THESIS

ARTIFICIAL NEURAL NETWORK and ITS APPLICATION IN MEDICAL DISEASE PREDICTION: REVIEW ARTICLE

by

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A Thesis

Submitted in partial fulfillment of the requirements for the degree of
Master of Biomedical Engineering (M.T)

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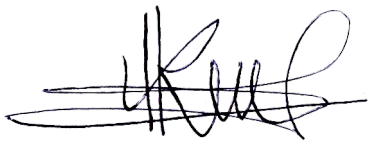

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STATEMENT OF ORIGINALITY

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Putri Alief Siswanto

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SUMMARY

Application of artificial intelligence (AI) in medicine is escalating in the last few decades. Artificial Neural Network (ANN) is among the most explored area of AI. Main feature of ANN is its proficiency in modeling complex non-linear problems in which conventional statistic fails to do so. Such approach is highly attractive for diagnostic or prognostic purpose.

Overview of some aspects of ANN such as definition, components, network architecture, training algorithm, backpropagation method had been described in this review as comprehensive understanding is required prior the application of ANN.

Application of ANN in medical disease prediction is summarized. Modelling techniques and its aspect for potential improvement are also carefully assessed. Ten studies were included, six were multicenter studies, eight were prognostic studies. Three studies reported on fewer than 500 patients, model validation were assessed in 9 studies and primarily used n-fold cross validation, backpropagation is carried out in 6 studies and only half of the studies reporting measure of discrimination and calibration. Results of nine studies yielded better performance over logistic regression but statistical insignificance were mostly found.

Prognostic models require more stochastic predictors than diagnostic studies which relevant to the feature of ANN. ANN could perform more than just binary outcome and having diverse findings would be much favorable. Attention to the accuracy of training data is necessary in which it should represent all the inputs needed to precisely produce the output since even extreme values in data can be well represented if it is included in training data and vice versa. Internal validation method such as bootstrapping or cross-validation should be preferred for small datasets as it provided much better estimates. Backpropagation is mostly employed although in general has slower convergence but it is in trade for better accuracy. Performance of the model depends heavily on the selection of predictors than modeling strategies hence methodological advice is to rely on expertise or literature findings to consider the appropriate clinical criteria for variable selection. Studies must report both performance measurement (discrimination and calibration). Results from both training and testing phase should also be reported so others could consider whether the model is overfitting. Prior to ulitization of ANN available software, concern for software accuracy is essential.

In particular cases when ANN is compared against traditional statistical method such as logistic regression, ANN will certainly outperform regression because ANN is capable of handling more complex problems in which conventional computation like logistic regression fails to do so. If the results stated otherwise, then one must consider the accuracy of training data, variable selection and network parameter. ANN and logistic regression might be used in complementary manner when there is no clinical criteria available as regression helps to identify those variables that might be good predictors.