ICU Mortality Risk Prediction: Model development and Operational Application

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Objectives

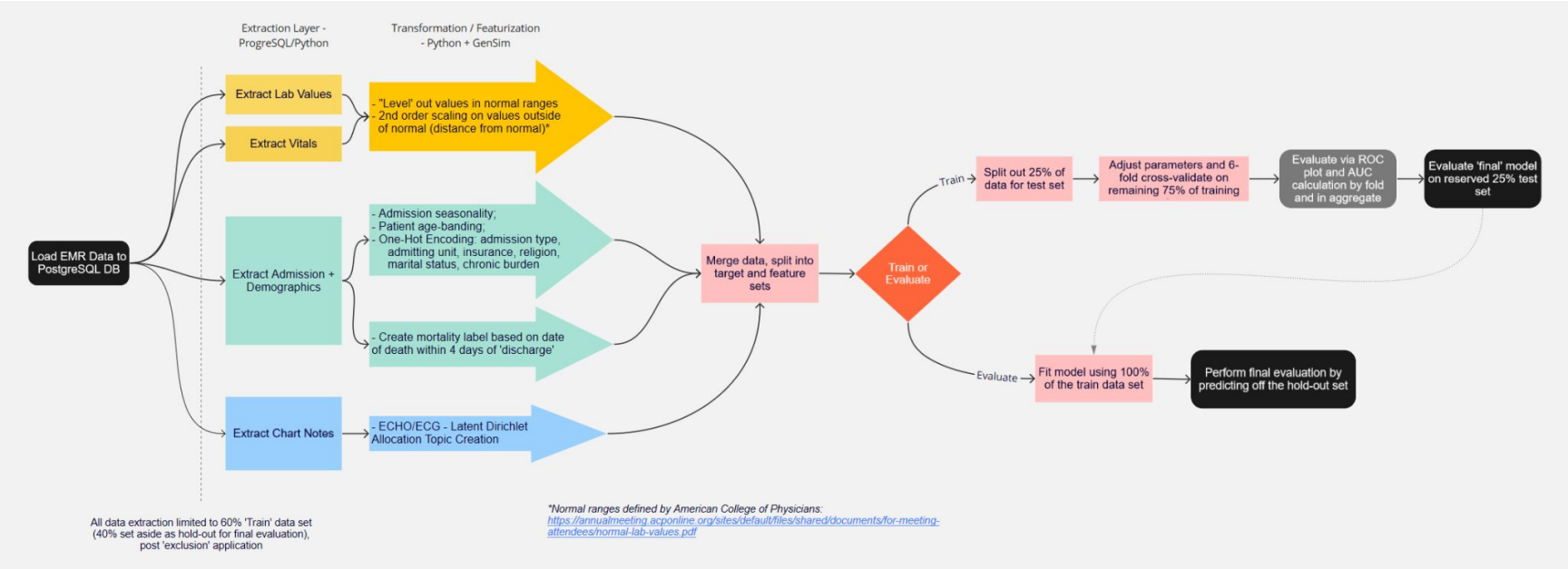
- Build a mortality risk prediction model for intensive care unit (ICU) patients
  - ‘Risk of death in the next four days’
- Develop a proof-of-concept ICU management dashboard
  - Use ‘live’ electronic medical record (EMR) data
  - Incorporate patient-specific mortality risk predictions

The Data - MIMIC III Dataset*

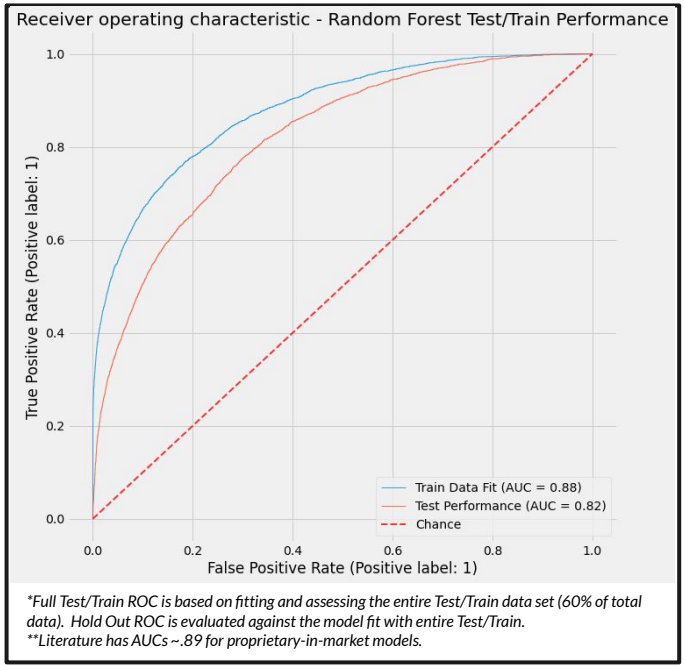
- 10 years of ICU admission data from Beth Israel Deaconess Medical Center
  - Demographics
  - Lab test results
  - Vital sign measurements (~hourly)
  - Chart notes
  - Medications
  - Billing, coding, and discharge information *(excluded from consideration here)*
- Retrospectively added mortality indicators (including post-hospital discharge)

