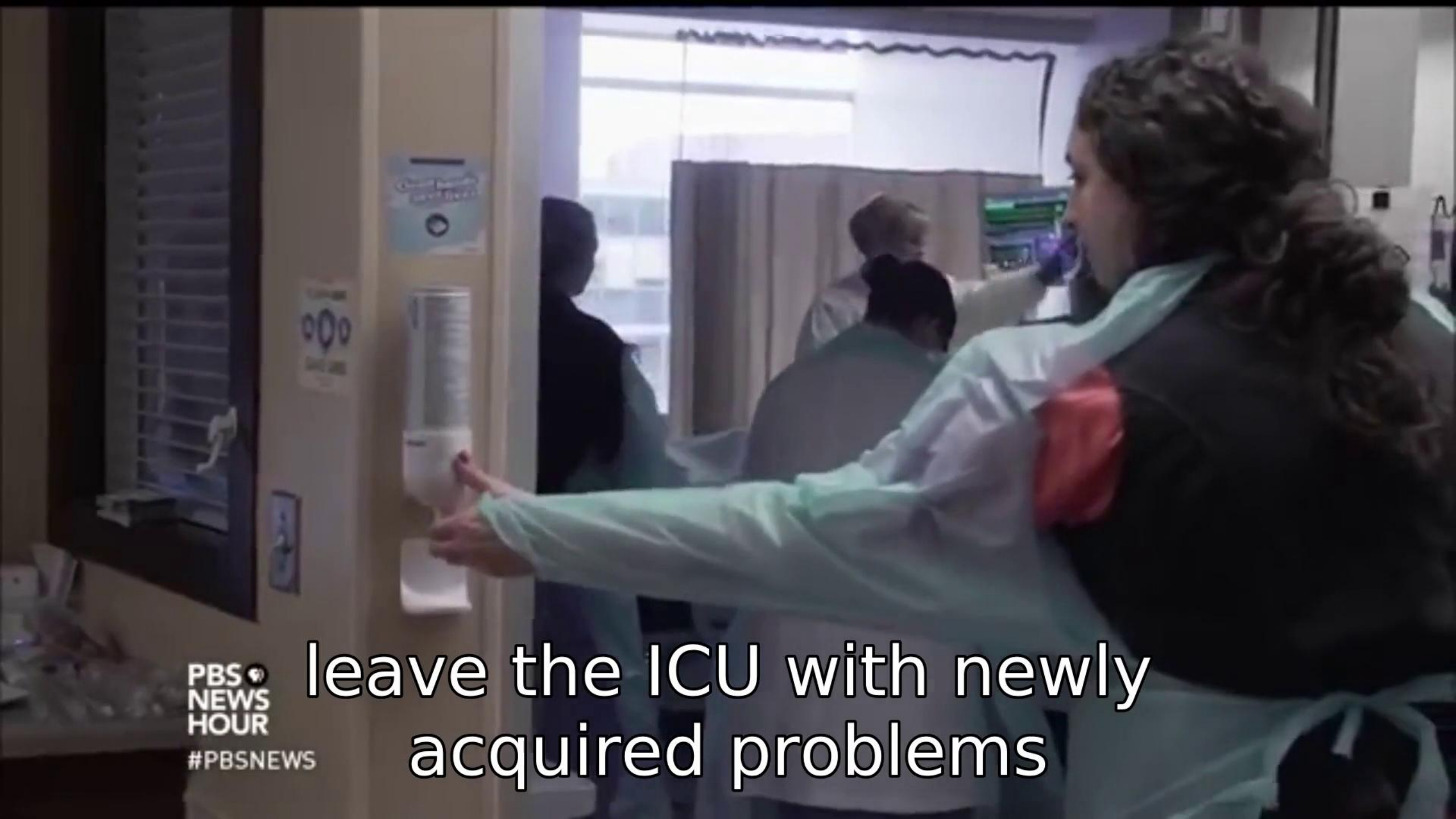
Team Name & Campus

Techno Nerdz
Delhi Technological University (DTU)

Gaps in Care & Treatment

- We need to know how **critically ill a patient is** to decide between treatment and care.
- There must be smart prediction for risk analysis. It has been recorded that **20% of all lives lost are due to slow responses**.
- The costs of futile care add up to **30% of all treatment costs**, ranging from **$90,000 - $100,000** per patient.
- **86%** of mistakes made in the healthcare industry are **administrative**.
- Patient charts cannot be found on **30% of visits**.
- As many as **80% of the errors** initiating cascades involve informational or personal miscommunication.
- There are more than **7,000 deaths** and more than **500,000 preventable injuries** from **medication errors** each year.


