COVID-19 Patient Outcomes

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Overview of Presentation

- Introduction
- ML Modeling
- iOS App
- Web App

Introduction: The Problem

Introduction

Central Problem

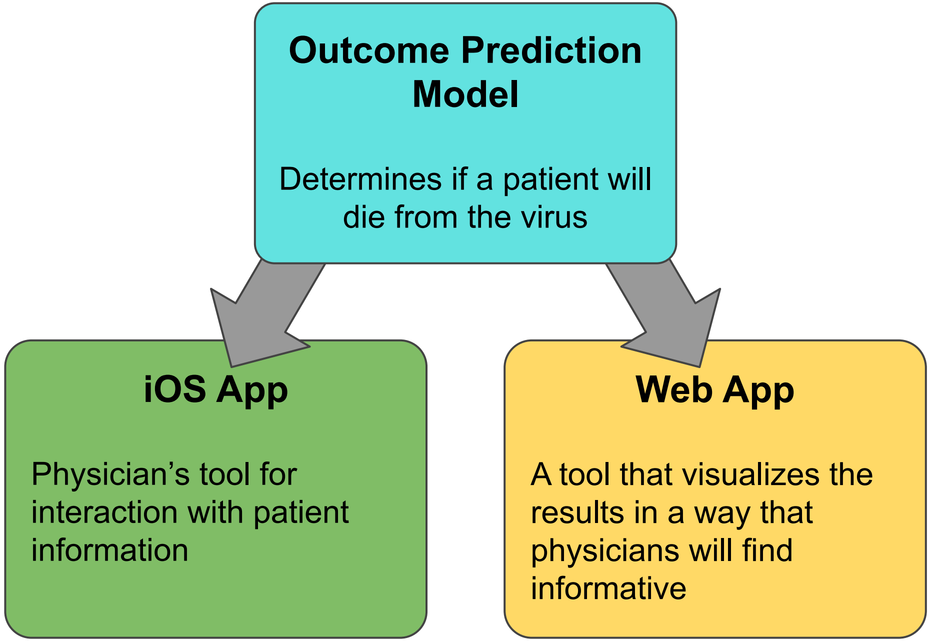
- Administering care during this pandemic has been quite difficult
- Since the rate of infections has put quite a strain on hospitals, many physicians have had difficulties in administering the most efficient care

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



Outcome Prediction Model

Determines if a patient will die from the virus

iOS App

Physician's tool for interaction with patient information

Web App

A tool that visualizes the results in a way that physicians will find informative

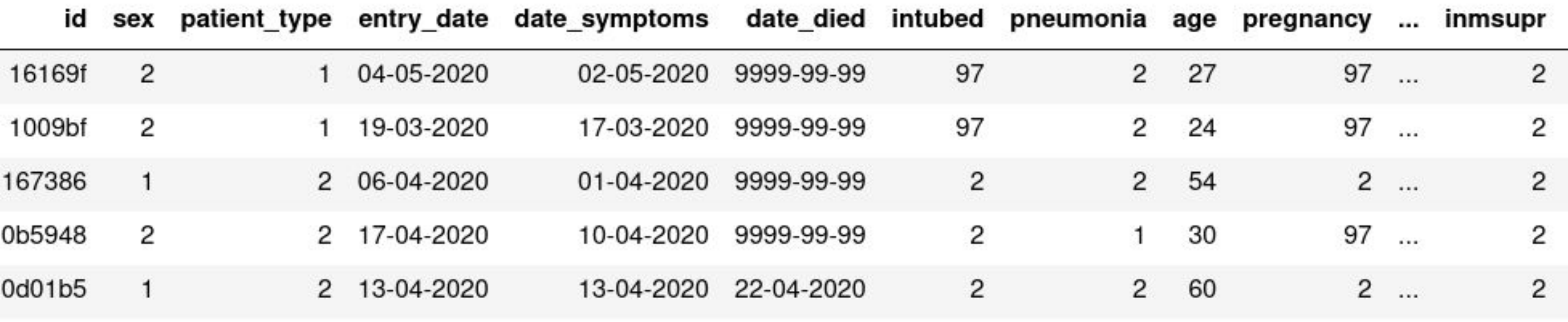
ML Modeling

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



id	sex	patient_type	entry_date	date_symptoms	date_died	intubed	pneumonia	age	pregnancy	...	inmsupr
16169f	2	1	04-05-2020	02-05-2020	9999-99-99	97	2	27	97	...	2
1009bf	2	1	19-03-2020	17-03-2020	9999-99-99	97	2	24	97	...	2
167386	1	2	06-04-2020	01-04-2020	9999-99-99	2	2	54	2	...	2
0b5948	2	2	17-04-2020	10-04-2020	9999-99-99	2	1	30	97	...	2
0d01b5	1	2	13-04-2020	13-04-2020	22-04-2020	2	2	60	2	...	2

ML Modeling: Death Outcomes Model Results

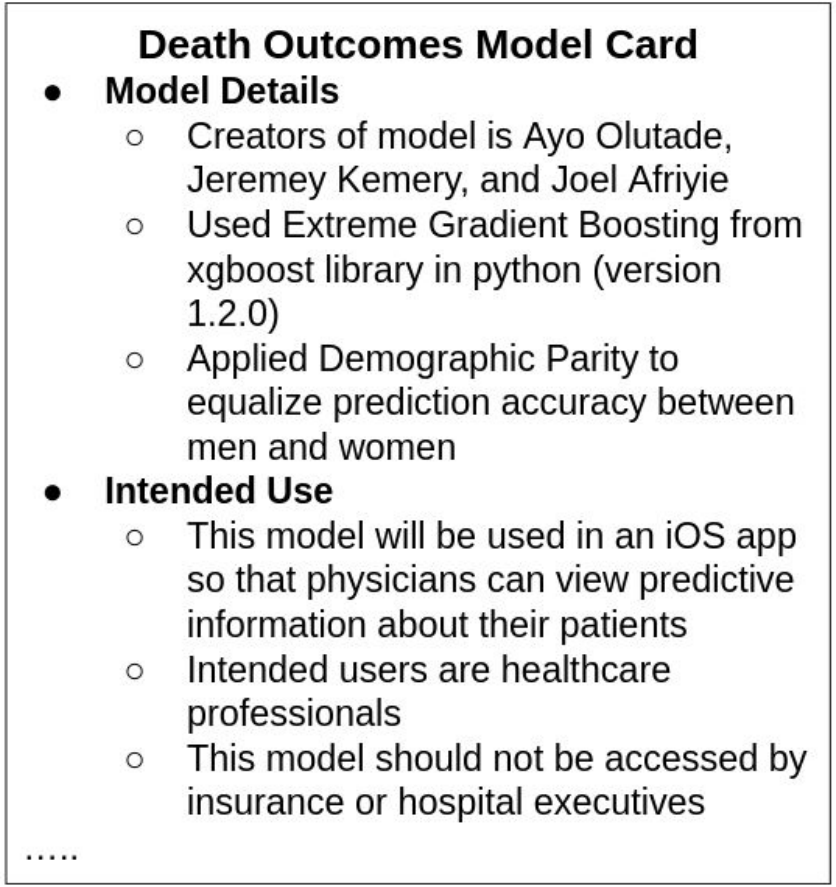
- Train-test split: 80-20
- CV: K-Fold Cross Validation on train set (N = 7)
- Model used: Extreme Gradient Boosting
- Accuracy: 76%

- 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

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

iOS App

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

Demo

Some of the Feedback

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

Q & A