Assessing the Effect of Imputation in Predictive Modeling

The post-imputation analysis examined the impact of missForest imputation on model performance. The performance of CoFormer and Raindrop with missForest imputation was evaluated on MIMIC-III and P12 datasets under MCAR, MAR, and MNAR missingness conditions, with missing rates of 5%, 20%, 35%, and 50%. CoFormer maintained stable AUROC values on MIMIC-III under MCAR, ranging from 73.87 to 72.11, while P12 saw declines in F1 and precision as missingness increased. Raindrop experienced more noticeable drops in AUROC on both datasets, with MIMIC-III values decreasing from 70.54 to 65.09 and P12 showing a similar trend. Under MAR, CoFormer exhibited stable AUROC values on both datasets, while Raindrop showed more sensitivity to missingness, particularly on MIMIC-III. In the MNAR scenario, CoFormer's AUROC on MIMIC-III ranged between 73.54 and 71.65, while Raindrop's AUROC decreased from 69.5 to 62.5. While missForest imputation slightly improved some metrics, these were not consistent across all cases.

Table 1: Performance of CoFormer and Raindrop on the MIMIC and P12 datasets under different percentages of missing data (MCAR) with missForest imputation

Model	Missingness	MIMIC				P12			
		AUROC ↑	AUPRC ↑	Accuracy ↑	F1-score ↑	AUROC ↑	AUPRC ↑	Accuracy ↑	F1-score ↑
CoFormer (missForest imputation)	5%	73.87	66.44	70.30	48.33	**77.52**	**46.55**	**87.28**	**28.93**
	20%	**74.28**	**67.62**	**71.93**	**59.56**	76.03	45.94	86.64	27.22
	35%	72.40	66.41	70.99	57.49	76.77	43.81	86.57	25.30
	50%	72.11	64.91	69.44	53.05	73.80	42.05	82.53	22.35
Raindrop (missForest imputation)	5%	**70.54**	**64.78**	**70.58**	**56.50**	**72.12**	**48.09**	**78.55**	**29.27**
	20%	68.52	60.85	68.20	53.63	70.53	46.26	77.03	28.47
	35%	68.80	59.57	66.00	50.91	69.40	44.54	77.57	26.83
	50%	65.09	57.00	64.50	48.23	69.17	43.32	70.56	26.20

Table 2: Performance of CoFormer and Raindrop on the MIMIC and P12 datasets under different percentages of missing data (MAR) with missForest imputation

Model	Missingness	MIMIC				P12			
		AUROC ↑	AUPRC ↑	Accuracy ↑	F1-score ↑	AUROC ↑	AUPRC ↑	Accuracy ↑	F1-score ↑
CoFormer (missForest imputation)	5%	72.71	**67.75**	71.41	55.56	76.47	**48.87**	**87.33**	27.12
	20%	**73.69**	67.36	**72.19**	**56.82**	76.64	47.74	86.43	24.92
	35%	72.70	65.63	70.22	56.58	**77.11**	46.46	86.72	28.92
	50%	73.78	67.61	71.59	57.41	75.22	45.17	85.98	23.53
Raindrop (missForest imputation)	5%	**69.45**	**60.53**	**66.38**	**51.34**	**70.94**	**44.30**	**76.00**	**27.80**
	20%	67.34	59.87	64.86	49.96	69.37	43.20	75.20	26.40
	35%	66.85	57.56	62.34	48.88	70.05	42.90	74.50	27.10
	50%	66.12	55.31	62.76	46.84	68.24	41.50	73.80	25.20

Table 3: Performance of CoFormer and Raindrop on the MIMIC and P12 datasets under different percentages of missing data (MNAR) with missForest imputation

Model	Missingness	MIMIC				P12			
		AUROC ↑	AUPRC ↑	Accuracy ↑	F1-score ↑	AUROC ↑	AUPRC ↑	Accuracy ↑	F1-score ↑
CoFormer (missForest imputation)	5%	73.54	67.43	71.24	**57.29**	**75.50**	**45.05**	**86.70**	23.40
	20%	**74.79**	**69.18**	**71.33**	56.56	74.95	44.50	86.65	**31.15**
	35%	72.12	65.42	69.19	52.21	74.10	41.20	86.30	20.85
	50%	71.65	67.71	71.25	57.15	73.57	41.50	85.25	23.50
Raindrop (missForest imputation)	5%	**69.55**	**60.00**	**66.82**	**51.38**	**71.00**	**41.87**	**74.55**	**25.15**
	20%	66.22	59.24	64.30	50.76	68.52	39.00	72.94	22.57
	35%	63.83	56.90	62.50	47.53	68.10	39.48	70.63	21.75
	50%	62.50	54.87	60.25	45.12	65.50	36.16	68.54	19.50