PBS NEWS HOUR
#PBSNEWS
leave the ICU with newly acquired problems

What we do

- We are using **NER technique in NLP** to extract data from medical records at the time of admission to **predict important keywords.**

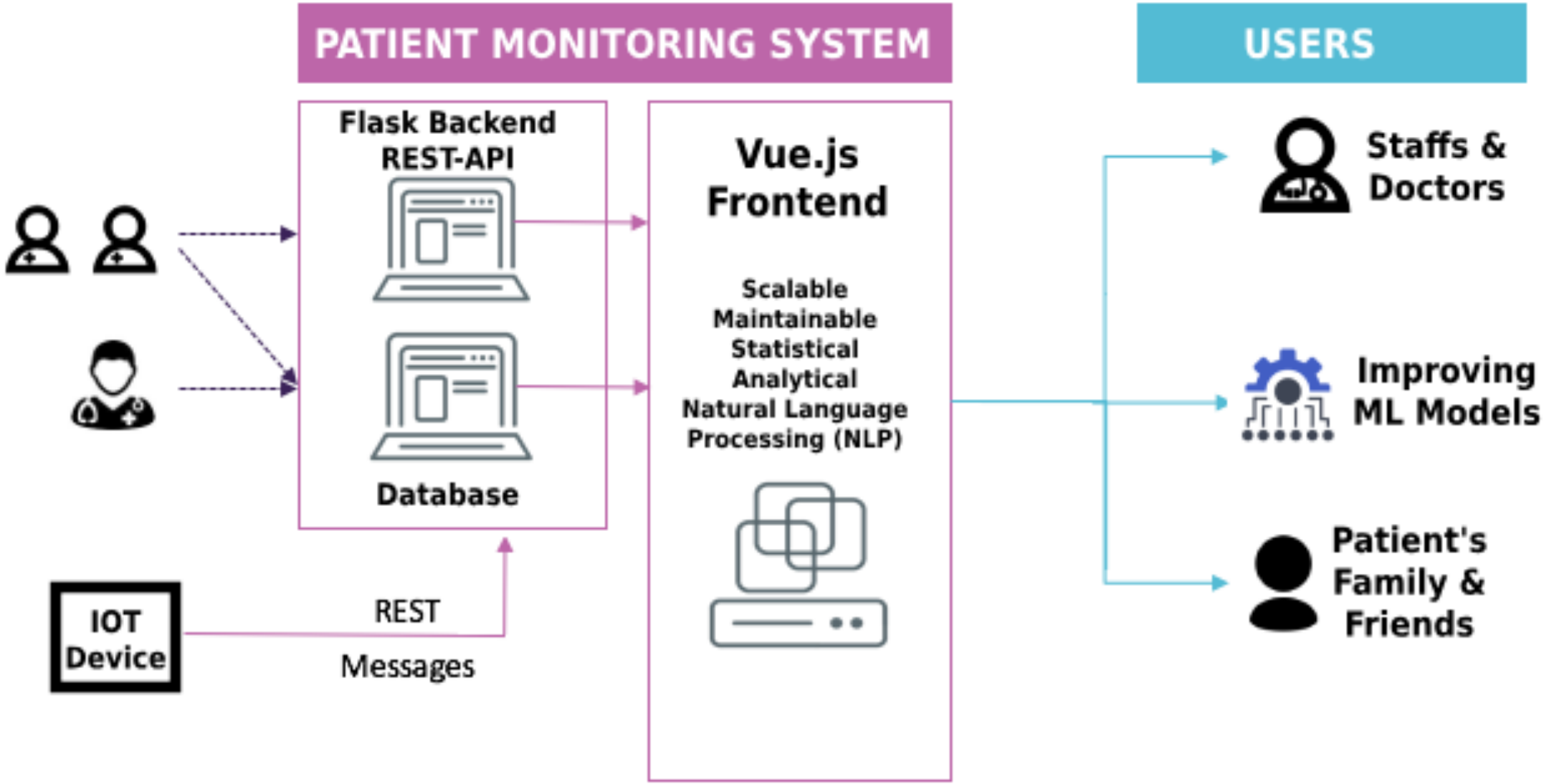
- We predict a **patient's inhouse death & length of stay in ICU** in real time by analysing **37 key parameters** which get updated regularly using **Random Forest Classifier & Gradient boosting regressors, respectively.**

- We calculate **patient's acuity scores** such as **Apache-II, SOFA, SAPS-II** to find the case's severity.

