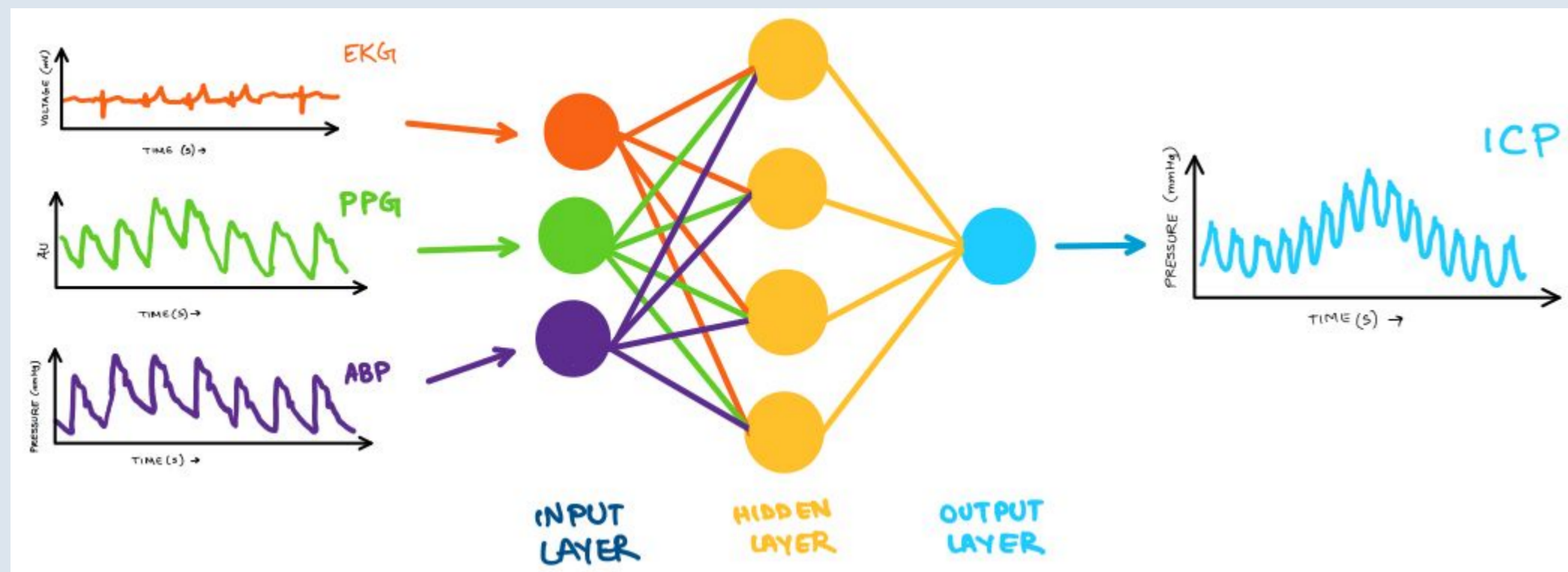


ICPpredict

a non-invasive way to measure ICP



Our solution

We will take extracranial waveforms such as arterial blood pressure (ABP), electrocardiogram, (EKG), and photoplethysmography (PPG), which are all recorded at as high-frequency and predict an ICP waveform from these features in real time, allowing neurosurgeons to infer hypertensive events as they happen.



Our product is a scalable algorithm which can be seamlessly integrated with existing medical devices used in the hospital to measure vital signs.



Sickbay



Center-TBI



MIMIC-III

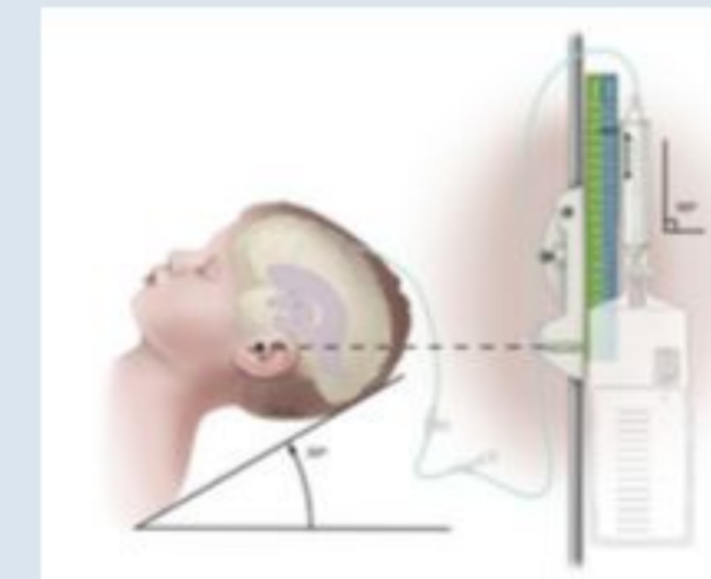
We have access to 3 datasets with TBI contain high frequency time series waveform data for ICP, EKG, AbP, and PPG. We will validate our algorithms externally using Beth Israel Deaconess Hospitals' MIMIC III data and European collective initiative of Center-TBI database.

