Research Article

Comparative evaluation of RSM and ANN models for Cellulase production from *Bacillus paralicheniformis* using *Plumeria alba* in submerged fermentation

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Table S1: CCD matrix with observed and predicted CMCase and FPase activities produced by *Bacillus paralicheniformis* using *Plumeria alba* as substrate under submerged fermentation conditions.

Run NO	A	B	C	CMCase activity IU			FPase activity IU		
				Observed	predicted	Residual	Observed	predicted	Residual
1	0.25	0.1	0.25	53.37140	52.62210	0.7493	189.1990	236.3828	-47.1838
2	0	0.2	0.5	46.19320	53.30286	-7.1097	154.2250	153.0074	1.2176
3	0	0.2	0	48.73700	48.02120	0.7158	297.6440	309.2448	-11.6008
4	0.5	0.2	0.5	41.42940	38.16211	3.2673	111.8900	80.8319	31.0581
5	0.25	0.1	0.25	53.57500	52.62210	0.9529	259.9710	236.3828	23.5882
6	0.25	0.1	-0.17045	41.03150	35.56524	5.4663	332.0966	259.9736	72.1230
7	0.25	0.268179	0.25	50.50105	49.76554	0.7355	243.1169	233.3287	9.7882
8	-0.17045	0.1	0.25	49.15900	46.83249	2.3265	145.9880	194.1245	-48.1365
9	0.5	0	0.5	56.65470	65.16684	-8.5121	297.8372	305.6622	-7.8250
10	0.25	0.1	0.25	53.63360	52.62210	1.0115	236.6525	236.3828	0.2697
11	0.5	0.2	0	60.27880	64.62990	-4.3511	251.8480	304.5736	-52.7256
12	0.25	0.1	0.670448	52.13500	46.46560	5.6694	100.3953	143.8472	-43.4519
13	0	0	0	0.00000	11.06363	11.0636	96.0000	146.4839	-50.4839
14	0.25	0.1	0.25	53.08210	52.62210	0.4600	237.6147	236.3828	1.2319
15	0	0	0.5	47.33600	50.78124	-3.4452	265.3810	232.0812	33.2998

16	0.25	-0.06818	0.25	52.02900	41.54959	10.4794	302.9240	284.8963	18.0277
17	0.25	0.1	0.25	53.40590	52.62210	0.7838	311.6182	236.3828	75.2354
18	0.25	0.1	0.25	53.33400	52.62210	0.7119	236.8687	236.3828	0.4859
19	0.670448	0.1	0.25	60.53300	58.69411	1.8389	123.3786	107.6535	15.7251
20	0.5	0	0	56.51200	57.19868	-0.6867	266.9257	287.5691	-20.6434