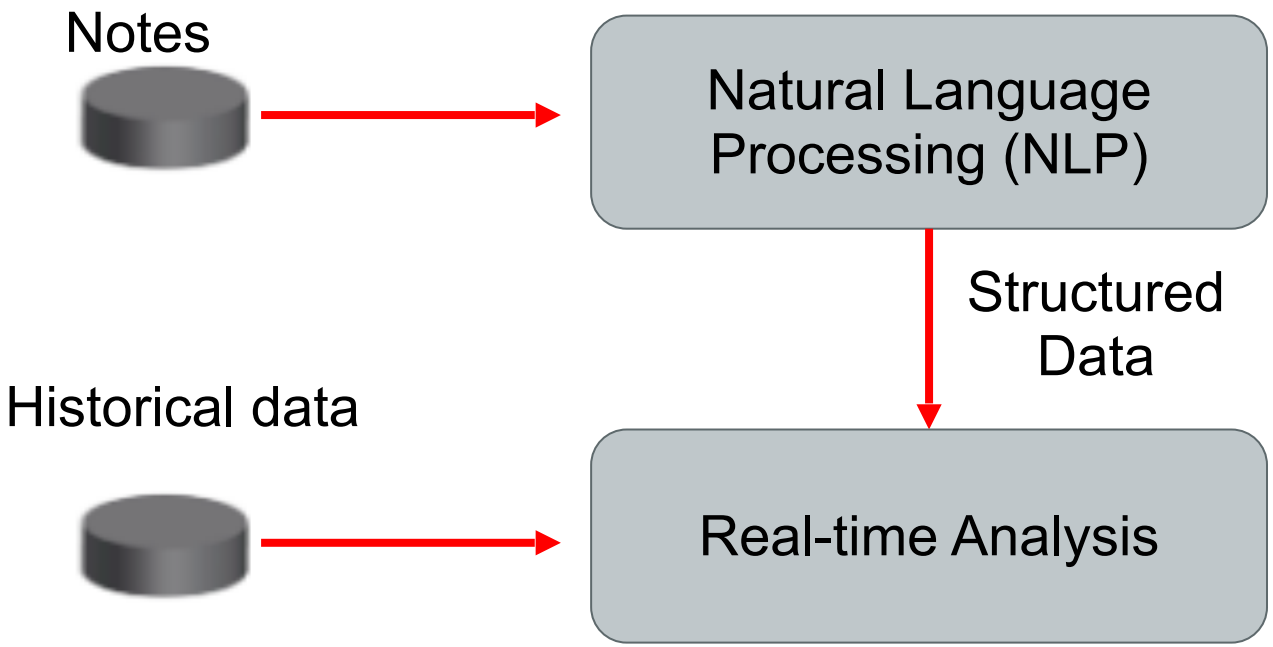
- We provide over **20 different statistical techniques** for data analysis. Eg: Patient timer analysis (provides vitals at each time instance), Mortality plot (Survival/Death proportion for each factor), etc.

- We also use **QR codes** at ICU beds to increase **convenience** and **data accessibility** to both the doctor and the patients.

Architecture Overview



- **Extract the initial data i.e. keywords for symptom analysis** with the power of NLP to **predict their ailments in a faster manner** , which is important aspect of treating any severely ill patient. This instantly classifies keywords in the medical notes and segregate the patients into 4 categories.



Problems this approach solves:

- **Speeds up the initial information gathering** phase by upto **60%**.
- **Automates and streamlines** the process of data entry making it **faster by 20%**.

Actual Medical Records

Raw Notes

```
DATE OF ADMISSION: 05/22/2019
ADMITTING DIAGNOSIS: Syncope.
CHIEF COMPLAINT: Vertigo or dizziness.

HISTORY OF PRESENT ILLNESS: past medical history of coronary artery disease, CABG don

PROCEDURES PERFORMED: The patient had a chest x-ray, which showed cardiomegaly with a
```

Tags categorized after NLP

Problem

vasovagal syncope | fall | traumatic arthritis | hypertension | recurrent urinary tract infection | renal carcinoma

chronic obstructive pulmonary disease | previous stroke | hypertension | copd | renal carcinoma | syncope | did hit her head on the ground

loss of consciousness | previous falls | a hip fracture | bruising around the left eye | a baseline decreased mobility of her left arm

her positive histories | diagnostic studies | acute fractures | old healed left humeral head and neck fracture | facial bone fracture

syncopal episode | traumatic injury of her knee | significant pain and swelling | h. p.r.n

Treatment

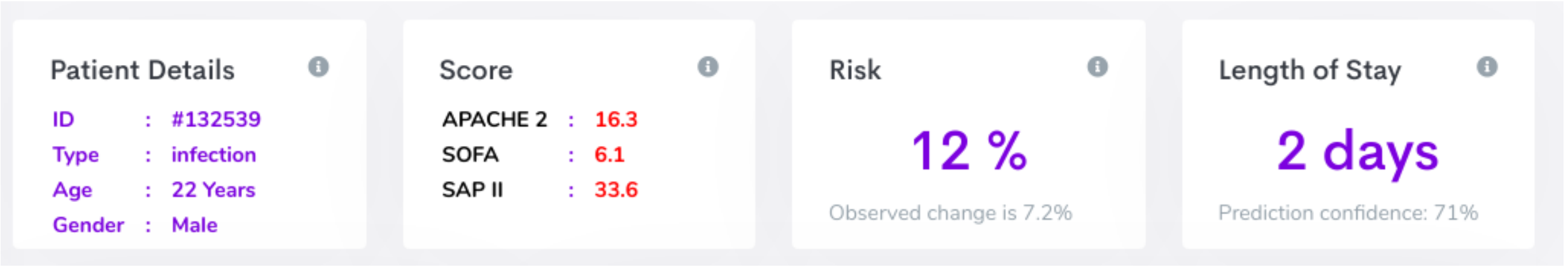
physical therapy | baseline anterior dislocation | rehabilitation | darvocet-n | colace | zestril | plavix | norvasc | hydrochlorothiazide

