L2G-ECG: Learning to Generate Missing Leads in ECG Signals via Adversarial Autoencoder

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1 Arrhythmia classes

In this work the subjects suffering from twenty-six cardiac arrhythmia are considered which are atrial fibrillation, atrial flutter, bundle branch block, bradycardia, 1st-degree AV block, complete right bundle branch block, left axis deviation, left anterior fascicular block, left bundle branch block, low QRS voltages, nonspecific intraventricular conduction disorder, complete left bundle branch block, incomplete right bundle branch block, premature ventricular contractions, pacing rhythm, premature atrial contraction, pacing rhythm, poor R wave progression, prolonged PR interval, prolonged QT interval, Q-wave abnormal, right axis deviation, right bundle branch block sinus arrhythmia, sinus bradycardia, sinus tachycardia, T wave abnormal, T wave inversion and ventricular premature beats.

2 Quantitative analysis of generated 12-Lead ECG signals using various available leads

Table 1: Result demonstrating the quantitative analysis of generated 12-lead ECG signal using single available lead. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	Quantitative Evaluation Metric																		
	Validation Set			Held-out Set			Validation Set						Held-out Set						
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	Interval (s)			Amplitude			Interval (s)			Amplitude			
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
I	0.86	29.18	0.03	0.87	29.42	0.03	0.013	0.009	0.015	0.04	0.05	0.07	0.016	0.009	0.014	0.04	0.05	0.06
II	0.87	23.33	0.02	0.87	24.07	0.02	0	0	0	0	0	0	0	0	0	0	0	0
III	0.76	32.28	0.04	0.76	23.35	0.04	0.013	0.009	0.26	0.04	0.05	0.06	0.01	0.009	0.027	0.04	0.05	0.06
aVR	0.74	35.49	0.04	0.75	28.25	0.04	0.005	0.006	0.007	0.02	0.04	0.05	0.006	0.005	0.007	0.02	0.05	0.05
aVL	0.74	31.83	0.04	0.76	24.2	0.04	0.013	0.009	0.26	0.05	0.05	0.07	0.016	0.01	0.021	0.05	0.06	0.07
aVF	0.76	30.57	0.04	0.76	27.49	0.04	0.006	0.007	0.007	0.02	0.03	0.04	0.006	0.007	0.007	0.02	0.04	0.04
V1	0.83	28.03	0.03	0.83	35.32	0.03	0.016	0.009	0.025	0.05	0.06	0.07	0.011	0.009	0.024	0.04	0.06	0.07
V2	0.83	30.51	0.03	0.84	39.66	0.03	0.016	0.009	0.019	0.04	0.06	0.06	0.011	0.009	0.021	0.05	0.08	0.07
V3	0.84	30.57	0.02	0.85	36.79	0.02	0.01	0.009	0.014	0.04	0.06	0.06	0.013	0.009	0.014	0.04	0.07	0.07
V4	0.85	30.51	0.02	0.85	35.06	0.02	0.01	0.009	0.013	0.03	0.06	0.06	0.016	0.009	0.014	0.03	0.06	0.06
V5	0.72	28.03	0.05	0.74	31.77	0.05	0.013	0.009	0.023	0.04	0.05	0.06	0.013	0.009	0.021	0.02	0.05	0.06
V6	0.85	30.52	0.03	0.86	36.09	0.03	0.013	0.009	0.02	0.03	0.05	0.06	0.013	0.009	0.014	0.02	0.05	0.05

Table 2: Result demonstrating the quantitative analysis of generated 12-lead ECG signal using two available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	**Quantitative Evaluation Metric**																	
	Validation Set			**Held-out Set**			**Validation Set**						**Held-out Set**					
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	**Interval (s)**			**Amplitude**			**Interval (s)**			**Amplitude**		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
I,III	0.94	13.15	0.02	0.93	13.44	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,V1	0.79	18.33	0.04	0.78	18.27	0.04	0.009	0.006	0.019	0.04	0.06	0.06	0.009	0.006	0.013	0.03	0.06	0.06
I,V2	0.89	21.46	0.02	0.88	22.15	0.03	0.008	0.006	0.013	0.04	0.05	0.06	0.008	0.006	0.015	0.03	0.07	0.06
I,V3	0.9	19.53	0.02	0.89	20.21	0.02	0.008	0.006	0.014	0.04	0.05	0.07	0.007	0.006	0.01	0.03	0.06	0.07
I,V4	0.9	18.52	0.02	0.9	18.02	0.02	0.008	0.006	0.017	0.03	0.05	0.07	0.009	0.005	0.012	0.03	0.05	0.06
I,V5	0.82	18.03	0.03	0.81	19.14	0.03	0.007	0.006	0.016	0.03	0.05	0.06	0.008	0.005	0.011	0.03	0.05	0.06
I,V6	0.9	20.31	0.02	0.9	23.97	0.02	0.008	0.006	0.01	0.03	0.05	0.06	0.008	0.005	0.011	0.03	0.06	0.05