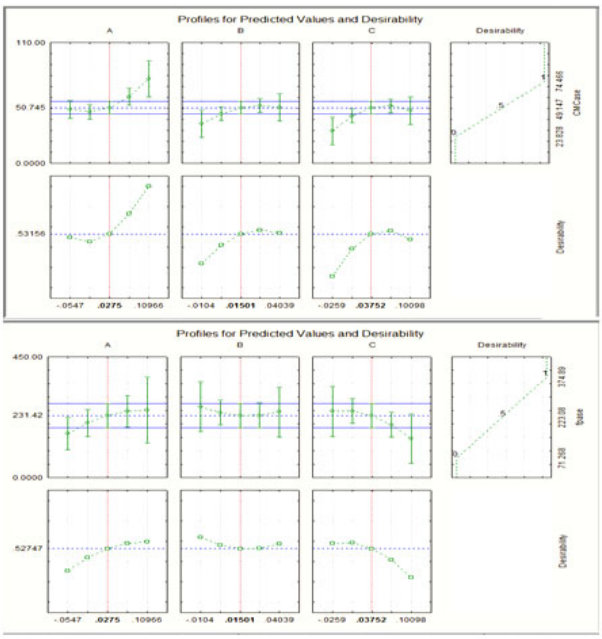
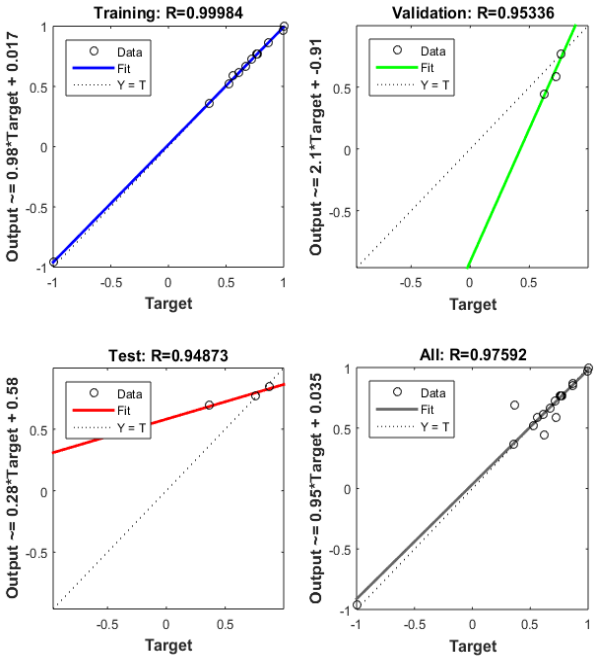
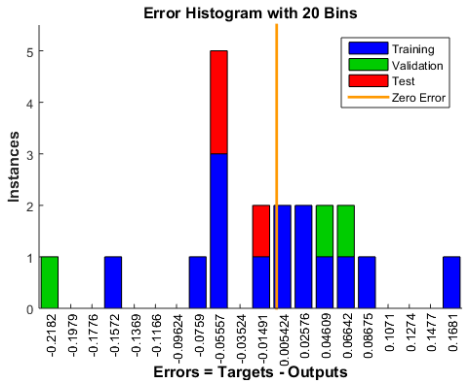


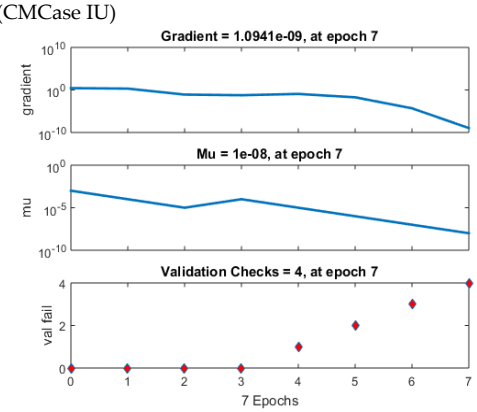
Figure S1. Desirability plots for predicted optimal levels of yeast extract (A), $MgSO_4$ (B), and $(NH_4)_2SO_4$ (C) maximizing CMCase (top) and FPase (bottom) activities produced by *Bacillus paralicheniformis* using *Plumeria alba* as substrate under submerged fermentation conditions.



(a) ANN regression plot (CMCase IU)

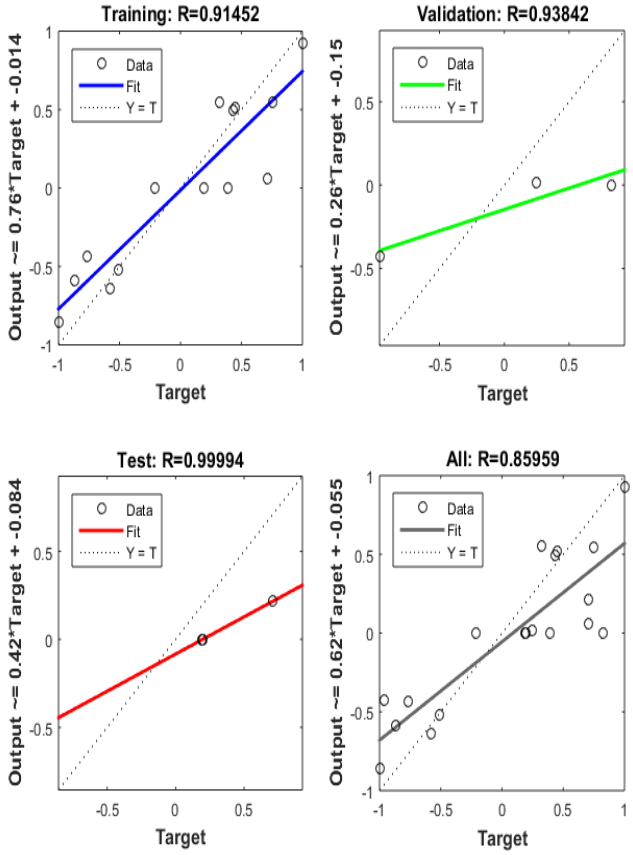


(b) Error histogram (CMCase IU)