MIMIC-III, a freely accessible critical care database. Johnson AEW, Pollard TJ, Shen L, Lehman L, Feng M, Ghassemi M, Moody B, Szolovits P, Celi LA, and Mark RG. Scientific Data (2016). DOI: 10.1038/sdata.2016.35. Available from: http://www.nature.com/articles/sdata201635

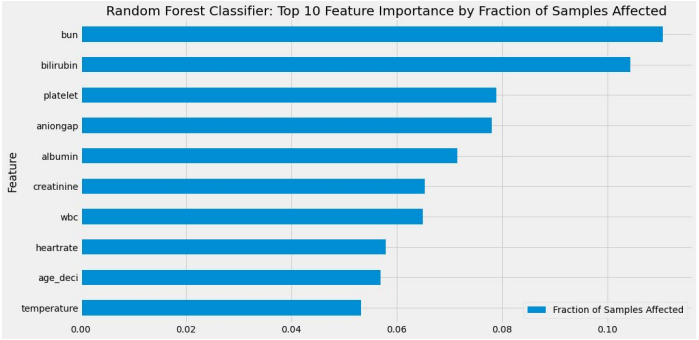
Model Creation Pipeline

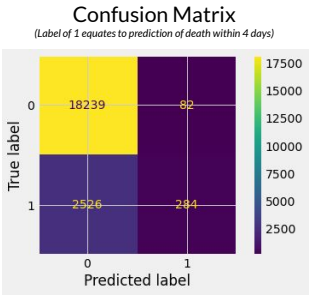


Best-fit Model Performance



**Full Test/Train ROC is based on fitting and assessing the entire Test/Train data set (60% of total data). Hold Out ROC is evaluated against the model fit with entire Test/Train.*
***Literature has AUCs ~.89 for proprietary-in-market models.*

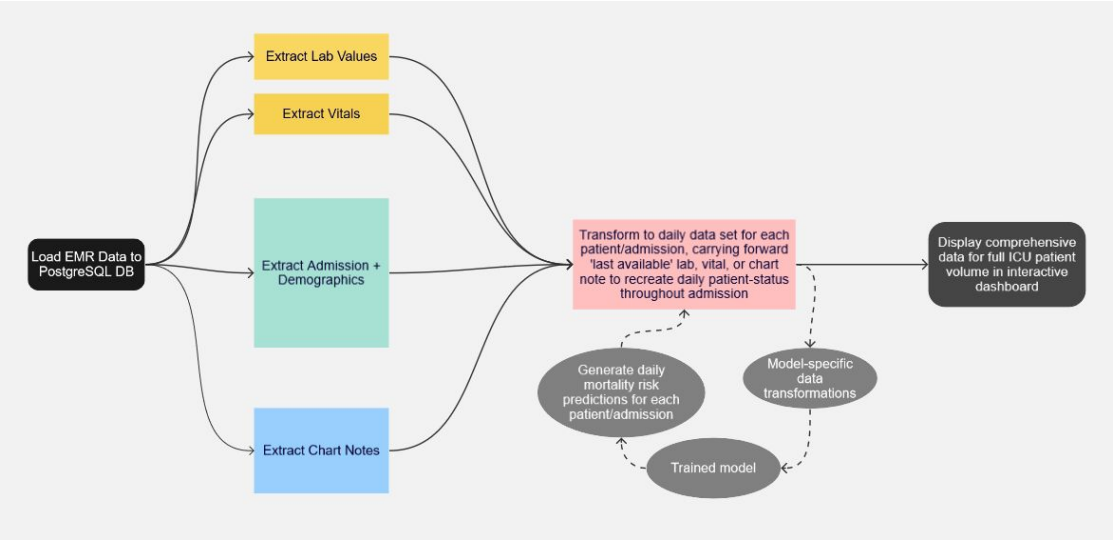




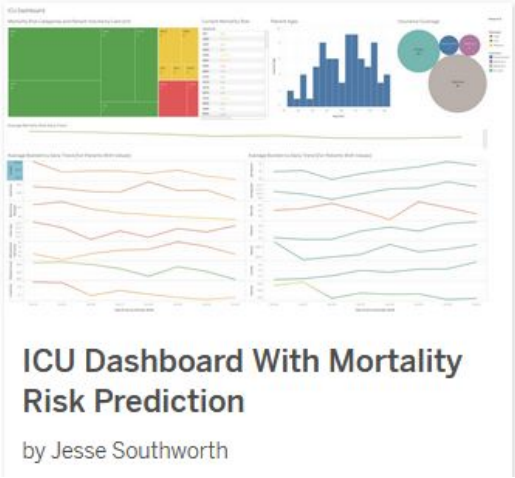
Opportunities for refinement:

- Expand beyond ECHO/ECG notes
- Adjust probability threshold below .5
- Create lab/vitals trend features
- Additional models and ensembling

Application via Operational Dashboard



[Dashboard on Tableau Public]



Thank you!

Learn more at:
https://github.com/qitoahc/ICU_mortality_risk_monitoring