III,V1	0.8	12.03	0.03	0.8	11.77	0.03	0.008	0.006	0.012	0.03	0.05	0.06	0.009	0.006	0.016	0.03	0.05	0.06
III,V2	0.81	9.38	0.03	0.81	8.92	0.03	0.008	0.006	0.013	0.03	0.05	0.06	0.009	0.006	0.014	0.04	0.06	0.06
III,V3	0.9	9.76	0.02	0.9	10.81	0.02	0.008	0.006	0.012	0.03	0.05	0.06	0.01	0.006	0.017	0.03	0.06	0.06
III,V4	0.91	9.87	0.02	0.91	10.59	0.02	0.008	0.006	0.012	0.03	0.05	0.06	0.009	0.006	0.015	0.03	0.05	0.05
III,V5	0.92	11.62	0.03	0.92	13.09	0.02	0.008	0.006	0.015	0.03	0.05	0.05	0.01	0.006	0.014	0.03	0.05	0.05
III,V6	0.85	13.47	0.02	0.84	15.28	0.03	0.008	0.006	0.016	0.03	0.05	0.05	0.009	0.006	0.008	0.03	0.05	0.05
V1,V2	0.86	30.68	0.03	0.85	25.78	0.03	0.008	0.007	0.018	0.04	0.05	0.07	0.008	0.006	0.008	0.03	0.05	0.06
V1,V3	0.75	26.1	0.04	0.74	23.69	0.04	0.008	0.007	0.023	0.03	0.05	0.06	0.009	0.006	0.01	0.03	0.06	0.06
V1,V4	0.87	25.4	0.03	0.87	23.28	0.01	0.007	0.006	0.016	0.03	0.05	0.07	0.008	0.006	0.014	0.02	0.05	0.05
V1,V5	0.77	22.06	0.03	0.76	19.78	0.03	0.008	0.006	0.015	0.03	0.05	0.06	0.008	0.006	0.012	0.02	0.05	0.05
V1,V6	0.87	24.32	0.03	0.87	23.43	0.03	0.008	0.006	0.01	0.03	0.05	0.06	0.008	0.006	0.014	0.03	0.06	0.06
V2,V3	0.74	31.31	0.03	0.73	28.25	0.04	0.008	0.006	0.024	0.04	0.05	0.06	0.008	0.006	0.016	0.03	0.07	0.06
V2,V4	0.76	26.36	0.03	0.75	23.61	0.03	0.008	0.006	0.006	0.03	0.05	0.06	0.008	0.006	0.012	0.03	0.05	0.05
V2,V5	0.88	25.18	0.03	0.73	22.75	0.02	0.008	0.006	0.013	0.03	0.05	0.06	0.008	0.006	0.014	0.02	0.05	0.05
V2,V6	0.88	23.97	0.02	0.87	22.81	0.01	0.008	0.006	0.013	0.03	0.05	0.06	0.008	0.006	0.013	0.02	0.06	0.05
V3,V4	0.75	29.72	0.04	0.74	26.07	0.04	0.008	0.006	0.023	0.03	0.05	0.05	0.009	0.006	0.012	0.03	0.06	0.05
V3,V5	0.88	27.38	0.02	0.87	23.68	0.03	0.007	0.007	0.018	0.03	0.05	0.06	0.008	0.006	0.013	0.03	0.05	0.05
V3,V6	0.78	23.39	0.03	0.76	20.83	0.03	0.007	0.006	0.019	0.03	0.05	0.06	0.008	0.006	0.011	0.02	0.05	0.05
V4,V5	0.77	28.03	0.03	0.75	23.17	0.03	0.007	0.006	0.02	0.03	0.05	0.05	0.008	0.006	0.01	0.03	0.06	0.05
V4,V6	0.77	25.78	0.03	0.76	23.25	0.03	0.008	0.006	0.02	0.03	0.05	0.05	0.008	0.006	0.016	0.03	0.06	0.05
V5,V6	0.75	29.78	0.03	0.74	28.63	0.02	0.008	0.006	0.023	0.03	0.05	0.05	0.008	0.006	0.018	0.03	0.06	0.05

Table 3: Result demonstrating the quantitative analysis of generated 12-lead ECG signal using three available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	**Quantitative Evaluation Metric**																	
	Validation Set			**Held-out Set**			**Validation Set**						**Held-out Set**					
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	**Interval (s)**			**Amplitude**			**Interval (s)**			**Amplitude**		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
I,III,V1	0.96	10.08	0.01	0.96	11.13	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2	0.97	5.18	0.01	0.96	5.43	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V3	0.98	5.28	0.01	0.96	4.8	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V4	0.95	9.01	0.01	0.93	9.22	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V5	0.95	15.91	0.01	0.92	10.81	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V6	0.94	8.62	0.01	0.92	13.29	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,V1,V2	0.8	12.61	0.01	0.81	15.6	0.01	0.008	0.007	0.011	0.03	0.06	0.07	0.008	0.006	0.011	0.03	0.07	0.07
I,V1,V3	0.9	9.76	0.01	0.91	12.61	0.01	0.008	0.007	0.014	0.03	0.05	0.06	0.009	0.006	0.012	0.04	0.06	0.06
I,V1,V4	0.91	19.78	0.01	0.92	9.47	0.01	0.008	0.007	0.011	0.04	0.05	0.07	0.008	0.006	0.013	0.03	0.06	0.06
I,V1,V5	0.92	16.74	0.01	0.92	9.43	0.01	0.008	0.007	0.012	0.03	0.05	0.06	0.008	0.006	0.013	0.02	0.06	0.06
I,V1,V6	0.84	16.74	0.01	0.85	10.42	0.01	0.008	0.007	0.01	0.03	0.04	0.06	0.008	0.006	0.013	0.03	0.05	0.05
I,V2,V3	0.82	26.5	0.01	0.83	13.22	0.01	0.008	0.007	0.013	0.02	0.04	0.05	0.008	0.007	0.013	0.02	0.05	0.05