atrovent inhaler | albuterol inhaler | clonidine | cardura | prophylaxis

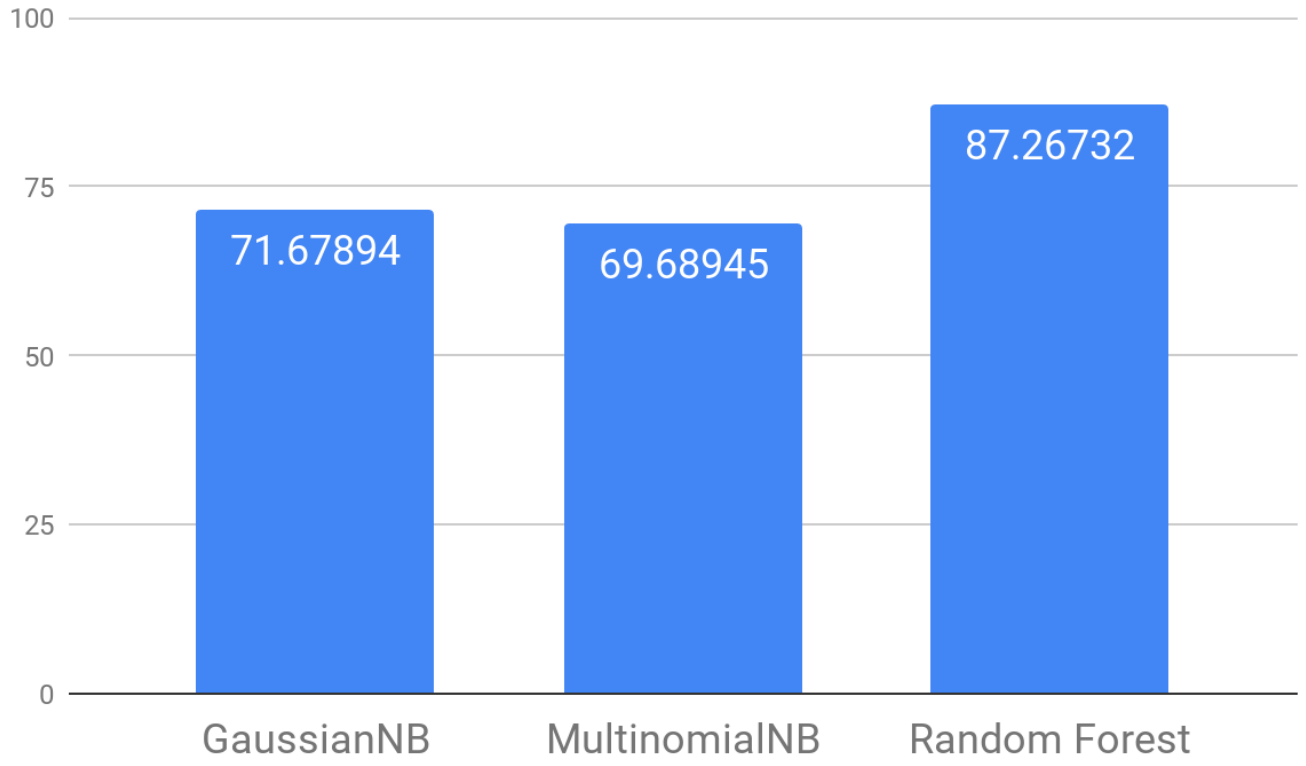
Test

initial examination | evaluation | diagnostic studies | cervical spine | ct of the brain | ct of the maxillofacial area | echocardiogram

