Hearing Loss (NIHL) cases based on compensation applications submitted to the Social Security Organization (SOCSO). In general, DOSH and SOCSO Malaysia are the legislative bodies under the Ministry of Human Resource Malaysia. DOSH is a government body that responsible in handling all issues that related to Occupational Safety and Health (OSH), meanwhile, SOCSO's responsibility focusing more to implementing and enforcing the Employers Social Security Act (AKSP) 1969 and the Social Security General Labor 1971 Regulations.

NIHL is a hearing disease that commonly detected among the worker and classified as one of occupational disease. NIHL reported cases will be referred to the Occupational Health Doctor (OHD) for further investigation. OHD is a certified doctor that is registered under DOSH who responsible for investigating occupational disease cases that has been reported. In Malaysia, NIHL disease recorded by the DOSH from year 2013 to 2016 were exponentially increasing about more than 3000 cases; from 2588 to 6020 cases and the confirmed cases were from 1821 to 3890 respectively. The increment number of cases reported is in line with the prediction by the World Health Organization (WHO). WHO had predicted that the number of people with hearing loss in 2018 was 6.1% (466 million) from the world population. Based on the data projected in 2008, the number of people that will be suffering from hearing loss will keep