

Towards Speech-Based Early Detection of Heart Failure Decompensation

Benjamin Cauchi, Andreas Hein

Carl von Ossietzky University
Oldenburg, Germany

Patients with heart failure are at high risk of recurrent decompensation and rehospitalization after discharge. Early detection of clinical deterioration is therefore essential, creating a need for reliable, non-intrusive methods suitable for long-term monitoring at home. In this study, we investigate whether patient status can be estimated from voice recordings alone. Voice data were collected in the hospital from 20 patients admitted for heart failure decompensation and discharged after successful recompensation. Recordings were acquired at regular intervals from admission to discharge, and each sample was labeled according to the clinical status assigned by a cardiologist during the corresponding visit. Our results indicate that a combination of autoencoder-based feature extraction and a compact recurrent neural network (RNN) can predict patient status using voice recordings alone. The autoencoder feature extractor was trained, unsupervised, on a large corpus of clean, publicly available speech recordings. The resulting features were then input to the RNN-based predicting function trained and evaluated using 5-fold cross validation. The agreement between predicted and clinician-assigned status was promising, with both linear and rank correlations of about 0.8. These findings provide an encouraging proof of concept for non-intrusive voice-based monitoring of heart failure patients. Despite the small considered cohort and the recordings currently being done from decompensation to recompensation in an hospital setting, this approach could be extended to support early detection of decompensation in at-risk patients in a home monitoring setting.