



CONTINUOUS BLOOD PRESSURE ESTIMATION USING GRAPH AND CNN

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Data Incubator fellowship

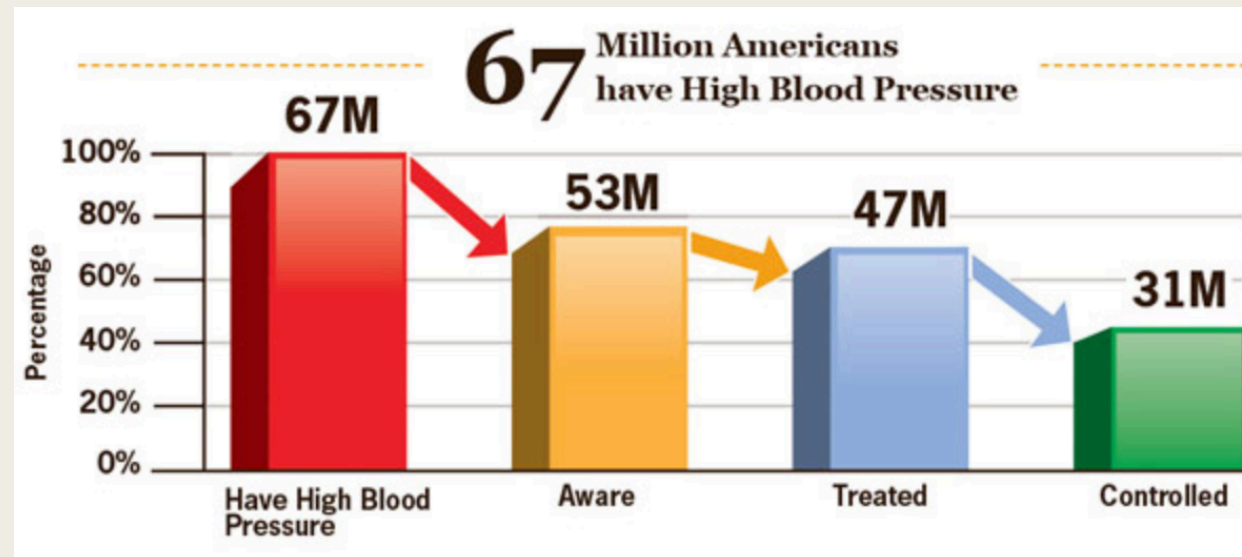


Outline

- Motivation and Object
- Method
- (Preliminary) Results

Motivation and Objective

- High blood pressure (BP) and hypertension are:
 - *common reasons to cause the cardiovascular diseases*
 - *major risk factor for death*
- Only 1/2 of the hypertensive population has their BP under control
 - *lack of proper monitoring and feedback on the treatment*