I,V2,V4	0.83	20.25	0.01	0.85	19.34	0.01	0.007	0.007	0.013	0.02	0.04	0.05	0.009	0.006	0.015	0.02	0.04	0.05
I,V2,V5	0.92	17.53	0.01	0.93	17.06	0.01	0.008	0.007	0.016	0.02	0.04	0.05	0.009	0.006	0.013	0.02	0.04	0.05
I,V2,V6	0.84	16.24	0	0.85	10.46	0	0.009	0.007	0.016	0.03	0.05	0.06	0.01	0.007	0.021	0.03	0.05	0.05
I,V3,V4	0.91	27.92	0.01	0.92	13.14	0.02	0.008	0.005	0.01	0.03	0.04	0.05	0.009	0.007	0.017	0.03	0.05	0.05
I,V3,V5	0.92	21.6	0.02	0.92	10.43	0.02	0.008	0.006	0.01	0.02	0.04	0.05	0.008	0.007	0.011	0.03	0.05	0.04
I,V3,V6	0.92	18.86	0.02	0.93	9.93	0.02	0.007	0.045	0.009	0.02	0.04	0.05	0.008	0.007	0.011	0.03	0.05	0.05
I,V4,V5	0.91	13.38	0.02	0.92	12.36	0.02	0.008	0.006	0.016	0.03	0.05	0.05	0.01	0.007	0.017	0.03	0.06	0.06
I,V4,V6	0.84	21.58	0.01	0.86	10.54	0.01	0.007	0.007	0.011	0.03	0.04	0.05	0.009	0.007	0.012	0.03	0.05	0.05
I,V5,V6	0.83	28.37	0.03	0.84	16.04	0.02	0.008	0.007	0.01	0.02	0.04	0.05	0.009	0.007	0.011	0.03	0.04	0.05
III,V1,V2	0.85	11.86	0.02	0.86	10.62	0.02	0.007	0.007	0.021	0.02	0.04	0.05	0.008	0.007	0.015	0.03	0.05	0.05
III,V1,V3	0.93	7.61	0.02	0.93	8.08	0.02	0.008	0.007	0.01	0.02	0.04	0.05	0.008	0.007	0.013	0.03	0.05	0.05
III,V1,V4	0.93	6.27	0.02	0.93	6.91	0.02	0.008	0.007	0.009	0.02	0.04	0.05	0.008	0.007	0.008	0.03	0.05	0.04
III,V1,V5	0.94	7.08	0.02	0.94	8.7	0.02	0.007	0.007	0.016	0.04	0.06	0.07	0.009	0.007	0.014	0.03	0.06	0.06
III,V1,V6	0.87	10.2	0.02	0.87	12.72	0.01	0.008	0.063	0.015	0.03	0.05	0.07	0.009	0.007	0.012	0.02	0.05	0.05
III,V2,V3	0.85	10.56	0.02	0.84	11.24	0.02	0.008	0.063	0.011	0.03	0.05	0.06	0.008	0.007	0.012	0.02	0.05	0.06
III,V2,V4	0.87	6.65	0.03	0.87	7.16	0.03	0.008	0.063	0.011	0.03	0.05	0.05	0.008	0.007	0.013	0.03	0.06	0.05
III,V2,V5	0.88	4.91	0.01	0.89	4.43	0.02	0.008	0.063	0.012	0.03	0.05	0.06	0.008	0.007	0.014	0.03	0.06	0.05
III,V2,V6	0.94	5.83	0.02	0.94	5.6	0.02	0.008	0.007	0.012	0.03	0.05	0.06	0.008	0.007	0.013	0.03	0.06	0.05
III,V3,V4	0.92	11.42	0.02	0.92	11.67	0.02	0.007	0.063	0.01	0.03	0.05	0.06	0.008	0.007	0.011	0.02	0.06	0.05
III,V3,V5	0.93	7.92	0.02	0.94	5.93	0.02	0.008	0.063	0.012	0.03	0.05	0.06	0.008	0.007	0.013	0.02	0.05	0.05
III,V3,V6	0.88	6.66	0.01	0.89	4.89	0.01	0.008	0.063	0.015	0.03	0.05	0.06	0.007	0.007	0.011	0.02	0.05	0.05
III,V4,V5	0.86	12.52	0.03	0.87	10.83	0.02	0.007	0.006	0.014	0.03	0.05	0.06	0.008	0.007	0.009	0.02	0.05	0.05
III,V4,V6	0.87	11.13	0.02	0.88	9.43	0.02	0.008	0.007	0.013	0.03	0.05	0.06	0.009	0.007	0.017	0.03	0.06	0.05
III,V5,V6	0.93	18.7	0.02	0.93	10.37	0.02	0.009	0.008	0.014	0.03	0.06	0.06	0.008	0.007	0.008	0.03	0.06	0.05
V1,V2,V3	0.87	24.76	0.02	0.88	26.24	0.02	0.008	0.007	0.011	0.03	0.05	0.06	0.008	0.007	0.016	0.03	0.06	0.06
V1,V2,V4	0.78	20.56	0.02	0.79	20.15	0.02	0.008	0.007	0.01	0.03	0.05	0.05	0.008	0.007	0.013	0.03	0.06	0.05
V1,V2,V5	0.89	19.54	0.02	0.89	20.58	0.01	0.008	0.007	0.013	0.03	0.05	0.06	0.008	0.007	0.013	0.02	0.06	0.05

Table 4: Result in continuation demonstrating the quantitative analysis of generated 12-lead ECG signal using three available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	Quantitative Evaluation Metric																	
	Validation Set			Held-out Set			Validation Set						Held-out Set					
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	Interval (s)			Amplitude			Interval (s)			Amplitude		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
V1,V2,V6	0.78	17.46	0.02	0.8	19	0.02	0.008	0.007	0.014	0.03	0.05	0.06	0.008	0.007	0.013	0.02	0.06	0.06
V1,V3,V4	0.77	21.48	0.01	0.78	22.45	0.03	0.008	0.007	0.014	0.03	0.05	0.06	0.008	0.007	0.015	0.03	0.05	0.05
V1,V3,V5	0.78	18.84	0.01	0.8	19.78	0.01	0.007	0.007	0.016	0.03	0.05	0.06	0.008	0.007	0.016	0.03	0.06	0.06
V1,V3,V6	0.89	18.46	0.01	0.89	21.72	0.02	0.007	0.045	0.009	0.02	0.04	0.05	0.008	0.007	0.011	0.03	0.05	0.05
V1,V4,V5	0.88	20.88	0.01	0.89	23.62	0.02	0.008	0.006	0.016	0.03	0.05	0.05	0.01	0.007	0.017	0.03	0.06	0.06