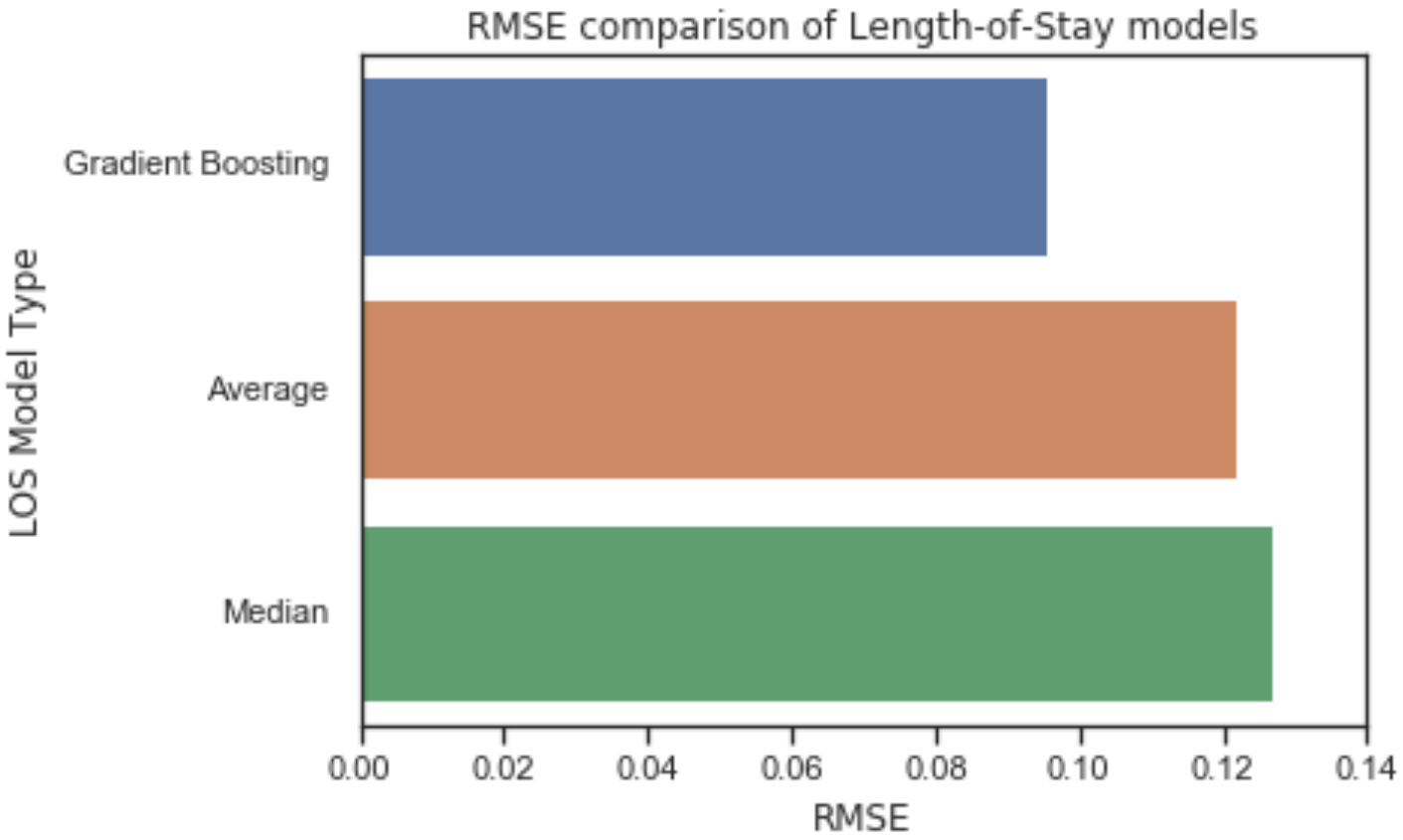
- After extracting the tags, we classify **their ailments into 4 major categories** i.e. **Respiratorial, Close Monitoring, Cardiac and Infection,** which are the 4 most prevalent in the ICU.
- After admitting them in their respective wards, we shall **constantly monitor their vitals and conduct a regular analysis on survivability** at real-time with accuracy weightage analysis.
- We want to **minimize false positive rate,** at every point of prediction so we will show associated accuracy rate calculated over ensembling of different quality scores n-th day of stay: Tags will be assigned which shall be shown in **dashboard where the patients can be monitored.**



● Using **Random Forest model** we train given dataset and predict whether person will in **house die or survive based on data provided**. It gives a **confidence of 87%** and also culls down the problem of overfitting the dataset and is successful in handling different varieties of datasets (missing values). Other techniques fail in this regard, by a **margin of 10 - 20%** as shown.

