Data-

Data set used is MIMIC 2 link: https://www.kaggle.com/lbote87/mimic-pleth-to-abp . This dataset has 3 files - trainset, testset, valset. Trainset has 1546 files. Each file has a 10 min signal of each PPG and ABP . Each signal has 75000 points sampled at 125Hz. Divided whole dataset in 8sec windows . So each file has 75 windows. Resampled this each 8sec window to 256 Hz. So each window has 2048 points. The windows which has difference of more than 100 in maximum BP value and minimum BP value are discarded. The windows which have dead signals are also discarded.

Neural Network-

A UNet type architecture is used similar to used in https://arxiv.org/abs/1902.04236 . A network is trained to covert PPG signal to ABP signal.

A Dilated Residual Inception Block

Refer to Figure

1 : Input to dialated Residual Block
2-5 : Convolution layers kernel size=1x1 stride=1 padding=0
6: Convolution layers kernel size=3x1 stride=1 padding=2 dilation=2

7: Convolution layers kernel size=3x1 stride=1 padding=4 dilation=4

8: Convolution layers kernel size=3x1. stride=1 padding=8 dilation=8

10: Convolution layers kernel size=1x1 stride=1 padding=0

Unet-

Refer to figure

Input and output dimensions are mentioned

DRB is Dilated Residual Block
conv is convolutional Layer
Tconv is Transpose Convolutional Layer
BN & Relu is Batch Normalisation layer followed by LeakyRelu

LeakyRelu value= 0.1 everywhere
1-7 : Convolutional layers, kernel_size=4, stride=2, padding=1
8-14: Transpose Convolutional Layers, kernel_size=4, stride=2, padding=1 15 : Convolutional layer, kernel_size=1, stride=1, padding=0

Discussion-

Training Method-

Smooth L1 error is determined between network prediction and ground-truth signal for each minibatch comprising of 256 input windows. The network parameters were optimized using Stochastic Gradient Descent. The training is carried out in 60 epochs . First 10 epochs had learning rate of 0.1. Next 10 epochs had learning rate of 0.05 . Next 10 epochs had learning rate of 0.01. Next 30 epochs had learning rate of 0.005. The model was developed and implemented in PyTorch. The training was carried out on google Cloud Platform using NVIDIA Tesla K80.

B. Evaluation Method-

ABP signal is generated from our network.

AAMI standard : Mean error <= 5

stdefv <= 8

Number of subjects >= 85

Method	MAE in Diastolic	MAE in Systolic	Mean & stdev Diastolic in error	Mean & stdev Systolic in error	Number of subjects
Our method	1.6 +- 2.34	2.8 +- 3.88	-0.33 , 2.83	0.65 , 4.747	> 90
Hindawi2	2.27 +- 1.82	4.02 +- 2.79	0.0975, 2.91	-0.0217, 4.9	90
Khalid	3.25 +- 4.16	4.8 +- 4.313	-0.6 , 5.2	-0.1 , 6.5	32
Springer	0.80 +- 4.947	1.21 +- 8.67	0.25 , 5.76	-0.14 , 5.75	120

On 98% best testing data	MAE in Diastolic	MAE in Systolic	Mean & stdev Diastolic	Mean & stdev Systolic
Our method	1.39 +- 1.29	2.4 +- 2.43	-0.39 , 1.86	0.538, 3.383

Results using cross-validation

1.

	MAE in Diastolic	MAE in Systolic	Mean & stdev Diastolic	Mean & stdev Systolic
	1.78 +- 2.57	3.11 +- 4.22	-0.62, 3.0	-0.47, 5.22

2.

	MAE in Diastolic	MAE in Systolic	Mean & stdev Diastolic	Mean & stdev Systolic
	1.65 +- 3.59	2.89 +- 4.344	-0.35 , 3.93	-0.511, 5.19

3.

	MAE in Diastolic	MAE in Systolic	Mean & stdev Diastolic	Mean & stdev Systolic
	1.70 +- 2.51	3.122 +- 4.39	0.043, 3.03	-0.10, 5.39