V1,V4,V6	0.89	18.79	0.01	0.89	22.86	0.02	0.007	0.007	0.011	0.03	0.04	0.05	0.009	0.007	0.012	0.03	0.05	0.05
V1,V5,V6	0.77	18.97	0.01	0.78	22.36	0.02	0.008	0.007	0.01	0.02	0.04	0.05	0.009	0.007	0.011	0.03	0.04	0.05
V2,V3,V4	0.76	20.68	0.02	0.77	28.69	0.02	0.008	0.063	0.015	0.03	0.05	0.06	0.007	0.007	0.011	0.02	0.05	0.05
V2,V3,V5	0.88	19.31	0.02	0.89	26.66	0.02	0.007	0.006	0.014	0.03	0.05	0.06	0.008	0.007	0.009	0.02	0.05	0.05
V2,V3,V6	0.77	16.91	0.02	0.79	23.91	0.02	0.005	0.004	0.005	0.02	0.04	0.01	0.005	0.005	0.009	0.02	0.01	0.01
V2,V4,V5	0.88	18.97	0.02	0.89	25.55	0.01	0.004	0.004	0.006	0.02	0.04	0.01	0.005	0.005	0.007	0.03	0.01	0.01
V2,V4,V6	0.88	17.54	0.01	0.89	25.78	0.02	0.004	0.004	0.007	0.02	0.05	0.01	0.004	0.005	0.004	0.03	0.01	0.01
V2,V5,V6	0.88	17.14	0.01	0.89	25.52	0.02	0.005	0.004	0.004	0.02	0.04	0.01	0.005	0.004	0.006	0.02	0.05	0.05
V3,V4,V5	0.87	21.52	0.01	0.88	29.16	0.02	0.008	0.006	0.006	0.03	0.05	0.06	0.008	0.006	0.012	0.03	0.05	0.05
V3,V4,V6	0.77	18.36	0.01	0.79	25.66	0.02	0.008	0.006	0.013	0.03	0.05	0.06	0.008	0.006	0.014	0.02	0.05	0.05
V3,V5,V6	0.77	17.88	0.01	0.79	25.28	0.01	0.008	0.006	0.013	0.03	0.05	0.06	0.008	0.006	0.013	0.02	0.06	0.05
V4,V5,V6	0.76	20.61	0.01	0.78	27.99	0.02	0.008	0.006	0.023	0.03	0.05	0.05	0.009	0.006	0.012	0.03	0.06	0.05

Table 5: Results demonstrating the quantitative analysis of generated 12-lead ECG signal using four available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	Quantitative Evaluation Metric																	
	Validation Set			Held-out Set			Validation Set						Held-out Set					
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	Interval (s)			Amplitude			Interval (s)			Amplitude		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
I,III,V1,V2	0.95	4.41	0.01	0.95	4.51	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V3	0.98	1.84	0.01	0.98	2.33	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V4	0.98	2	0.01	0.98	2.59	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V5	0.98	3.87	0.01	0.98	6.03	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V6	0.98	6.95	0.01	0.97	9.21	0.02	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V3	0.95	2.13	0.02	0.95	2.46	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V4	0.98	1.22	0.01	0.98	1.48	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V5	0.98	1.35	0.01	0.98	1.64	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V6	0.98	2.66	0.01	0.98	2.88	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V3,V4	0.95	3.55	0.02	0.96	2.82	0.02	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V3,V5	0.98	3.37	0.01	0.98	2.27	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V3,V6	0.98	3.68	0.01	0.98	2.71	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V4,V5	0.95	7.55	0.02	0.95	6.65	0.02	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V4,V6	0.95	7.86	0.02	0.96	6.82	0.02	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V5,V6	0.97	15.24	0.02	0.97	17.97	0.02	0	0	0	0	0	0	0	0	0	0	0	0
I,V1,V2,V3	0.91	23.52	0.01	0.92	11.57	0.01	0.04	0.02	0.05	0.04	0.05	0.02	0.04	0.03	0.06	0.03	0.03	0.03
I,V1,V2,V4	0.92	17.65	0.01	0.93	15.87	0.01	0.04	0.02	0.06	0.03	0.05	0.02	0.04	0.02	0.03	0.03	0.02	0.03
I,V1,V2,V5	0.86	12.56	0.02	0.87	11.04	0.02	0.05	0.02	0.07	0.03	0.05	0.02	0.03	0.02	0.04	0.03	0.02	0.03
I,V1,V2,V6	0.86	12.43	0.01	0.87	14.27	0.01	0.04	0.02	0.03	0.03	0.05	0.02	0.04	0.02	0.04	0.03	0.03	0.02
I,V1,V3,V4	0.84	16.06	0.01	0.86	14.99	0.01	0.04	0.02	0.04	0.03	0.05	0.03	0.04	0.03	0.03	0.03	0.03	0.03
I,V1,V3,V5	0.86	11.64	0.01	0.88	10.27	0.01	0.03	0.02	0.02	0.03	0.05	0.02	0.04	0.03	0.02	0.03	0.02	0.02
I,V1,V3,V6	0.93	11.09	0.02	0.93	12.99	0.01	0.04	0.02	0.06	0.03	0.05	0.02	0.04	0.02	0.04	0.02	0.02	0.03
I,V1,V4,V5	0.86	12.44	0.01	0.87	12.76	0.01	0.04	0.02	0.07	0.03	0.05	0.01	0.03	0.02	0.04	0.03	0.02	0.03

