ECE1508
Assignment 9

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March 24, 2019

1 Tables for changing the number of features

In the table below you can find the required parameters for different models.

Number of features	MLP Model		SVR Model		LSTM Model	
	MSE	NMSE	MSE	NMSE	MSE	NMSE
2	0.0030	1.3362	0.00124	0.53860	0.000929	0.401565
3	0.002478	1.070945	0.0013970	0.603586	0.0009302	0.4018888
4	0.002278	0.984495	0.001482	0.640301	0.0009307	0.402099
5	0.00289005	1.2485928	0.001585	0.685133	0.000932	0.402881
6	0.00228	0.985315	0.001719	0.7426875	0.000960	0.415013
7	0.002970	1.283182	0.0017731	0.766035	0.0009713	0.4196461
8	0.002778	1.20036	0.0018228	0.7875077	0.0009597	0.414649
9	0.00268616	1.1605072	0.0018670	0.8066385	0.00097864	0.4228032
10	0.0029216	1.2622376	0.0018720	0.808783	0.000967	0.4181357

Table 1: Table of Results (for residuals time-series)

Number of features	MLP Model		SVR Model		LSTM Model	
	MSE	NMSE	MSE	NMSE	MSE	NMSE
2	68225.57212	0.171056	27498.95825	0.068946	20502.16173	0.0514035
3	54677.739207	0.1370894	30816.455177	0.077263	20518.6681	0.051444
4	50264.012671	0.126023	32690.94230	0.081963	20529.4436	0.0514719
5	63747.635962	0.159829	34979.8985	0.087702	20569.35681	0.051572
6	50305.83902	0.126128	37918.34910	0.095069	21188.76456	0.0531250
7	65513.63663	0.164257	39110.38633	0.098058	21425.27793	0.053718
8	61285.52556	0.153656	40206.6670	0.100807	21170.1896	0.053078
9	59250.3738	0.1485541	41183.39976	0.1032561	21586.46805	0.054122
10	64444.27925	0.161576	41292.90400	0.103530	21348.16552	0.0535246

Table 2: Table of Results (for original time-series)

Number of Features	MLP Model time (sec)	SVR Model time (sec)	LSTM Model time (sec)
2	0.0001	0.0000	0.0212
3	0.0001	0.0000	0.0215
4	0.0001	0.0000	0.0214
5	0.0002	0.0000	0.0211
6	0.0002	0.0000	0.0211
7	0.0001	0.0000	0.0197
8	0.0001	0.0000	0.0217
9	0.0002	0.0000	0.0203
10	0.0001	0.0000	0.0207

Table 3: Table of Results (training time)

2 Tables for changing the number of training and test samples

Number of Training Samples	Number of Test Samples	MLP Model (NMSE)	SVR Model (NMSE)	LSTM Model (NMSE)
100	100	1.689960	1.00217713	0.4138247
300	100	1.2698733	0.727063	0.414500909
500	150	1.43755887	0.6953694	0.42535019
700	100	1.3009608	0.6851336	0.40292855
800	250	1.33861230	0.63293716	0.4201770
1000	250	0.794297	0.63445184	0.42180600
1500	500	0.96651828	0.5778822	0.4480015
2000	300	1.03940	0.5402691	0.4445546
2000	700	1.055143255	0.51158609	0.42775509
2000	1000	0.770215069	0.501095751	0.4175145106

Table 4: Table of Results (error for residual time-series)

3 Changing parameters of the model

1. SVR Model The result of SVR model can be found in table 7
2. LSTM Model The result of the LSTM model can be found in table 8

4 Find the optimal number of features

1. **DATA** and **SCALED** data are both LRD as you can see in the figure 1 but **DIFF** is SRD.
2. You can find the values below

Number of Training Samples	Number of Test Samples	MLP Model (NMSE)	SVR Model (NMSE)	LSTM Model (NMSE)
100	100	0.2163283	0.1282866	0.0529728
300	100	0.16255385	0.0930699	0.0530593
500	150	0.06214910	0.03006248	0.018388905
700	100	0.1665332	0.087702533	0.05157804
800	250	0.03828910	0.01810426	0.0120185676
1000	250	0.02271976	0.018147593	0.012065161
1500	500	0.0193519	0.01157052	0.00897001
2000	300	0.02414774	0.012551687	0.01032801
2000	700	0.01862322	0.00902947	0.007549857
2000	1000	0.0136075	0.00885297	0.00737632

Table 5: Table of Results (error for original time-series)

(a) 2

(b) 3

(c) 4

(d) 5

5 Find the optimal number of features

Number of Training Samples	Number of Test Samples	MLP Model time (sec)	SVR Model time (sec)	LSTM Model time (sec)
100	100	0.0478	0.0046	11.3590
300	100	0.1562	0.0047	13.7445
500	150	0.1715	0.0055	18.3428
700	100	0.0898	0.0066	19.4059
800	250	0.0964	0.0080	23.1421
1000	250	0.0893	0.0087	26.9709
1500	500	0.1268	0.0145	38.3500
2000	300	0.2651	0.0254	41.3337
2000	700	0.3536	0.0244	47.1275
2000	1000	0.1729	0.0246	49.6868

Table 6: Table of Results (training time)