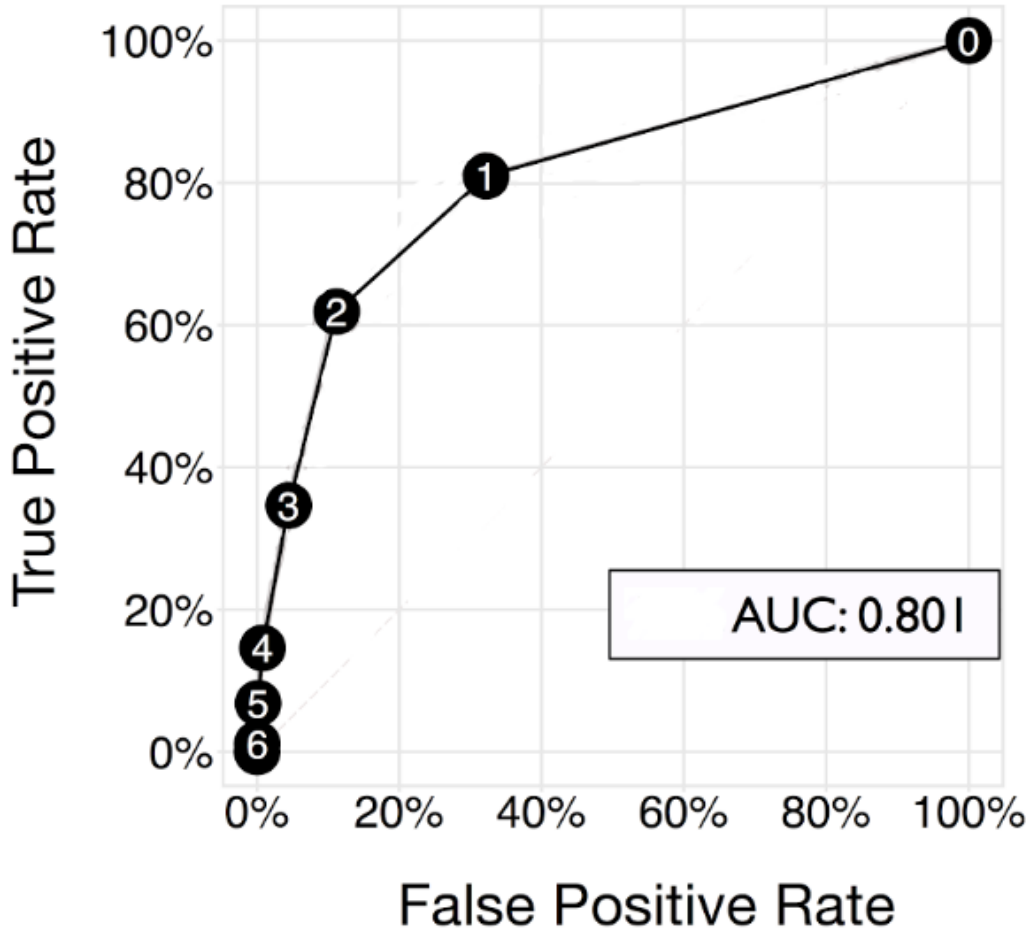


● Using **Gradient Boosting Regressor** we predicted the **length of stay** in the ICU. At each step, a new tree is trained against the negative gradient of the loss function. Given below is the comparison of Gradient boost model with five different regression models based on their root mean square error. It is **better by more than 24%** versus the constant average or median models. Giving the net **confidence of 73%**



● Risk factor is calculated live over a linear classifier with **user-based features** over time and **acuity scores**. This further helps in reducing False-Positive rate.

1. Any brief Rhythmic discharge (2 points)	2 points
2. Patterns include LPD	2 points
3. Any prior seizure	1 point
4. Epileptiform of discharge	1 point
....	...



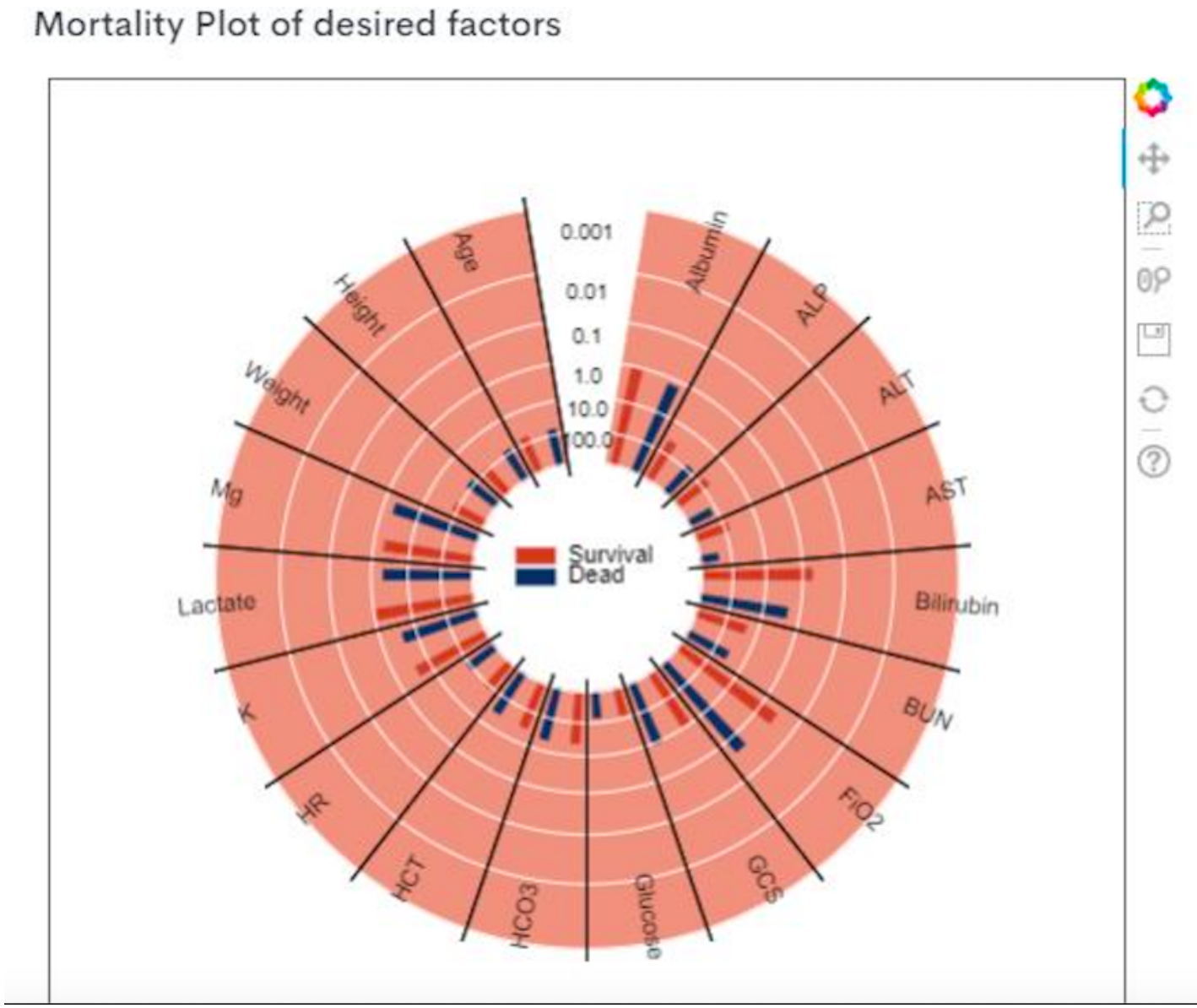
Score	0	1	2	3	4	5	6
Risk	4.7%	11.9%	26.9%	50.0%	73.1%	88.1%	95.3%

Problems our approach solves:

- **Communicate Findings in Constructive Ways**

Doctors' reports are often **elaborate with static tables and a variety of chart types** hence fail to make information **interpretive and easy to digest**.