Table 6: Result in continuation demonstrating the quantitative analysis of generated 12-lead ECG signal using four available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	Quantitative Evaluation Metric																	
	Validation Set			Held-out Set			Validation Set						Held-out Set					
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	Interval (s)			Amplitude			Interval (s)			Amplitude		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
I,V1,V4,V6	0.86	10.83	0.02	0.87	12.57	0.01	0.04	0.02	0.02	0.03	0.05	0.02	0.04	0.02	0.02	0.03	0.02	0.02
I,V1,V5,V6	0.86	12.87	0.01	0.87	15.29	0.02	0.04	0.02	0.02	0.03	0.04	0.01	0.04	0.02	0.02	0.03	0.02	0.02
I,V2,V3,V4	0.84	19.76	0.01	0.85	18.61	0.02	0.03	0.02	0.02	0.03	0.05	0.02	0.05	0.02	0.02	0.03	0.03	0.02
I,V2,V3,V5	0.92	16.46	0.01	0.93	16.18	0.02	0.04	0.02	0.03	0.03	0.04	0.02	0.04	0.02	0.08	0.03	0.03	0.03
I,V2,V3,V6	0.93	14.78	0.01	0.93	16.92	0.02	0.04	0.02	0.05	0.03	0.05	0.02	0.05	0.02	0.07	0.02	0.03	0.03
I,V2,V4,V5	0.92	16.49	0.01	0.93	17.28	0.02	0.05	0.02	0.05	0.03	0.05	0.01	0.04	0.03	0.07	0.02	0.03	0.02
I,V2,V4,V6	0.86	13.09	0.02	0.88	14.73	0.02	0.04	0.02	0.04	0.03	0.04	0.01	0.04	0.02	0.02	0.03	0.03	0.03
I,V2,V5,V6	0.86	13.87	0.02	0.87	14.25	0.02	0.04	0.02	0.03	0.03	0.04	0.01	0.04	0.02	0.04	0.03	0.03	0.03
I,V3,V4,V5	0.84	19.35	0.02	0.87	16.45	0.01	0.04	0.02	0.04	0.03	0.05	0.02	0.04	0.02	0.04	0.03	0.02	0.02
I,V3,V4,V6	0.92	18.09	0.02	0.93	18.3	0.01	0.04	0.02	0.03	0.03	0.05	0.02	0.04	0.02	0.08	0.03	0.03	0.02
I,V3,V5,V6	0.85	16.79	0.01	0.87	17.29	0.01	0.04	0.02	0.08	0.03	0.05	0.02	0.03	0.02	0.06	0.03	0.02	0.02
I,V4,V5,V6	0.92	24.44	0.01	0.93	25.09	0.01	0.04	0.02	0.09	0.03	0.05	0.02	0.04	0.02	0.06	0.02	0.02	0.02
III,V1,V2,V3	0.93	7.62	0.02	0.93	7.88	0.01	0.03	0.02	0.04	0.02	0.04	0.02	0.05	0.03	0.06	0.02	0.02	0.03
III,V1,V2,V4	0.94	5.13	0.02	0.94	5.48	0.01	0.04	0.02	0.04	0.02	0.04	0.01	0.04	0.03	0.03	0.02	0.02	0.02
III,V1,V2,V5	0.9	3.52	0.03	0.9	3.21	0.01	0.03	0.02	0.02	0.02	0.04	0.01	0.05	0.03	0.05	0.02	0.01	0.02
III,V1,V2,V6	0.95	4.22	0.01	0.95	4.18	0.01	0.04	0.02	0.06	0.02	0.04	0.01	0.04	0.02	0.03	0.02	0.01	0.02
III,V1,V3,V4	0.89	4.55	0.02	0.89	4.85	0.02	0.04	0.02	0.04	0.02	0.04	0.01	0.06	0.03	0.08	0.03	0.02	0.02
III,V1,V3,V5	0.9	2.86	0.02	0.91	2.26	0.01	0.04	0.02	0.01	0.02	0.04	0.01	0.04	0.03	0.04	0.02	0.01	0.01
III,V1,V3,V6	0.9	2.21	0.01	0.91	1.97	0.02	0.04	0.02	0.01	0.02	0.04	0.01	0.04	0.02	0.05	0.02	0.01	0.02
III,V1,V4,V5	0.94	4.21	0.01	0.95	3.81	0.02	0.03	0.02	0.01	0.02	0.04	0.01	0.04	0.03	0.05	0.03	0.02	0.02
III,V1,V4,V6	0.95	3.17	0.02	0.95	3.1	0.02	0.04	0.02	0.06	0.02	0.04	0.01	0.04	0.03	0.03	0.02	0.02	0.02
III,V1,V5,V6	0.94	5.53	0.01	0.95	7.17	0.01	0.03	0.02	0.06	0.02	0.04	0.01	0.04	0.03	0.02	0.02	0.01	0.02
III,V2,V3,V4	0.93	7.27	0.01	0.93	8.22	0.01	0.05	0.02	0.07	0.03	0.05	0.02	0.05	0.03	0.07	0.03	0.03	0.03
III,V2,V3,V5	0.94	4.67	0.01	0.95	3.83	0.01	0.05	0.03	0.05	0.03	0.05	0.01	0.05	0.03	0.09	0.03	0.02	0.02
III,V2,V3,V6	0.94	3.61	0.01	0.95	3.12	0.02	0.03	0.02	0.07	0.02	0.05	0.01	0.04	0.02	0.02	0.02	0.02	0.02
III,V2,V4,V5	0.89	4.11	0.01	0.9	3.4	0.02	0.04	0.02	0.01	0.02	0.04	0.01	0.04	0.03	0.05	0.03	0.02	0.02
III,V2,V4,V6	0.89	2.9	0.01	0.9	2.47	0.02	0.04	0.02	0.03	0.02	0.04	0.01	0.05	0.03	0.07	0.02	0.02	0.02
III,V2,V5,V6	0.89	3.53	0.01	0.9	3.38	0.02	0.04	0.02	0.02	0.02	0.04	0.01	0.04	0.02	0.05	0.03	0.02	0.01
III,V3,V4,V5	0.94	7.51	0.01	0.94	5.72	0.02	0.04	0.02	0.01	0.02	0.04	0.01	0.05	0.03	0.08	0.03	0.02	0.02
III,V3,V4,V6	0.89	5.77	0.02	0.9	4.28	0.02	0.05	0.02	0.02	0.02	0.04	0.01	0.04	0.03	0.05	0.03	0.02	0.02
III,V3,V5,V6	0.89	5.74	0.02	0.9	4.15	0.02	0.04	0.02	0.02	0.02	0.04	0.01	0.04	0.03	0.07	0.03	0.02	0.01
III,V4,V5,V6	0.88	10.71	0.02	0.89	9.15	0.02	0.04	0.02	0.01	0.02	0.04	0.01	0.04	0.02	0.04	0.03	0.02	0.01
V1,V2,V3,V4	0.88	21.23	0.02	0.89	21.89	0.02	0.04	0.02	0.04	0.03	0.05	0.02	0.04	0.03	0.07	0.03	0.03	0.02
