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Development of Ensemble Model Based Water Demand Forecasting Model

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ABSTRACT

In recent years, Smart Water Grid (SWG) concept has globally emerged over the last decade and also gained significant recognition in South Korea. Especially, there has been growing interest in water demand forecast and optimal pump operation and this has led to various studies regarding energy saving and improvement of water supply reliability. Existing water demand forecasting models are categorized into two groups in view of modeling and predicting their behavior in time series. One is to consider embedded patterns such as seasonality, periodicity and trends, and the other one is an autoregressive model that is using short memory Markovian processes (Emmanuel et al., 2012). The main disadvantage of the abovementioned model is that there is a limit to predictability of water demands of about sub-daily scale because the system is nonlinear. In this regard, this study aims to develop a nonlinear ensemble model for hourly water demand forecasting which allow us to estimate uncertainties across different model classes. The proposed model is consist of two parts. One is a multi-model scheme that is based on combination of independent prediction model. The other one is a cross validation scheme named Bagging approach introduced by Brieman (1996) to derive weighting factors corresponding to individual models. Individual forecasting models that used in this study are linear regression analysis model, polynomial regression, multivariate adaptive regression splines(MARS), SVM(support vector machine). The concepts are demonstrated through application to observed from water plant at several locations in the South Korea.

Keywords: water demand, non-linear model, the ensemble forecasting model, uncertainty.

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