What is ICP?

Intracranial pressure (ICP) is a vital metric used in evaluating perfusions of blood and blockages in the brain. Elevated ICP, or a hypertensive event due to traumatic brain injury, is a life-threatening condition which can result in brain damage or death.

Measuring ICP

The current method of measuring ICP is the intraventricular catheter is inserted via surgery deep into ventricles of the brain from the base of the skull.



Current Drawbacks

- Highly invasive surgery with postsurgical complications such as hemorrhaging, infections, or herniations.
- The surgery can take 30 minutes, delaying pro-active treatment

Non-invasive

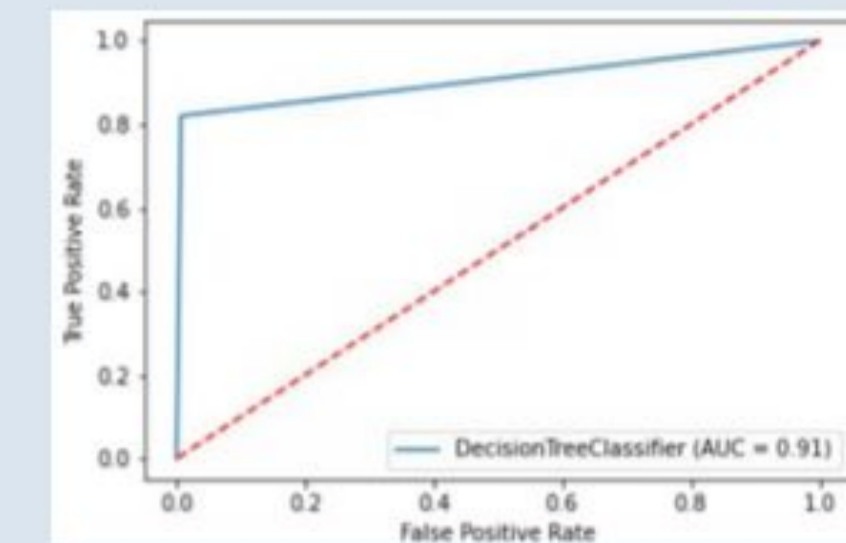
Real time

Accurate

Verification-Validation

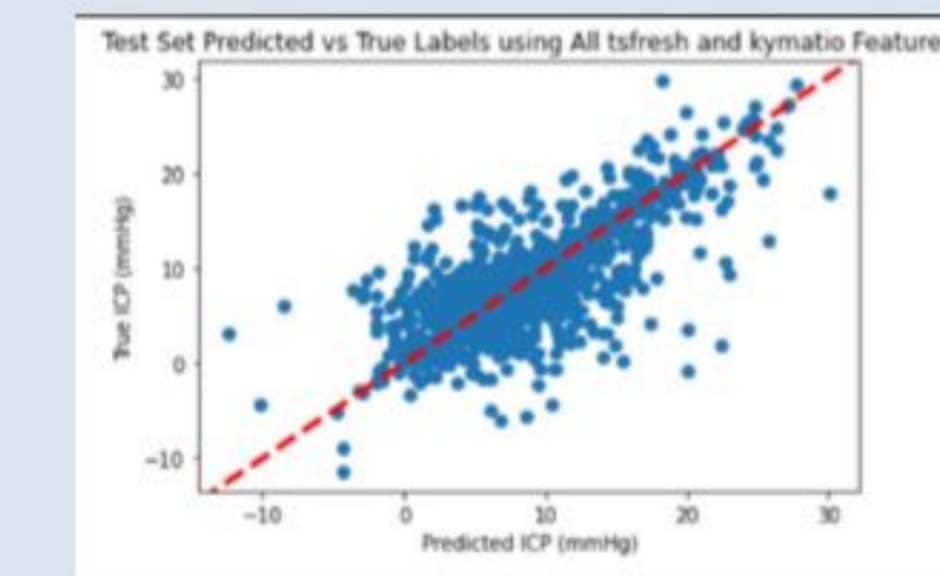
Binary Classification: Determining if a 5 minute window is an ICP hypertensive event (average ICP > 20 mmHg)

Using a random forest model, we can evaluate the prediction of hypertensive events with an area under the receiving operator curve (AUC ROC) of 0.91.



Mean Regression: Determining the average ICP in a 5 minute window

	MSE	RMSE	MAE
Linear	15.523	3.940	2.808
Elastic	16.858	4.106	2.988
Kernel	82.201	9.067	7.763
Random Forest	10.601	3.256	2.043



For random forest mean regression, we can verify the accuracy of our predictions by confirming they center about the $y=x$ line in a scatter plot of predictions vs ground truth

Our team



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