COVID-19 Patient Outcomes

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Overview of Presentation

- Introduction
- ML Modeling
- iOS App
- Web App
Introduction: The Problem
Introduction

Central Problem

- Administering care during this pandemic has been quite difficult
- Since the rate of infections has put quite a strain on hospitals, many physicians have had difficulties in administering the most efficient care

Proposed Solution

- We propose an iOS app that may help physicians efficiently administer care to patients.
- Within the app, we offer AI models and visualizations to guide physicians in administering care to their patients
Overview of Our Tool

- We created an iOS app that interfaces with our various AI models to determine a patient’s likelihood of death from the virus.
- We also created a website of visualizations and asked physicians for feedback on these visualizations.
ML Modeling
ML Modeling: Quick Details

- Dataset: Covid-19 Hospitalizations in Mexico (N = 121,788)
- Models
  - “Death Outcomes” model: Based on certain attributes, will a patient die from the virus
  - “Clustering Death Likelihood” model: Based on similar patients, what is a particular patient’s likelihood of death
- Prediction of Models
  - Predicting if a patient will die from the coronavirus
  - Clustering assignment of patient to find likelihood of death
ML Modeling: Data

- Within the original dataset we have 23 columns
  - Each column refers to if a patient has a certain pre-existing condition, their sex, date of symptoms, etc.
  - Most columns are binary where “1” refers to “yes” and “2” refers to “no” and “97” refers to an empty value
ML Modeling: Death Outcomes Model Results

- Train-test split: 80-20
- CV: K-Fold Cross Validation on train set (N = 7)
- Model used: Extreme Gradient Boosting
- Accuracy: 76%

- Most Important Features: Does the patient have pneumonia, do they have diabetes, are they obese, are they older, were the intubated
- Fairness: Slight accuracy discrepancy between men and women
- Takeaway: The model is particularly concerned with comorbidities such as obesity
ML Modeling: Patient Likelihood Cluster Model Results

- Applied 2-Sample Kolmogorov-Smirnov Tests to validate clusters
- Found 7 clusters or “groups” were ideal for synthesizing similarities amongst patient
- Created a MiniBatch KMeans model with the 7 clusters
ML Modeling: Model Card For Transparency

Death Outcomes Model Card

- **Model Details**
  - Creators of model is Ayo Olutade, Jeremey Kemery, and Joel Afriyie
  - Used Extreme Gradient Boosting from xgboost library in python (version 1.2.0)
  - Applied Demographic Parity to equalize prediction accuracy between men and women

- **Intended Use**
  - This model will be used in an iOS app so that physicians can view predictive information about their patients
  - Intended users are healthcare professionals
  - This model should not be accessed by insurance or hospital executives

Note: This Model Card is not exhaustive. We provide a more detailed version in our paper
Core ML

Apple’s machine learning framework
Converted SKLearn model to Core ML
Integration with iOS app
Limited support for SKLearn
Predict

Manage a list of patients & info

Generate COVID outcome predictions anonymously

Inline predictions for easier usage

Visualization of patient similarity
Audit

Dashboard for visualizing patient data

User customizable glanceable info

View trends in cases

Verify model accuracy
Demo
Web App
Web App

- Wanted to make sure that the website was simple and easy to use
- When our AI assistant made a prognosis, we wanted to make sure that the information and visualizations that we showed were meaningful
Framework

- Dash (https://plotly.com/dash/)
- Allows us to build ML and Data Science Webapps.
Main Tabs

- Home Tab
- Patient Info
  - Where physicians can input patient’s data
  - See the Prognosis and visualizations
- How it Works ->
  - Explains how AI systems learn
- Feedback
  - Contains a survey
How did we get Feedback?

For each physician that we worked with:

- Gave an intro of what our website does and why it would benefit them
- Ran 1 on 1 demos
- During/after demo the physician would give feedback
- Update the website and repeat
Some of the Feedback

- Age grouping (follow CDC guidelines)
- Keep “How it Works” content very concise
- Inpatient vs Outpatient (limitations)
Q & A