V1,V2,V3,V5	0.89	18.57	0.02	0.9	18.88	0.02	0.04	0.02	0.05	0.03	0.05	0.02	0.04	0.03	0.05	0.02	0.02	0.03
V1,V2,V3,V6	0.89	16.79	0.02	0.9	18.63	0.02	0.04	0.02	0.06	0.03	0.05	0.02	0.04	0.03	0.06	0.02	0.02	0.03
V1,V2,V4,V5	0.89	18.25	0.02	0.9	18.66	0.02	0.04	0.02	0.06	0.03	0.05	0.02	0.04	0.03	0.06	0.02	0.03	0.02
V1,V2,V4,V6	0.8	14.97	0.02	0.82	15.45	0.02	0.03	0.02	0.03	0.03	0.05	0.02	0.04	0.03	0.03	0.03	0.03	0.02

Table 7: Results demonstrating the quantitative analysis of generated 12-lead ECG signal using five available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	**Quantitative Evaluation Metric**																	
	Validation Set			**Held-out Set**			**Validation Set**						**Held-out Set**					
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	**Interval (s)**			**Amplitude**			**Interval (s)**			**Amplitude**		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
I,III,V1,V2,V3	0.97	1.69	0.01	0.97	1.88	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V4	0.99	0.77	0	0.98	1.05	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V5	0.99	0.93	0	0.99	1.27	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V6	0.99	2.27	0	0.99	2.68	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V3,V4	0.99	0.75	0	0.98	1.03	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V3,V5	0.99	0.25	0	0.99	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V3,V6	0.98	0.5	0.01	0.98	0.55	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V4,V5	0.99	1.35	0	0.99	1.52	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V4,V6	0.99	1.38	0	0.99	1.59	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V5,V6	0.98	3.58	0.01	0.98	5.28	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V3,V4	0.98	1.18	0.01	0.98	1.4	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V3,V5	0.99	0.68	0	0.99	0.63	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V3,V6	0.97	0.9	0.01	0.98	0.91	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V4,V5	0.98	0.67	0	0.99	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V4,V6	0.99	0.67	0	0.99	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V5,V6	0.97	1.23	0.01	0.97	1.48	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V3,V4,V5	0.96	3.04	0.02	0.97	2.03	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V3,V4,V6	0.97	3.04	0.01	0.97	1.99	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V3,V5,V6	0.98	3.36	0.01	0.99	2.28	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V4,V5,V6	0.98	8.32	0.01	0.98	7.25	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,V1,V2,V3,V4	0.92	17.53	0.03	0.93	16.1	0.03	0.005	0.004	0.008	0.03	0.06	0.03	0.004	0.005	0.006	0.03	0.02	0.02
I,V1,V2,V3,V5	0.93	12.53	0.02	0.94	12.1	0.02	0.004	0.004	0.004	0.03	0.05	0.01	0.005	0.004	0.004	0.02	0.02	0.02
I,V1,V2,V3,V6	0.93	11.23	0.02	0.94	12.66	0.02	0.023	0.004	0.004	0.03	0.05	0.02	0.004	0.004	0.004	0.02	0.02	0.02
I,V1,V2,V4,V5	0.87	11.24	0.02	0.88	10.28	0.02	0.023	0.004	0.005	0.03	0.04	0.02	0.004	0.004	0.006	0.03	0.05	0.05
I,V1,V2,V4,V6	0.88	9.87	0.02	0.89	10.12	0.02	0.004	0.004	0.005	0.03	0.04	0.02	0.005	0.004	0.004	0.03	0.05	0.06
I,V1,V2,V5,V6	0.93	11	0.01	0.94	11.82	0.01	0.004	0.004	0.007	0.03	0.04	0.02	0.005	0.004	0.005	0.03	0.02	0.01
I,V1,V3,V4,V5	0.93	12.68	0.02	0.94	12.96	0.01	0.004	0.004	0.004	0.03	0.05	0.01	0.004	0.004	0.004	0.02	0.02	0.02
I,V1,V3,V4,V6	0.93	10.88	0.02	0.94	11.79	0.02	0.004	0.004	0.004	0.03	0.05	0.01	0.005	0.004	0.004	0.02	0.01	0.02
I,V1,V3,V5,V6	0.93	10.63	0.01	0.94	11.79	0.02	0.004	0.004	0.009	0.03	0.05	0.02	0.005	0.004	0.007	0.03	0.02	0.02
I,V1,V4,V5,V6	0.93	11.61	0.01	0.94	13.44	0.01	0.005	0.004	0.009	0.03	0.05	0.02	0.005	0.005	0.007	0.03	0.02	0.02
I,V2,V3,V4,V5	0.86	14.8	0.03	0.88	13.77	0.02	0.004	0.004	0.007	0.03	0.05	0.02	0.005	0.004	0.004	0.03	0.01	0.01
