XI. SUPPLEMENTARY MATERIAL

TABLE SI: Comparison with Major Related Works - I

Ref.	Year	Main Objective	GAN Variant	Architecture (Gen. - Discr.)	Dataset
[11]	2019	Generating Realistic Synthetic ECG Signal	Regular	LSTM-4CNN, BiLSTM-4CNN	MIT-BIH (Lead II)
[10]	2019	Dataset Augmentation/Balancing	ACGAN	14CNN-16CNN	MIT-BIH (Lead II)
[14]	2019	Generating Realistic Synthetic ECG Signal	Regular	BiLSTM-(2CNN+FC)	MIT-BIH (one lead)
[13]	2021	Fully Automated Synthetic ECG Generation	Regular	2D BiLSTM 5CNN-2D 4CNN FC	12 lead, PTB-XL, CCDD, CSE, Chapman, Private Domain
[12]	2020	Generating Realistic Synthetic ECG Signal	DCGAN (SpectroGAN) Regular (WaveletGAN)	2D 4TrCNN-2D 4CNN (SpectroGAN) 2D 3FC-2D 3FC (WaveletGAN)	MIT-BIH (Lead I[1])
ThS[1]	2021	Generating Realistic Synthetic ECG Signal	Regular, WGAN)	FC-FC, DC-DC, BiLSTM-DC, AE/VAE-FC, DC-DC (WGAN)	MIT-BIH (Lead I)

TABLE SII: Comparison with Major Related Works - II

Ref.	Multiclass (study/model)	Mode Collapse Prevention	Metrics	Preprocessing	No. of Epochs
[11]	No/No (only Normal)	MBD [1] (didn't work)	MMD [2], DTW	Concatenation of beats	60
[10]	Yes/Yes	BN [3], DO [4] (in Discriminator)	ED, PCC [5], KL Div. (used templates)	NM	150
[14]	NM [6]	DO	PRD [7], RMS, FD [8]	NM	NM
[13]	Yes/No	NM	MMD (IQR [9] SK [10] KU [11]) (between train, test and synthetic sets)	makecellFWS [12]	up to 1000 (10 min.)
[12]	Yes/Yes	IN [13]	SVM [14], GTrTs [15]	4 second segmentation	NM
ThS	No/No	BN, Visual Inspection	Original Methods	Pan-Tompkins	30

TABLE SIII: Comparison with Major Related Works - III

Ref.	Batch Size	Optimization	Learning Rate	Hyper-Parameter Fine-Tuning
[11]	NM	Adam	NM	NM
[10]	NM	Adam	0.0001 (G) 0.0002 (D)	NM
[14]	NM	NM	NM	NM
[13]	32	NM	NM	NM
[12]	NM	RMSProp	0.0001 (SectroGAN) 0.00015 (WaveletGAN)	NM
ThS	9	Adam	0.0002	Used Recommended Suggestions

XII. GRAPHS

A. Graphical Representation of Architectures

Model 01

Generator **Discriminator**
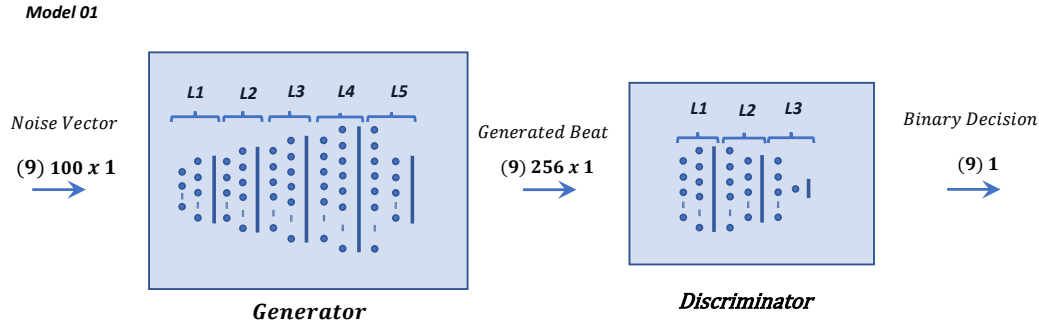
Model: 02

$$z = (z_1, z_2 \ldots, z_{100}), \; z_i \sim \mathcal{N}(0, 1)$$

Generator layers:

L1 – L5: 1D-transposed convolutional layer

L6: Fully Connected layer

All filters:

padding	1
stride	1
size	4

Model: 02

Discriminator layers:

L1 – L4: 1D-convolutional layer

L5: Fully Connected layer

All filters:

padding	1
stride	1
size	4
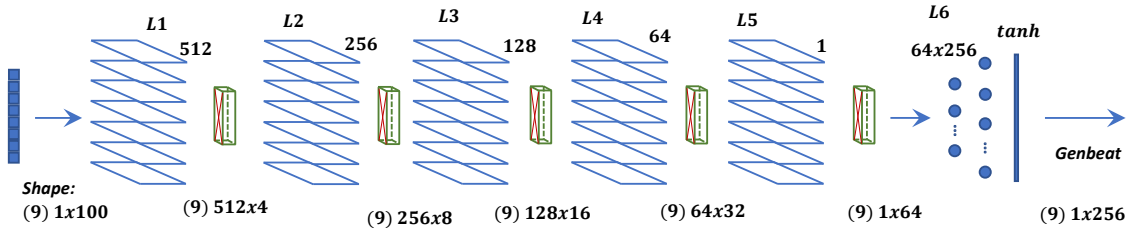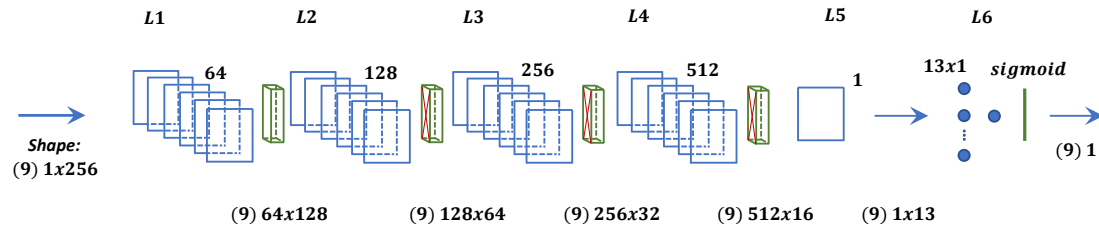
Fig. SIII. Graphical Representation of Model 3

Model 03

Shape:
(9) $1x256$

tanh

Shape:
(9) $1x2000$

Forward LSTM

Backward LSTM

$2 - Layer\ BiLSTM$

Shape:
(9) $1x100$

Shape:
(9) $1x256$

64   128   256   512   1 $13x1$ *sigmoid*

(9) 1

(9) $64x128$ (9) $128x64$ (9) $256x32$ (9) $512x16$ (9) $1x13$

Discriminator layers:

L1 – L4: 1D-convolutional layer

L5: Fully Connected layer

All filters:

padding   1

stride   1

size   4
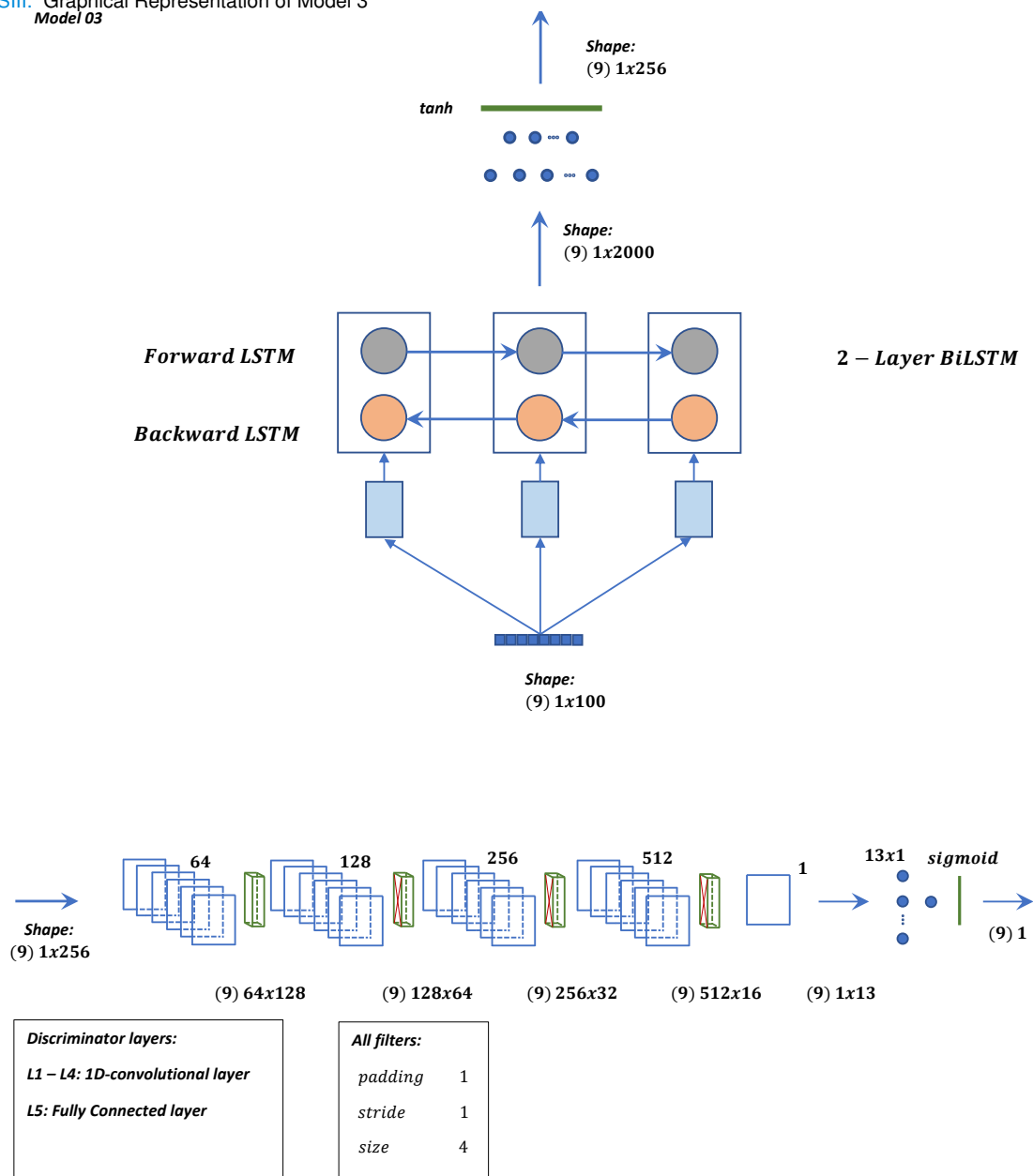
Graphical Representation of Model 4

