Predicting Reservoir Water Levels using Deep Learning

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May 2018

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Acknowledgements

My sincere appreciation goes to my family for the continuous support and motivation given to make this thesis a success. I also express my heartfelt gratitude to Dr. Amal Shehan Perera, my supervisor, for the supervision and advice given throughout to make this research a success. I also thank my parents, sister and brother-in-law for their heartfelt support. I am also thankful to Mr. Sanjaya Ratnayake for providing the required data. Last but not least I also thank my friends who supported me in this whole effort.

ABSTRACT

Currently the authorities in the field of water resource management for irrigation and hydro power electricity in Sri Lanka make use of basic forecasting methodology in order to make decisions with respect to water resource management. The results of this research would be useful to the relevant authorities as it would provide them an indication of the excepted water levels allowing them to make vital decisions regarding the competing needs such as water resource management for irrigation as opposed to water resource management for hydro power electricity generation during the monsoonal as well as inter-monsoonal periods with the use of the latest predictive framework with respect to artificial intelligence technology.

Most of the current research in this area use models such as multi-linear regression, support vector machines and artificial neural networks such as adaptive neuro-fuzzy inference systems to provide predictions for hydrological models. The models are developed for varying levels of granularity with respect to time such as daily and weekly depending on the need to forecast water levels for reservoirs.

This research will focus on the novel deep learning techniques of LSTM (Long Short-Term Memory) and GRU (Gated Recurrent Unit) recurrent neural networks as opposed to the conventional machine learning approaches. Historical daily water levels will be used as inputs along with meteorological variables at other nearby reservoirs to do forecast future values. These methods will be benchmarked against traditional baseline machine learning techniques to validate how much of a predictive gain can be obtained by use of the deep learning techniques. Furthermore, this research will evaluate the suitability of the aforementioned techniques to make predictions regarding the water level input by the usage of various metrics such as mean square error as the cost function which can be used to validate the output of the above models.

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List of Abbreviations

Abbreviation	Description
ARMA	Auto Regressive Moving Average
MLR	Multi Linear Regression
ANN	Artificial Neural Network
AR	Auto Regressive
MLP	Multi-Layer Perceptron
MA	Moving Average
MSE	Mean Square Error
MAE	Mean Absolute Error
RBF	Radial Basis Function
ANFIS	Adaptive Neuro-Fuzzy Inference System
SVM	Support Vector Machine
RNN	Recurrent Neural Network
LSTM	Long Short-Term Memory