I,V2,V3,V4,V6	0.87	13.01	0.03	0.88	14.71	0.02	0.004	0.004	0.005	0.03	0.04	0.01	0.004	0.004	0.009	0.03	0.01	0.01
I,V2,V3,V5,V6	0.87	13.07	0.03	0.88	13.82	0.02	0.005	0.004	0.005	0.03	0.04	0.02	0.005	0.004	0.007	0.02	0.01	0.01
I,V2,V4,V5,V6	0.93	14.09	0.01	0.94	15.09	0.01	0.005	0.004	0.005	0.03	0.04	0.02	0.005	0.004	0.006	0.03	0.02	0.01
I,V3,V4,V5,V6	0.92	17.84	0.02	0.93	18.65	0.01	0.005	0.004	0.007	0.03	0.05	0.02	0.004	0.005	0.007	0.03	0.02	0.02
III,V1,V2,V3,V4	0.94	4.83	0.02	0.94	5.21	0.02	0.005	0.004	0.004	0.03	0.04	0.01	0.004	0.005	0.007	0.03	0.03	0.03
III,V1,V2,V3,V5	0.95	2.97	0.01	0.95	2.31	0.01	0.005	0.004	0.005	0.02	0.04	0.01	0.005	0.005	0.009	0.02	0.01	0.01
III,V1,V2,V3,V6	0.95	2.31	0.01	0.96	2.02	0.01	0.004	0.004	0.006	0.02	0.04	0.01	0.005	0.005	0.007	0.03	0.01	0.01
III,V1,V2,V4,V5	0.95	2.88	0.01	0.95	2.28	0.02	0.004	0.004	0.007	0.02	0.05	0.01	0.004	0.005	0.004	0.03	0.01	0.01
III,V1,V2,V4,V6	0.91	1.77	0.01	0.92	1.51	0.01	0.005	0.004	0.004	0.02	0.04	0.01	0.005	0.004	0.006	0.02	0.05	0.05
III,V1,V2,V5,V6	0.91	2.4	0.02	0.91	2.37	0.02	0.005	0.004	0.005	0.02	0.04	0.01	0.004	0.005	0.005	0.02	0.04	0.05
III,V1,V3,V4,V5	0.9	2.76	0.02	0.91	2.25	0.02	0.005	0.004	0.005	0.02	0.04	0.01	0.004	0.005	0.004	0.02	0.05	0.05
III,V1,V3,V4,V6	0.95	1.97	0.01	0.96	1.65	0.01	0.005	0.004	0.005	0.02	0.04	0.01	0.004	0.005	0.007	0.02	0	0

Table 8: Result in continuation demonstrating the quantitative analysis of generated 12-lead ECG signal using five available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	Quantitative Evaluation Metric																	
	Validation Set			Held-out Set			Validation Set						Held-out Set					
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	Interval (s)			Amplitude			Interval (s)			Amplitude		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
III,V1,V3,V5,V6	0.95	1.93	0.01	0.96	1.63	0.01	0.004	0.004	0.006	0.02	0.04	0.01	0.004	0.005	0.004	0.03	0	0.01
III,V1,V4,V5,V6	0.95	3.09	0.02	0.95	2.99	0.02	0.005	0.004	0.006	0.02	0.04	0.01	0.004	0.005	0.004	0.02	0	0.01
III,V2,V3,V4,V5	0.94	4.54	0.02	0.95	3.77	0.01	0.005	0.004	0.004	0.02	0.05	0.01	0.005	0.005	0.007	0.02	0.01	0.01
III,V2,V3,V4,V6	0.95	3.14	0.01	0.95	2.68	0.01	0.004	0.004	0.006	0.03	0.05	0.01	0.004	0.005	0.007	0.03	0.01	0.01
III,V2,V3,V5,V6	0.95	3.02	0.01	0.95	2.58	0.02	0.005	0.004	0.005	0.03	0.05	0.01	0.005	0.005	0.009	0.03	0.01	0.01
III,V2,V4,V5,V6	0.95	3.01	0.01	0.95	2.59	0.02	0.004	0.004	0.007	0.02	0.04	0.01	0.005	0.004	0.005	0.03	0.01	0.01
III,V3,V4,V5,V6	0.89	5.52	0.02	0.91	4.1	0.02	0.005	0.004	0.005	0.02	0.04	0.01	0.005	0.004	0.007	0.03	0.06	0.06
V1,V2,V3,V4,V5	0.8	17.5	0.03	0.81	17.19	0.03	0.005	0.008	0.006	0.06	0.08	0.05	0.007	0.007	0.011	0.1	0.09	0.09
V1,V2,V3,V4,V6	0.8	15.6	0.03	0.82	16.7	0.03	0.004	0.004	0.005	0.03	0.05	0.02	0.004	0.004	0.007	0.02	0.01	0.02
V1,V2,V3,V5,V6	0.9	16.43	0.02	0.9	18.26	0.01	0.005	0.004	0.005	0.03	0.04	0.01	0.004	0.004	0.007	0.02	0.02	0.02
V1,V2,V4,V5,V6	0.9	16.26	0.02	0.9	17.98	0.02	0.005	0.004	0.007	0.03	0.05	0.01	0.004	0.004	0.005	0.02	0.02	0.02
V1,V3,V4,V5,V6	0.89	17.96	0.01	0.9	20.73	0.02	0.004	0.004	0.004	0.03	0.05	0.01	0.004	0.004	0.004	0.02	0.02	0.02
V2,V3,V4,V5,V6	0.89	21.42	0.01	0.89	25.12	0.02	0.004	0.005	0.009	0.03	0.06	0.02	0.005	0.004	0.004	0.03	0.02	0.02

Table 9: Results demonstrating the quantitative analysis of generated 12-lead ECG signal using six available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	Quantitative Evaluation Metric																	
	Validation Set			Held-out Set			Validation Set						Held-out Set					
	AUP_S	AUP_M $\times 10^{-5}$	IL	AUP_S	AUP_M $\times 10^{-5}$	IL	Interval (s)			Amplitude			Interval (s)			Amplitude		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