Kernel	SVR Model (NMSE)	SVR Model time (sec)
rbf	0.010760054	0.0138
linear	0.0102815448	0.0120
poly	0.02005216	0.0155
sigmoid	0.01157052	0.0141

Table 7: Table of Results (training time)

Number of Neurons	LSTM Model (NMSE)	LSTM Model time (sec)
100	0.0096152	5.1772
200	0.0090583	9.0979
300	0.0089833	13.7074
400	0.0089717	20.9778
500	0.0089696	26.7895
600	0.0089702	35.0587
700	0.0089704	49.3502
800	0.008971175	58.2411
900	0.008971458	69.0857

Table 8: Table of Results (training time)

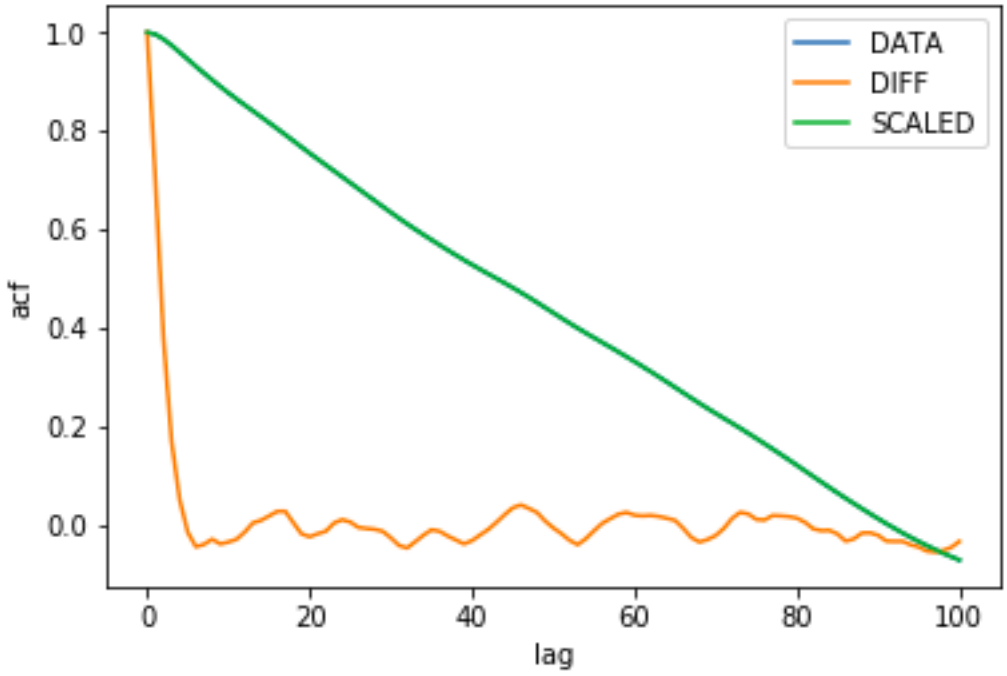

Figure 1: Graph of 3 versions of ACF values

Number of Training Samples	Number of Test Samples	MLP Model (NMSE)	SVR Model (NMSE)	LSTM Model (NMSE)
100	100	2.401500277	0.22102878144	0.4885491845
300	100	0.5204390496	0.1418267760390	0.26777056924
500	150	0.271403002	0.0432134286820	0.13468817742
700	100	0.898979734	0.1133347042	0.43853454954
800	250	0.204156149	0.029631597	0.0819993948
1000	250	0.23636296861	0.02857671576	0.0882958373
1500	500	0.0735506079620	0.0170794986	0.066361683
2000	300	0.2468206939840	0.0206132069035	0.070981274365
2000	700	0.12266811837	0.012627126431863	0.05428596822
2000	1000	0.09106933323	0.0123333436274	0.058587475145

Table 9: Table of Results (error for residual time-series)

Number of Training Samples	Number of Test Samples	MLP Model (NMSE)	SVR Model (NMSE)	LSTM Model (NMSE)
100	100	2.4015002772	0.2210287814	0.48854920176
300	100	0.520439049690	0.14182677603	0.267770536093
500	150	0.271403002	0.0432134286	0.134688174981
700	100	0.8989797344	0.1133347042	0.4385345234
800	250	0.20415614959	0.02963159777	0.0819994032
1000	250	0.2363629686	0.0285767157690	0.08829582833
1500	500	0.07355060796	0.0170794986	0.066361684994
2000	300	0.2468206939840	0.0206132069035	0.0709812736
2000	700	0.1226681183790	0.0126271264318	0.0542859687
2000	1000	0.0910693332300	0.0123333436270	0.05858747770

Table 10: Table of Results (error for original time-series)

Number of Training Samples	Number of Test Samples	MLP Model time (sec)	SVR Model time (sec)	LSTM Model time (sec)
100	100	0.0979	0.0044	10.9229
300	100	0.3224	0.0065	14.6880
500	150	0.1789	0.0091	17.0320
700	100	0.3709	0.0119	20.9940
800	250	0.7287	0.0150	23.7504
1000	250	0.3730	0.0163	28.4276
1500	500	0.5067	0.0320	38.3334
2000	300	0.3128	0.0655	44.8276
2000	700	0.7275	0.0653	46.7937
2000	1000	0.9362	0.0679	50.3620

Table 11: Table of Results (training time)