ABSTRACT

THESIS: Applications of Artificial Neural Networks (ANNs) and Random Forest (RF) for Temperature Prediction

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Artificial Neural Networks (ANNs) and Random Forest (RF) have been used in various domains for modeling and prediction with high accuracy due to their ability to learn and adapt. One of the major applications of ANNs and RF is temperature prediction. For instance, neural networks and random forest have been trained to build models to predict soil temperature, air temperature, sea surface temperature, etc., with minimal errors, and significant accuracy. This thesis concentrates on designing ANNs and RF prediction models to predict the surface temperature of a bridge.

Surface temperature plays an important role in homes, agriculture, industry, and engineering fields. Accurate surface temperature prediction can help improve productivity and avoid risks on many roads and bridges. ANNs and RF have been largely used by engineers for the measurement of diffusion-based overlay detection of structural damage fault, medical image processing for diagnosis of any symptoms, wind turbine based which is Simulink and fast, and others. Our goal is to research, put into practice, and recommend Artificial Neural Networks and Random Forest as more accurate machine learning approaches for temperature prediction.

Currently, many machine learning methods such as Multiple Linear Regression (MLR), Survival Forest (SF), Decision Tree, Support Vector Machine (SVM), and others, have been applied to surface temperature prediction. In this study, we will use artificial neural networks and random forest to the predict average surface temperature given the Direct Normal Irradiance (DNI), air temperature, humidity, and wind speed of a non-heated zone of a bridge as features in our dataset. To be precise, we intend to use the existing dataset and apply the Gradient Descent

Backpropagation (GDBP) and the RF techniques to build a predictive model for average surface temperature. To demonstrate how powerful ANNs and RF are as key machine learning methods for better temperature prediction, the predicted temperature values were compared with the actual (true) temperature values. The results showed that both ANNs and RF algorithms can predict the average surface temperature with high accuracy, but RF performed better than ANNs.