# Prediction of Intravesical Urine Volume Considering Individual Characteristics on Accumulative Transition

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## ABSTRACT

Urinary tract infections (UTI) are common infections in healthcare facilities and hospitals. Staff members often manage their patients' urination needs with a catheterization, which relapses the UTI. Therefore, patients need another way for staff to take care of each patients' urination without catheterization, though this increases the staff's work burden. If staff could predict how the urine volume accumulates in the bladder in advance, a care schedule could be made easily; and can reduce staff's work burden. Therefore, we propose a method for predicting the volume of accumulated urine utilizing data measured by an ultrasonic sensor. The proposed method is based on a deterministic model as a differential equation that represents the dynamics of the urine volume accumulation in the bladder, and utilizes the multi-task Gaussian process technique in the model. The Gaussian process predicts urinary volume at each moment by learning patients' individual characteristics on accumulative transition from the training data on people are mixed. To evaluate the accuracy of the proposed method, we carried out a validity experiment with six subjects. In the experiment, we asked the subject to wear the ultrasonic sensor to measure urine volume during the experiment. The data measured by the ultrasonic sensor are applied to train the Gaussian process. The mean absolute error (MAE) between the predicted urine volume and the actual urine volume as measured by the ultrasonic sensor were calculated to evaluate the accuracy of the prediction. The results showed that the average MAE is 71.08 ml.

Keywords: multi-task Gaussian process; ultrasonic sensor; nursing; urinary volume; urinary tract infection