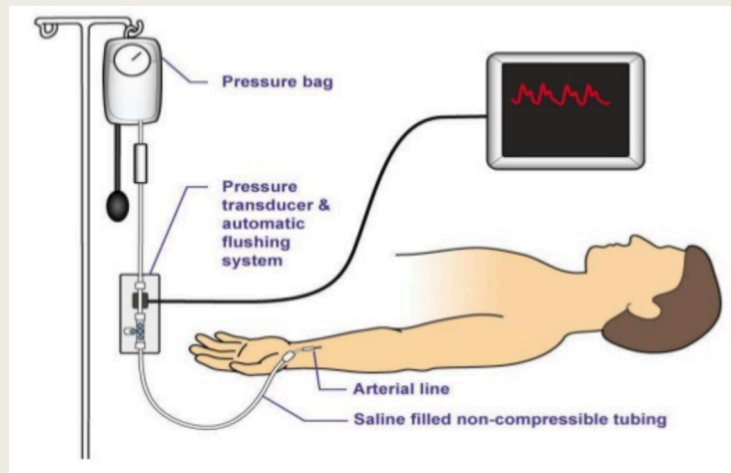


Motivation and Objective

- Existed BP measuring methods are:
 - *not able to monitoring continuously*

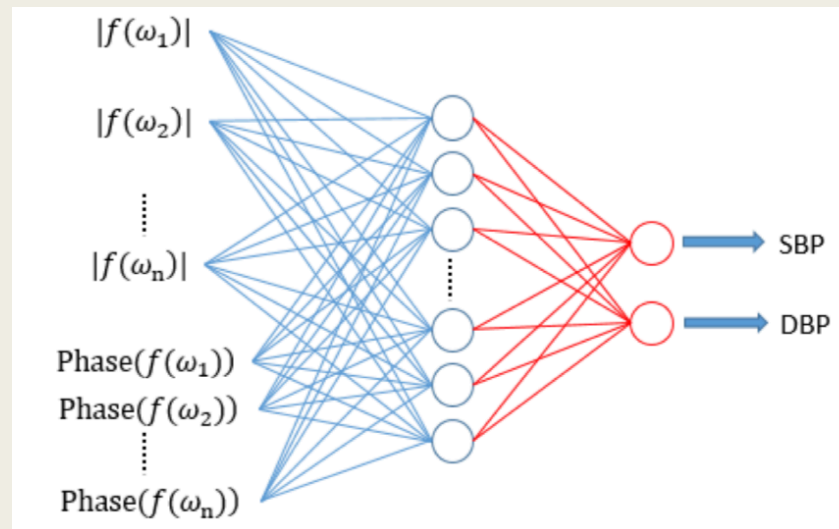


- *not flexible due to invasive implementation*



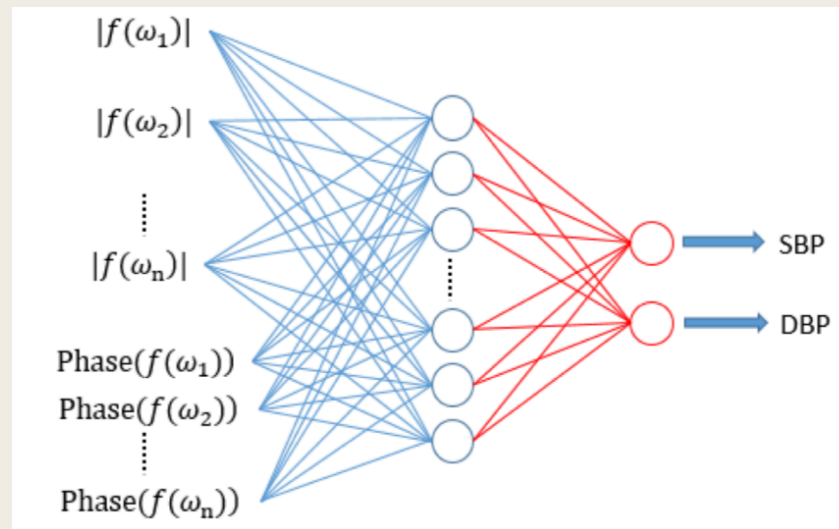
Motivation and Objective

- State-of-the-art BP measuring methods:
 - *utilize simultaneously measured ECG and PPG signals*
 - *LSTM or ANN are used based on carefully selected features*



Motivation and Objective

- Problem in State-of-the-art BP measuring methods:
 - *concurrently measuring two types of signals*
 - *human selected feature*
 - *requires huge amount data – prevent personalized estimation*

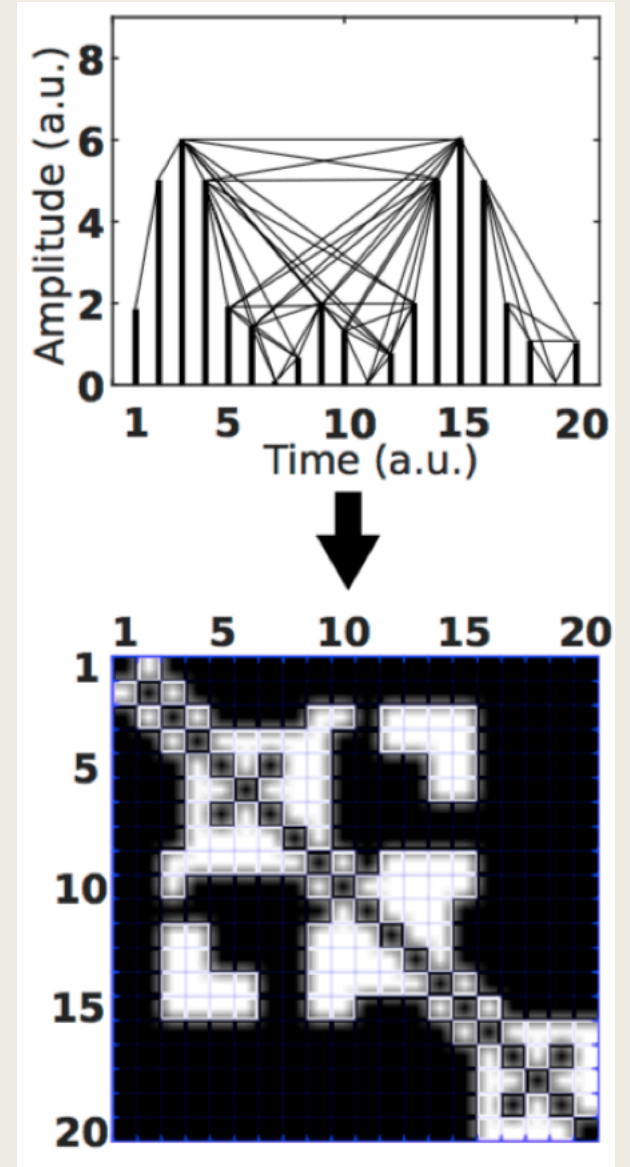
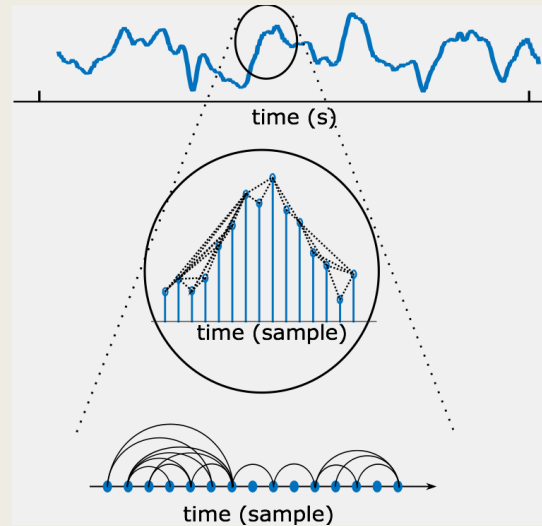
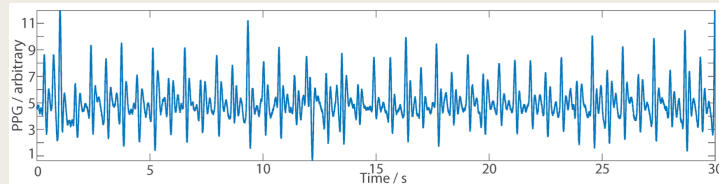