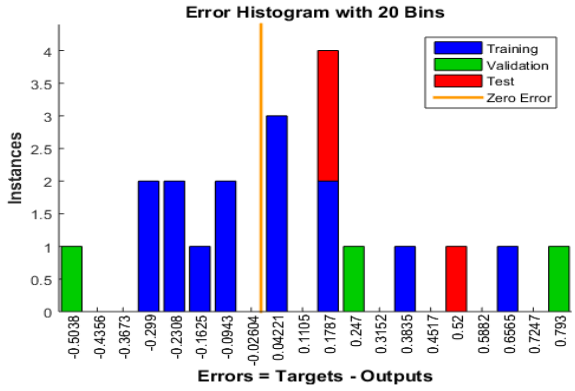


(c) Training state plot (CMCase IU)

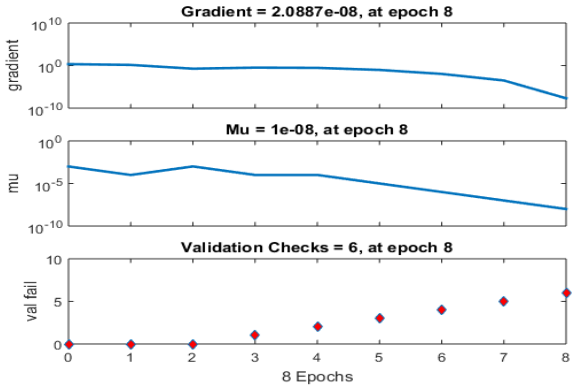
Figure S2: (a) ANN model performance for CMCase activity prediction: (a) regression plots showing the fit between observed and predicted values across training, validation, testing, and all data subsets; (b) error histogram; and (c) training state plot.



(a) ANN regression plot (FPase IU)

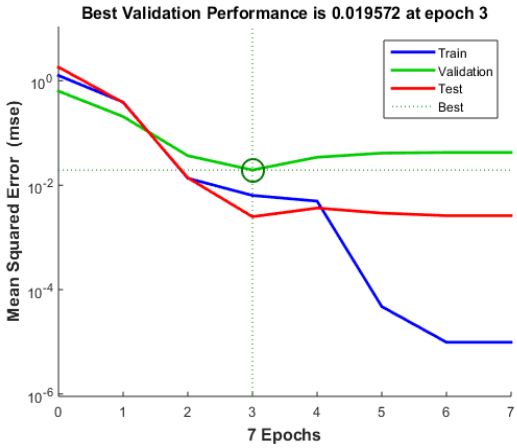


(b) Error histogram (FPase IU)

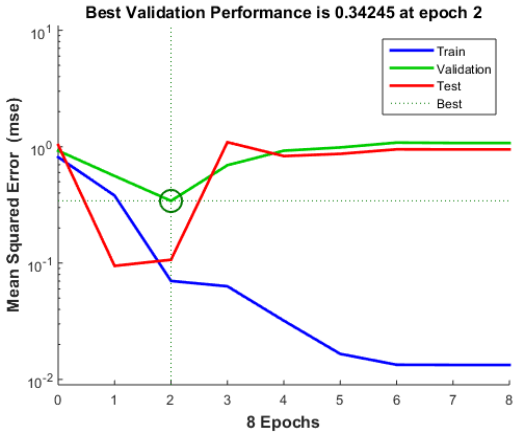


(c) Training state plot (FPase IU)

Figure S3: ANN model performance for FPase activity prediction: (a) regression plots showing the fit between observed and predicted values across training, validation, testing, and all data subsets; (b) error histogram; and (c) training state plot.



