# MACHINE LEARNING-BASED PROBABILISTIC ENSEMBLE FOR URBAN WATER DEMAND FORECASTING

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Quality forecast of urban water demand is critical to effective water resource management. Machine learning and ensemble techniques have been widely adopted to provide accurate deterministic forecasts but have less emphasis on uncertainty quantification (UQ). Here we propose a novel probabilistic ensemble scheme that can capture different aspects of predictive uncertainties in water demand forecasts. We first propose or identify UQ techniques for an array of popular machine learning algorithms, including random forest, gradient boosting machine, and neural network. Then, we implement the ensemble scheme to estimate the predictive uncertainty for long- and short-term future monthly water demand on a household level. The results show that our ensemble scheme successfully improves the predictive distribution regarding log-likelihood from all individual models in both long- and short-term forecasting problems. To further assist the decision-making process in water management, we provide a long short-term memory (LSTM) model with deterministic forecasting accuracy as the primary concern. The model is parsimonious (requires monitoring only two variables to make forecasts), light, and accurate, which is practically useful for operations.

**PRESENTER BIO**: Yi Han is a Ph.D. candidate in Agricultural and Biological Engineering department at the University of Florida. His expertise and research interests include statistics, machine learning, and deep learning for agricultural and environmental problems.