Motivation and Objective

- Estimate blood pressure using PPG signals only
- Using CNN framework
- Validate the method using large amount of real PPG data measured from both healthy and patients
- MIMIC III waveform database:
<https://physionet.org/physiobank/database/mimic3wdb/>

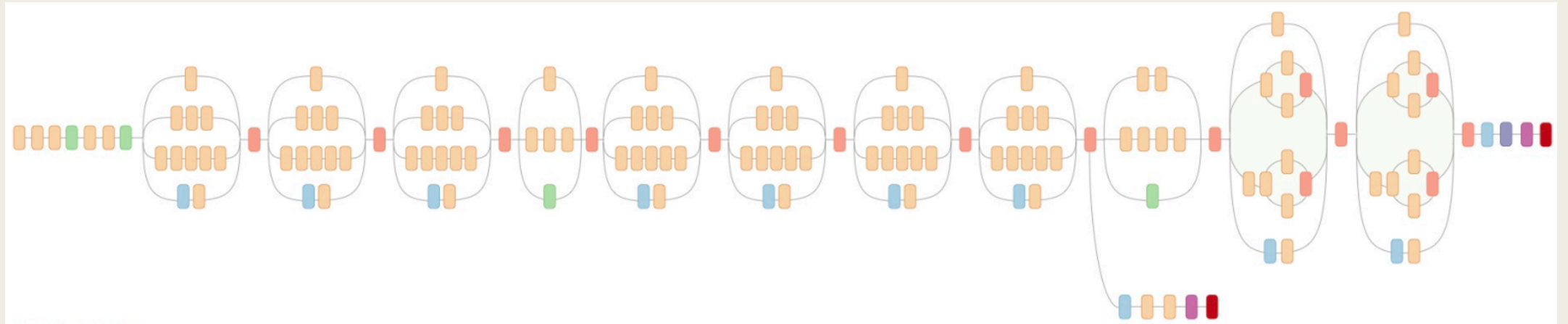
Method

- PPG time series \rightarrow Visibility graph
- *visibility graph inherit temporal dynamics of time series*