(CMCase IU)



(FPase IU)

Figure S4: Best validation performance plots for CMCase and FPase ANN models.

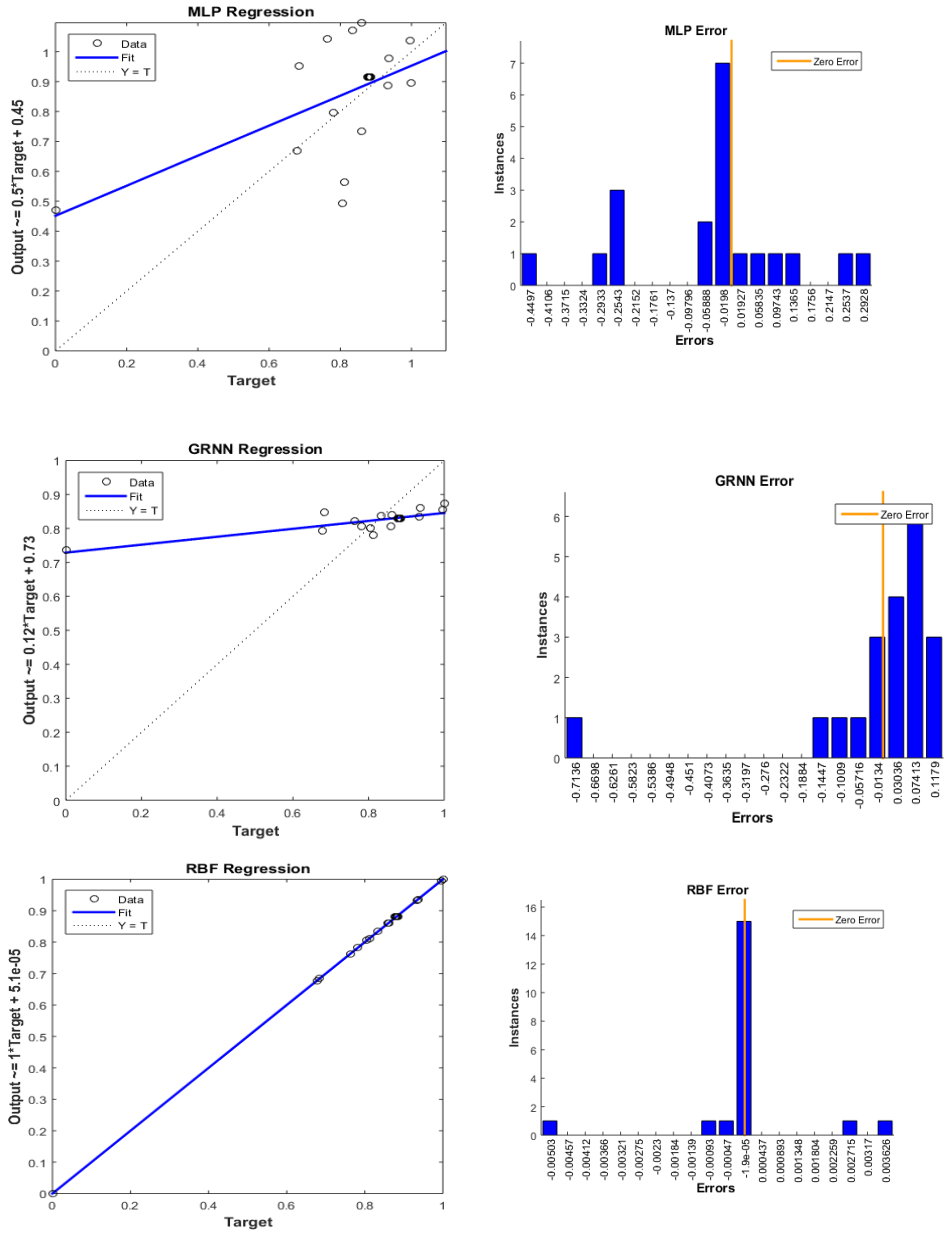


Figure S5: Regression plots and error histograms for MLP, GRNN, and RBF network architectures.