Introduction & Background

Hypotension (a sustained decrease in blood pressure) within critical care patients is associated with a higher risk of mortality and other severe complications. It is periodically monitored non-invasively for all ICU patients. Continuous blood pressure monitoring via arterial line catheters has been shown to lead to faster response times but is also associated with complications such as infection. With recent advances in machine learning, we take an innovative approach and train a model that is able to predict Arterial Blood Pressure continuously and non-invasively through the following three measures: Electrocardiogram, Photoplethysmography, and EHR Vasopressors medication.

MIMIC-III Data

<table>
<thead>
<tr>
<th>MIMIC</th>
<th>MIMIC-III is a large, freely-available database comprising deidentified health-related data associated with over 40,000 patients who stayed in critical care units.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient Samples</td>
<td>Training 18  Testing 2</td>
</tr>
<tr>
<td>Frames (400 msec)</td>
<td>218,649 24,295</td>
</tr>
<tr>
<td>BP mean (mmHg)</td>
<td>72.9 73.7</td>
</tr>
<tr>
<td>Data Size (Gb)</td>
<td>129.70 14.41</td>
</tr>
</tbody>
</table>

Methods

1. Load data
   - EKG
   - PPG
   - vasopressors

2. Preprocess Data
   - 1D-Vnet Deep Learning Model

3. Train Model

Results

- **Fig. 1a**: Displays a predicted waveform with a patient with no vasopressor medication administered. By no surprise, we see that the predictions are identical. In Fig. 1b, we see differentiation between the first model versus our current model which takes into account clinical interventions. In this particular frame, the prediction is performing better than the original.

Discussion & Conclusion

- **Table**: We see a slight improvement in diastolic prediction performance and a slight worsening in systolic performance.
- **Table**: As briefly mentioned in the results section, our mean is highly representative and that there are less poorly predicted waveforms.
- **Table**: We have presented a novel method for imputing the arterial blood pressure waveform that is continuous, non-invasive, accurate, for patients in the ICU setting and beyond, without the need for any additional instrumentation.

Future Works

- Optimize and scale the approach up to massive datasets.
- Test on additional datasets collected from different patient populations.
- Explore optimal approaches of representing clinical interventions.

References & Code


Special Thanks

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