I,III,V1,V2,V3,V4	0.99	0.76	0	0.99	1.05	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V3,V5	0.99	0.25	0	0.99	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V3,V6	0.99	0.56	0	0.99	0.57	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V4,V5	0.98	0.23	0.01	0.98	0.2	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V4,V6	0.99	0.2	0	0.99	0.18	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V5,V6	0.98	0.84	0	0.98	1.09	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V3,V4,V5	0.99	0.25	0	0.99	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V3,V4,V6	0.99	0.24	0	0.99	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V3,V5,V6	0.99	0.25	0	0.99	0.22	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V4,V5,V6	0.98	1.26	0	0.98	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V3,V4,V5	0.97	0.63	0.01	0.98	0.57	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V3,V4,V6	0.99	0.69	0	0.99	0.66	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V3,V5,V6	0.99	0.67	0	0.99	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V4,V5,V6	0.99	0.66	0	0.99	0.61	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V3,V4,V5,V6	0.98	3.19	0.01	0.99	2.18	0.01	0	0	0	0	0	0	0	0	0	0	0	0
I,V1,V2,V3,V4,V5	0.93	6.28	0.02	0.94	6.27	0.02	0.005	0.005	0.005	0.03	0.04	0.03	0.006	0.005	0.009	0.02	0.03	0.03
I,V1,V2,V3,V4,V6	0.94	5.4	0.02	0.94	5.66	0.02	0.006	0.005	0.005	0.03	0.05	0.03	0.006	0.005	0.009	0.03	0.03	0.03
I,V1,V2,V3,V5,V6	0.94	5.68	0.02	0.94	6.04	0.02	0.007	0.005	0.004	0.03	0.05	0.03	0.006	0.005	0.004	0.03	0.03	0.03
I,V1,V2,V4,V5,V6	0.88	4.62	0.03	0.89	5.11	0.02	0.005	0.005	0.006	0.03	0.04	0.03	0.006	0.004	0.005	0.02	0.02	0.03
I,V1,V3,V4,V5,V6	0.88	4.83	0.03	0.89	5.33	0.02	0.005	0.005	0.006	0.03	0.04	0.03	0.006	0.004	0.005	0.03	0.02	0.02
I,V2,V3,V4,V5,V6	0.93	7.04	0.02	0.94	7.19	0.02	0.005	0.005	0.004	0.03	0.05	0.03	0.006	0.004	0.006	0.03	0.03	0.03
III,V1,V2,V3,V4,V5	0.95	1.45	0.01	0.96	2.32	0.01	0.004	0.004	0.004	0.02	0.04	0.02	0.006	0.005	0.006	0.03	0.02	0.02
III,V1,V2,V3,V4,V6	0.96	0.98	0.01	0.96	1.63	0.01	0.004	0.004	0.004	0.02	0.04	0.02	0.005	0.005	0.006	0.02	0.02	0.02
III,V1,V2,V3,V5,V6	0.96	0.95	0.01	0.96	1.57	0.01	0.004	0.004	0.004	0.02	0.04	0.02	0.006	0.005	0.007	0.02	0.01	0.02
III,V1,V2,V4,V5,V6	0.96	0.93	0.01	0.96	1.54	0	0.003	0.004	0.004	0.02	0.04	0.02	0.006	0.005	0.007	0.02	0.01	0.02
III,V1,V3,V4,V5,V6	0.95	0.95	0.01	0.96	1.62	0.01	0.004	0.004	0.004	0.02	0.04	0.02	0.006	0.005	0.007	0.03	0.01	0.02
III,V2,V3,V4,V5,V6	0.95	1.49	0.01	0.96	2.57	0.01	0.004	0.005	0.004	0.03	0.04	0.02	0.007	0.005	0.006	0.03	0.02	0.02
V1,V2,V3,V4,V5,V6	0.9	16.64	0.02	0.91	14.69	0.02	0.005	0.005	0.006	0.03	0.05	0.03	0.006	0.005	0.007	0.02	0.02	0.03

Table 10: Results demonstrating the quantitative analysis of generated 12-lead ECG signal using seven available leads. Metrics AUP_S, AUP_M, and IL were evaluated on 12-lead ECG signals, with a comparison of clinical features from Lead-II.

Leads	Quantitative Evaluation Metric																	
	Validation Set			Held-out Set			Validation Set						Held-out Set					
	AUP_S	AUP_M $\times 10^{-5}$	IL	$AUPs_S$	AUP_M $\times 10^{-5}$	IL	Interval (s)			Amplitude			Interval (s)			Amplitude		
							RR	**PR**	**QR**	**R**	**P**	**T**	**RR**	**PR**	**QR**	**R**	**P**	**T**
I,III,V1,V2,V3,V4,V5	0.99	0.24	0	0.99	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V3,V4,V6	1	0.22	0	0.99	0.19	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V3,V5,V6	1	0.24	0	1	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V2,V4,V5,V6	1	0.24	0	1	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V1,V3,V4,V5,V6	1	0.23	0	1	0.21	0	0	0	0	0	0	0	0	0	0	0	0	0
I,III,V2,V3,V4,V5,V6	0.99	0.67	0	0.99	0.62	0	0	0	0	0	0	0	0	0	0	0	0	0
I,V1,V2,V3,V4,V5,V6	0.94	10.54	0.01	0.94	6.2	0.01	0.009	0.006	0.01	0.02	0.03	0.03	0.01	0.006	0.08	0.02	0.05	0.03
III,V1,V2,V3,V4,V5,V6	0.96	1.9	0.01	0.96	1.61	0.01	0.006	0.005	0.01	0.01	0.03	0.03	0.006	0.005	0.009	0.02	0.02	0.02