

# Predicting Readmission of Heart Failure Patients

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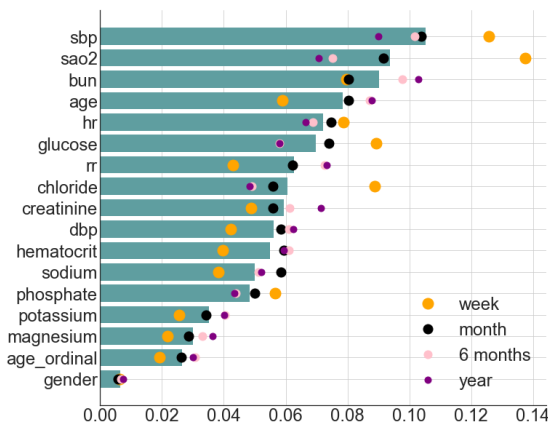
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Heart failure is the main reason for readmission in hospitals especially for patients over age 65. To prevent heart failure recurrence, and to reduce the burden on the health care system, we propose a method to predict HF recurrence for patients leaving intensive care units.

We use structural data from the freely available MIMIC-III database. We retrieved 2 demographic attributes, age ( $73.09 \pm 13.13$ ) and sex (3,692 women and 4005 men), 5 nurse-verified physiological measurements from electronic charts recorded on the last day in the ICU, and 10 laboratory features from the blood for 7,697 patients.

We predict heart failure with 4 random forest models at time intervals up to a week, a month, half a year and a year. Optimal hyperparameters are calculated for each of the individual models using grid search and 5-fold cross-validation on the training set. Next, an ensemble model was constructed from these four submodels. The test part of the data (N=1,234) was dichotomized by the ensemble model and survival analysis was performed over a time period of 5.6 years.



Random forest feature importance

Results of the log-rank test for dichotomized cohort show a significant difference ( $p < 0.0001$ ) and a Hazard ratio of 3.68 (2.68-5.05). We also examined the RF feature importance. The 4 most important features according to the Gini importance namely systolic blood pressure, blood oxygen saturation blood urea nitrogen, and heart rate

are consistent with the parameters observed during the discharge of patients from the ICU according to the guidelines. Our model also suggests that age and blood glucose play a significant role in predicting HF recurrence, especially within one week after hospitalization.