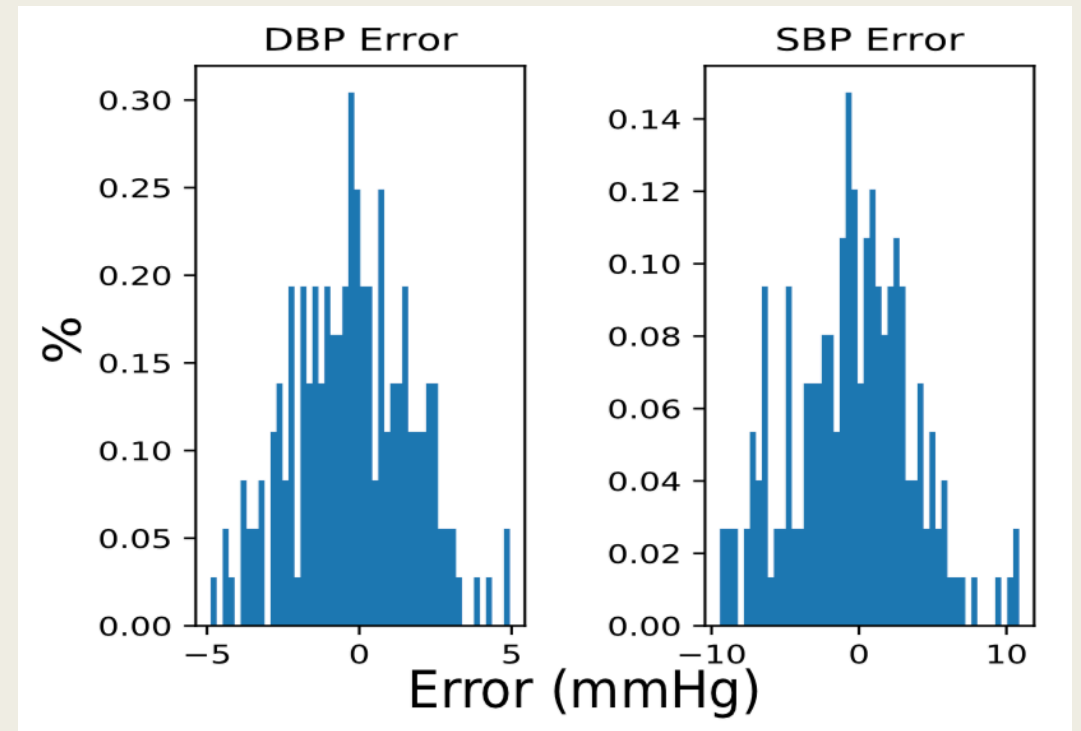
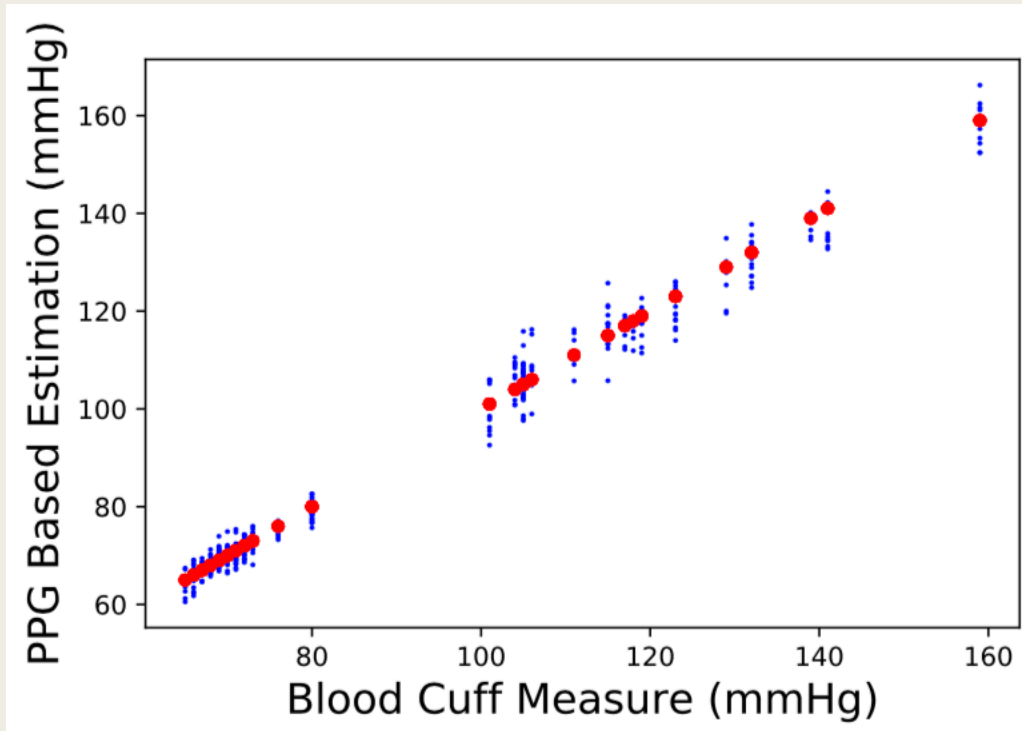
Method

- Transfer learning based on Google Inception v3
 - *regression problem*
 - *change the final layer with fully connected layer without softmax*



Results

- Data analysis had been conducted on two subjects.
- Results outperformed British Hypertension Society (BHS) protocol and ranks grade A



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ESTIMATION ACCURACY AS COMPARED WITH BHS PROTOCOL. THE GRADES REPRESENT THE CUMULATIVE PERCENTAGE OF READINGS FALLING WITHIN *5 mmHg*, *10 mmHg*, AND *15 mmHg* OF THE STANDARD.

	≤ 5 (%)	≤ 10 (%)	≤ 15 (%)
DBP	93.18	99.62	100
SBP	74.24	89.39	97.73
Grade A	60	85	95