Reports coming from our solution, however, simplify complex information through **interactive elements and new visualizations** such as circular graphs which **fastens decision making**.

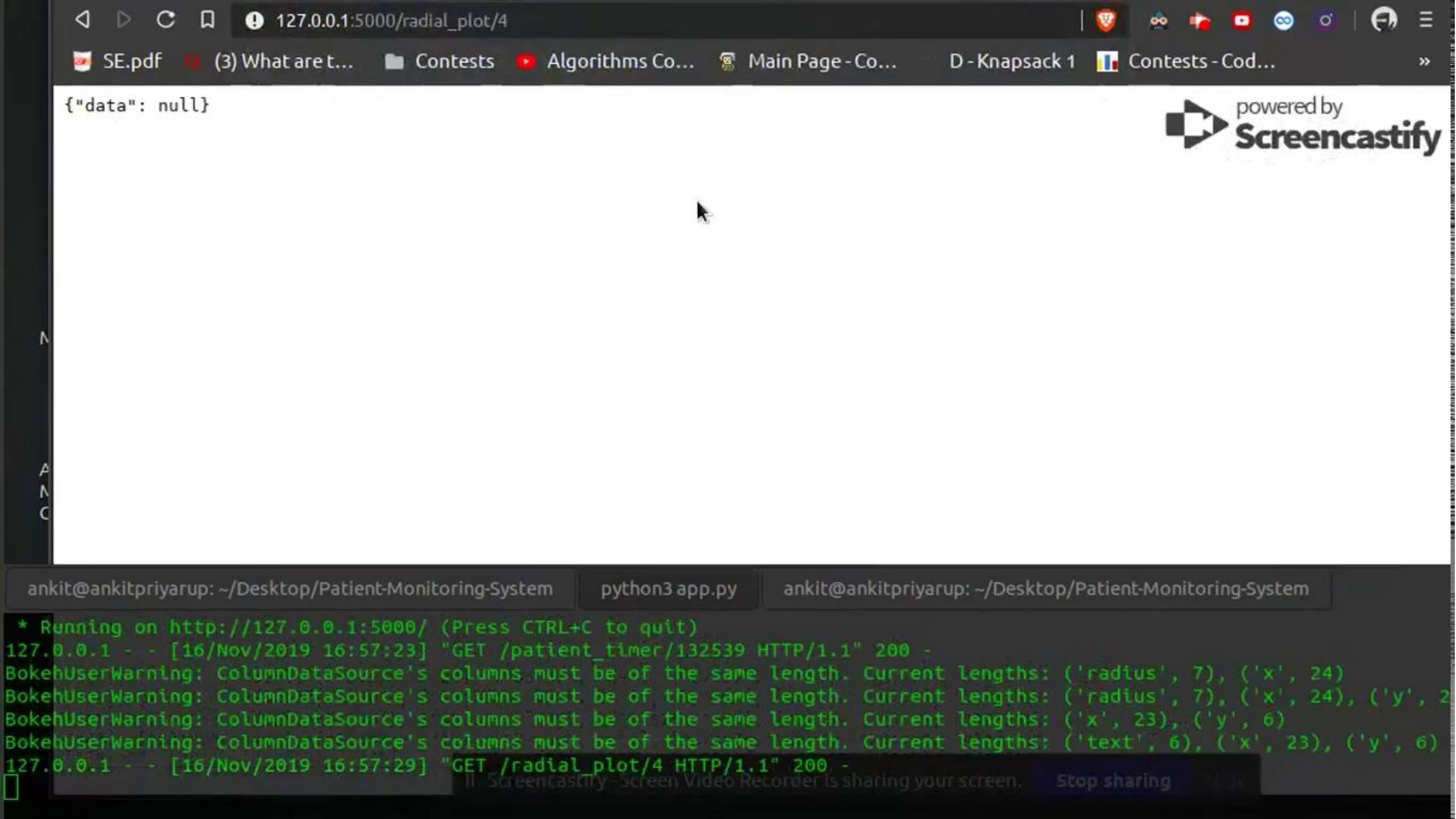


- **Faster Action and better decision making**

We provide a very clear form of communication allowing **doctors to interpret and act upon their information more rapidly** which is **life saving under critical care**.

It is calculated using - Acuity scores & Risk calculated from previous slides.

Earliest duration post admission can be calculated by linear regression of historical analysis, patient type & assosiated risk scores.


