

The utility of discharge summaries and nursing notes among Medicare patients with heart failure to predict 30-day rehospitalization: a pilot study



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INTRODUCTION

- Nearly 80% of all patients with heart failure (HF) are older adults (≥65 years of age): at high risk for frequent hospitalizations
- HF is one of the diagnoses for which the Centers for Medicare & Medicaid Services initiated public report on 30-day risk-standardized rehospitalization rates
- Predictive models to predict the risk of 30-day rehospitalization
- Not showing high validity such as low score of the area under the curve (AUC):Most of these studies used the structured data from electronic health records and did not contain free-text clinical notes

OBJECTIVES

To identify clinical notes for building a predictive model for risk of 30-day rehospitalization among Medicare patients with HF

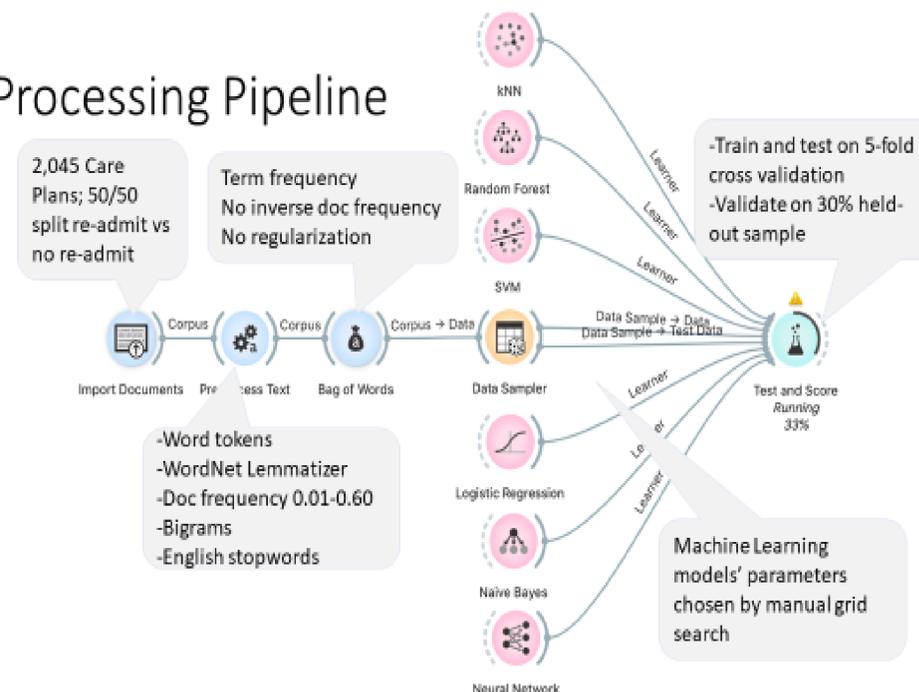
METHODS

- Free-text discharge summary notes and nursing care plans collected from June 1, 2015 to December 31, 2019, for a randomly selected 500 Medicare patients with HF.
- All Medicare patients who were discharged in that time period with a diagnosis of HF

METHODS

- Natural Language Processing (NLP):two models
 - The classification model called Bag-of Words (BOW), where each document is represented by a vector based on the pre-processed text
 - Document Embedding, where document terms are mapped to a dimension-reducing layer : exceptionally fast
- Machine Learning (ML): the output of the NLP BOW and Document Embedding models were fed to six different conventional machine learning systems :logistic regression (LR), support vector machine (SVM), random forest, k-nearest neighbor (KNN) clustering, neural network, and Naïve Bayes.

NLP Processing Pipeline



RESULTS

- The mean age:, 77 ± 7.9
- The average of length of hospital stay : 4.9 days ± 4.8

ML model performance :Discharge summaries

ML model	AUC	CA	F1	Precision	Recall
Neural Network	0.74	0.63	0.61	0.68	0.63
Random Forest	0.72	0.63	0.62	0.65	0.63
Naïve Bayes	0.71	0.64	0.62	0.68	0.64
LR	0.59	0.53	0.53	0.53	0.53
kNN	0.56	0.52	0.52	0.59	0.56
SVM	0.36	0.41	0.41	0.66	0.53

ML model performance: Nursing care plan notes

ML model	AUC	CA	F1	Precision	Recall
Neural Network	0.83	0.74	0.74	0.74	0.74
Random Forest	0.82	0.74	0.74	0.74	0.74
Naïve Bayes	0.79	0.73	0.73	0.73	0.73
LR	0.78	0.72	0.72	0.72	0.72
kNN	0.62	0.59	0.59	0.59	0.59
SVM	0.58	0.51	0.35	0.68	0.51

CONCLUSIONS

Nursing care plan notes are a better predictor of 30-day rehospitalization risk than discharge summaries. Because nursing care plans are shorter than discharge summaries, they have the added advantage of faster processing.

PRODUCTS

- Nursing Investigator Award: 2020 Heart Failure Society Of America conference
- PCORI full application is in review
- Paper is in print: Journal of Cardiovascular Nursing