Model 04

Generator
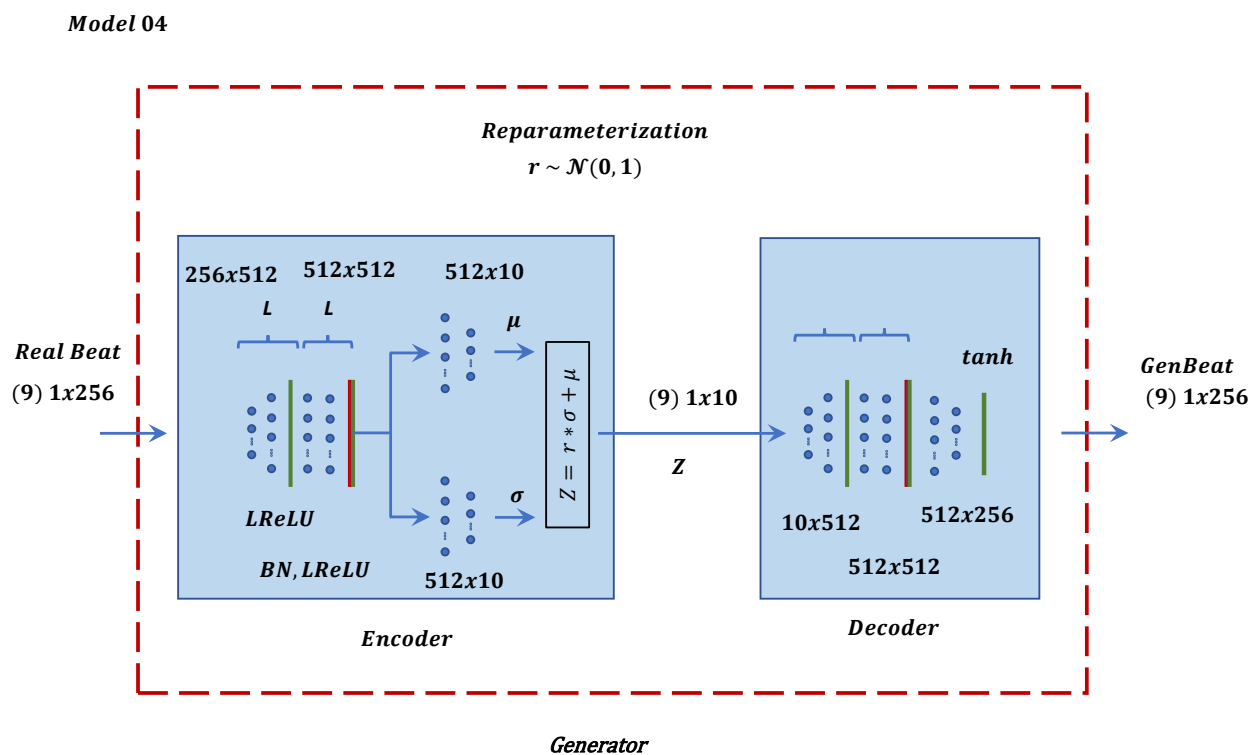
model: 04

Discriminator

Fig. SV. Graphical Representation of Model 5

Model: 05 - Generator

$$z = (z_1, z_2 \ldots, z_{100}), \qquad z_i \sim \mathcal{N}(0,1)$$
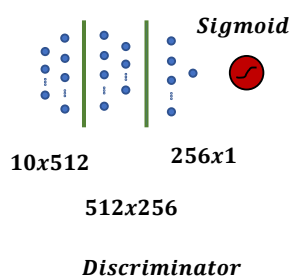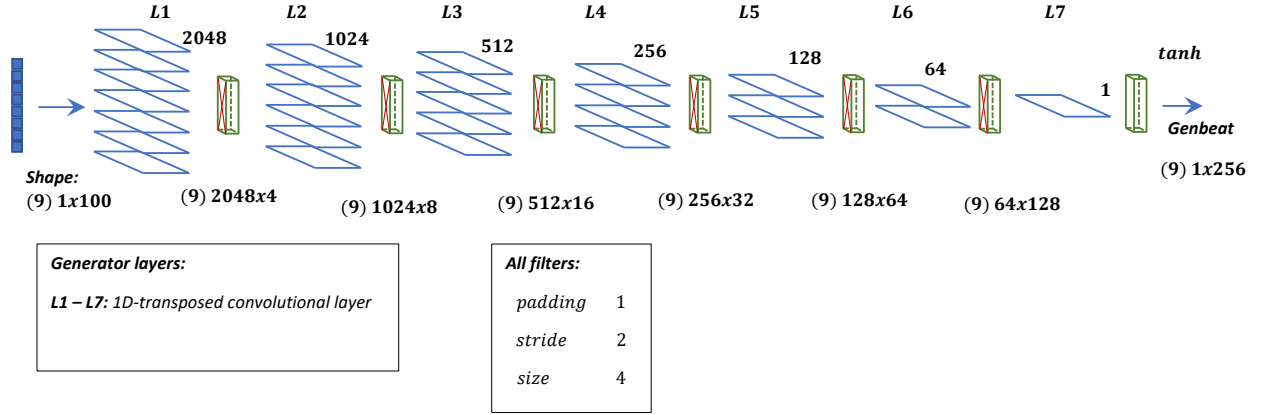
L1   L2   L3   L4   L5   L6   L7

2048   1024   512   256   128   64 $tanh$ 1

Shape:
(9) $1x100$ (9) $2048x4$ (9) $1024x8$ (9) $512x16$ (9) $256x32$ (9) $128x64$ (9) $64x128$

Genbeat (9) $1x256$

Generator layers:

L1 – L7: 1D-transposed convolutional layer

All filters:

$padding$	1
$stride$	2
$size$	4

Model: 05 - Discriminator

L1   L2   L3   L4   L5   L6   L7

64   128   256   512   1024   2048   1

Shape:
(9) $1x256$ (9) $64x128$ (9) $128x64$ (9) $256x32$ (9) $512x16$ (9) $1024x8$ (9) $2048x4$ 1

Discriminator layers:

L1 – L4: 1D-convolutional layer

All filters:

$padding$	1
$stride$	1
$size$	4