127.0.0.1:5000/radial_plot/4
SE.pdf
(3) What are t...
Contests
Algorithms Co...
Main Page - Co...
D - Knapsack 1
Contests - Cod...
{"data": null}
powered by
Screencastify
ankit@ankitpriyarup: ~/Desktop/Patient-Monitoring-System
python3 app.py
ankit@ankitpriyarup: ~/Desktop/Patient-Monitoring-System
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
127.0.0.1 - - [16/Nov/2019 16:57:23] "GET /patient_timer/132539 HTTP/1.1" 200 -
BokehUserWarning: ColumnDataSource's columns must be of the same length. Current lengths: ('radius', 7), ('x', 24)
BokehUserWarning: ColumnDataSource's columns must be of the same length. Current lengths: ('radius', 7), ('x', 24), ('y', 2
BokehUserWarning: ColumnDataSource's columns must be of the same length. Current lengths: ('x', 23), ('y', 6)
BokehUserWarning: ColumnDataSource's columns must be of the same length. Current lengths: ('text', 6), ('x', 23), ('y', 6)
127.0.0.1 - - [16/Nov/2019 16:57:29] "GET /radial_plot/4 HTTP/1.1" 200 -
Screencastify - Screen Video Recorder is sharing your screen.
Stop sharing

Salient Features

- Our approach employs a **highly intuitive UI and unburdens the doctors** from learning a new workflow for it emulates the current one, allowing for **immediate adoption** of our solution.

- By utilising a **web interface** (developed using Vue.js frontend flask rest API backend) and a local wifi network, we ensure the **data privacy and convenience of data access.** Also, by using QR codes, we further allow data to be **delivered at the swipe of a finger.**

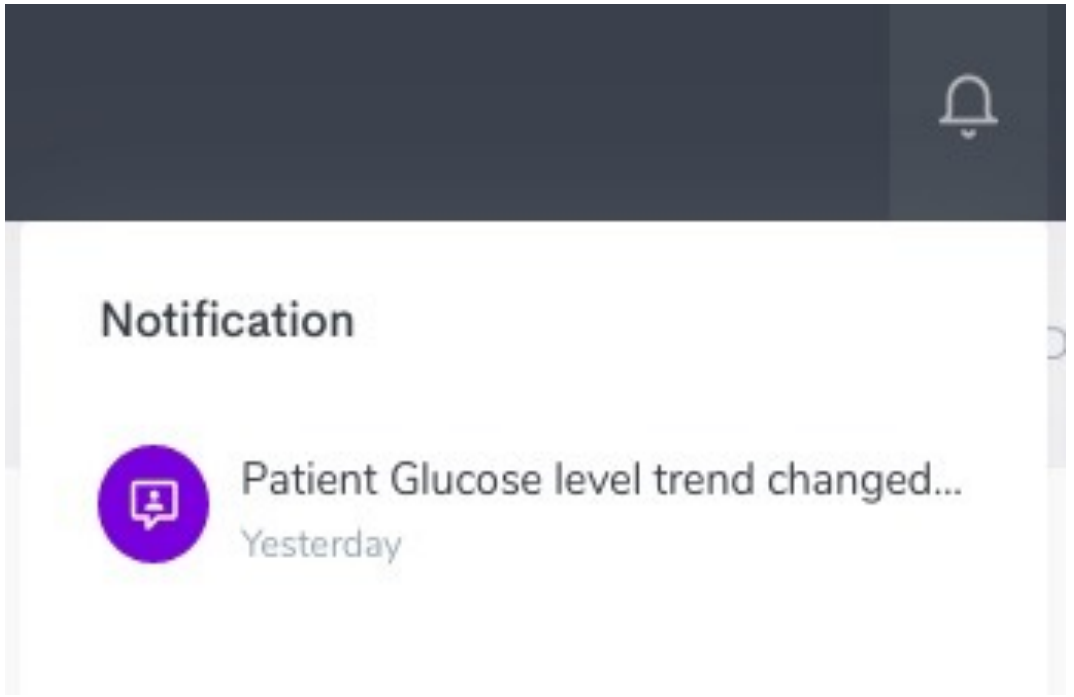
Scalable REST-API Backend

Collaborative Login-Dashboard Environment

Easily Accessible Scan QR code to access report

- If an **unnatural trend or a fatal new symptom** is identified in the patient we shall **send a notification to the concerned doctor** for immediate monitoring.

- **Effective Time utilization**
  AI to automate insights helps to do **more with less time and resources**, and tackle the large amount of information that each physician uses to make a clinical decision. We **speed up the entire process of by 44%** in totality by automation (data retrieval, response time etc).



Summary

- Need to know how acutely ill an individual is so you can decide whether you need to specify treatments very quickly, or whether you need to focus more care on them.
- Our system, provides real time analysis - **over 20 statistical measures**. Real time **prediction of - Length of stay, survival rate, risk of in-hospital death with confidence of 87%.**
- **NLP** is used to **predict important keyword** associated, bridging the **gap of initial information retrieval by 60%.**
- Flask REST-API backend, provides room for **scalability (IOT devices), collaboration, and data accessibility.**
- **Real-time notification** keeps the track of unnatural trend or a fatal new symptom.
- Entire **patient report is accessible** just by scanning a simple **QR code** in an archive of all compiled plots & data.