Optum Stratethon

Engineering Track Problem Statement

Idea #1

Gaps in care and treatment advice

Problem

- A “Gap in care” is defined as the discrepancy between recommended best practices and the care that is actually provided.
- As per research, medical errors are third leading causes of death in USA.
- Right treatment as per the best practice can help improve health outcomes.

Possible Solution

- An AI based treatment advice system (that can recommend the medical practitioner with the right additional parameters to keep track of in order to improve the probability of survival).

Data

- Six descriptors are collected at the time the patient is admitted to the ICU. Their associated time-stamps are set to 00:00 (thus they appear at the beginning of each patient's record).
  - RecordID (a unique integer for each ICU stay)
  - Age (years)
  - Gender (0: female, or 1: male)
  - Height (cm)
  - ICUType (1: Coronary Care Unit, 2: Cardiac Surgery Recovery Unit,
  - 3: Medical ICU, or 4: Surgical ICU)
  - Weight (kg)*.

- Given the data of the patients admitted in an ICU, at least a few of the following variables are recorded at least once during their stay

- Albumin (g/dL)
- ALP [Alkaline phosphatase (IU/L)]
- ALT [Alanine transaminase (IU/L)]
- AST [Aspartate transaminase (IU/L)]
- Bilirubin (mg/dL)
- BUN [Blood urea nitrogen (mg/dL)]
- Cholesterol (mg/dL)
- Creatinine [Serum creatinine (mg/dL)]
- DiasABP [Invasive diastolic arterial blood pressure (mmHg)]
- FiO2 [Fractional inspired O_2 (0-1)]
- GCS [Glasgow Coma Score (3-15)]
- Glucose [Serum glucose (mg/dL)]
- HCO3 [Serum bicarbonate (mmol/L)]
- HCT [Hematocrit (%)]
- HR [Heart rate (bpm)]
- K [Serum potassium (mEq/L)]
- Lactate (mmol/L)
- Mg [Serum magnesium (mmol/L)]
- MAP [Invasive mean arterial blood pressure (mmHg)]
- MechVent [Mechanical ventilation respiration (0:false, or 1:true)]
- Na [Serum sodium (mEq/L)]
- NIDiasABP [Non-invasive diastolic arterial blood pressure (mmHg)]
- NIMAP [Non-invasive mean arterial blood pressure (mmHg)]
- NISysABP [Non-invasive systolic arterial blood pressure (mmHg)]
- PaCO2 [partial pressure of arterial CO_2 (mmHg)]
- PaO2 [Partial pressure of arterial O_2 (mmHg)]
- pH [Arterial pH (0-14)]
- Platelets (cells/nL)
- RespRate [Respiration rate (bpm)]
- SaO2 [O_2 saturation in hemoglobin (%)]
- SysABP [Invasive systolic arterial blood pressure (mmHg)]
- Temp [Temperature (°C)]
- TropI [Troponin-I (µg/L)]
- TropT [Troponin-T (µg/L)]
- Urine [Urine output (mL)]
- WBC [White blood cell count (cells/nL)]
- Weight (kg)*

- Outcome-related Descriptors
    - The outcome-related descriptors are kept in a separate CSV text file for each of the three record sets; as noted, only the file associated with training set A is available to participants. Each line of the outcomes file contains these descriptors:
        - *RecordID* (defined as above)
        - *SAPS-I score* (Le Gall et al., 1984)
        - *SOFA score* (Ferreira et al., 2001)
        - *Length of stay* (days)
        - *Survival* (days)
        - *In-hospital death* (0: survivor, or 1: died in-hospital)
    - The *Length of stay* is the number of days between the patient's admission to the ICU and the end of hospitalization (including any time spent in the hospital after discharge from the ICU). If the patient's death was recorded (in or out of hospital), then *Survival* is the number of days between ICU admission and death; otherwise, *Survival* is assigned the value -1. Since patients who spent less than 48 hours in the ICU have been excluded, *Length of stay* and *Survival* never have the values 0 or 1 in the challenge data sets. Given these definitions and constraints,
        - $Survival > Length\ of\ stay \Rightarrow$ Survivor
          $Survival = -1 \Rightarrow$ Survivor
          $2 \leq Survival \leq Length\ of\ stay \Rightarrow$ In-hospital death

Data Link

- https://www.physionet.org/content/challenge-2012/1.0.0/#files-panel

Goal

- Design an approach to find the earliest duration post admission, after which the most accurate prediction can be made per patient in terms of their survival.
- Design a mechanism to decrease the False Positive Rate.
- Given that not all variables are tracked for all the members, identify the probable gaps in treatment/care and recommend what additional variables (in the above list) should be taken care of, which can increase the probability of the patient's survival.
- How do you envision the final product to be used by the medical practitioners, build an MVP.
- Differentiate your solution from the existing, if any.

Citation

- Goldberger AL, Amaral LAN, Glass L, Hausdorff JM, Ivanov PCh, Mark RG, Mietus JE, Moody GB, Peng C-K, Stanley HE. PhysioBank, PhysioToolkit, and PhysioNet: Components of a New Research Resource for Complex Physiologic Signals (2003). Circulation. 101(23):e215-e220.