



Research article

Integrating LSTM with Fama-French six factor model for predicting portfolio returns: Evidence from Shenzhen stock market China

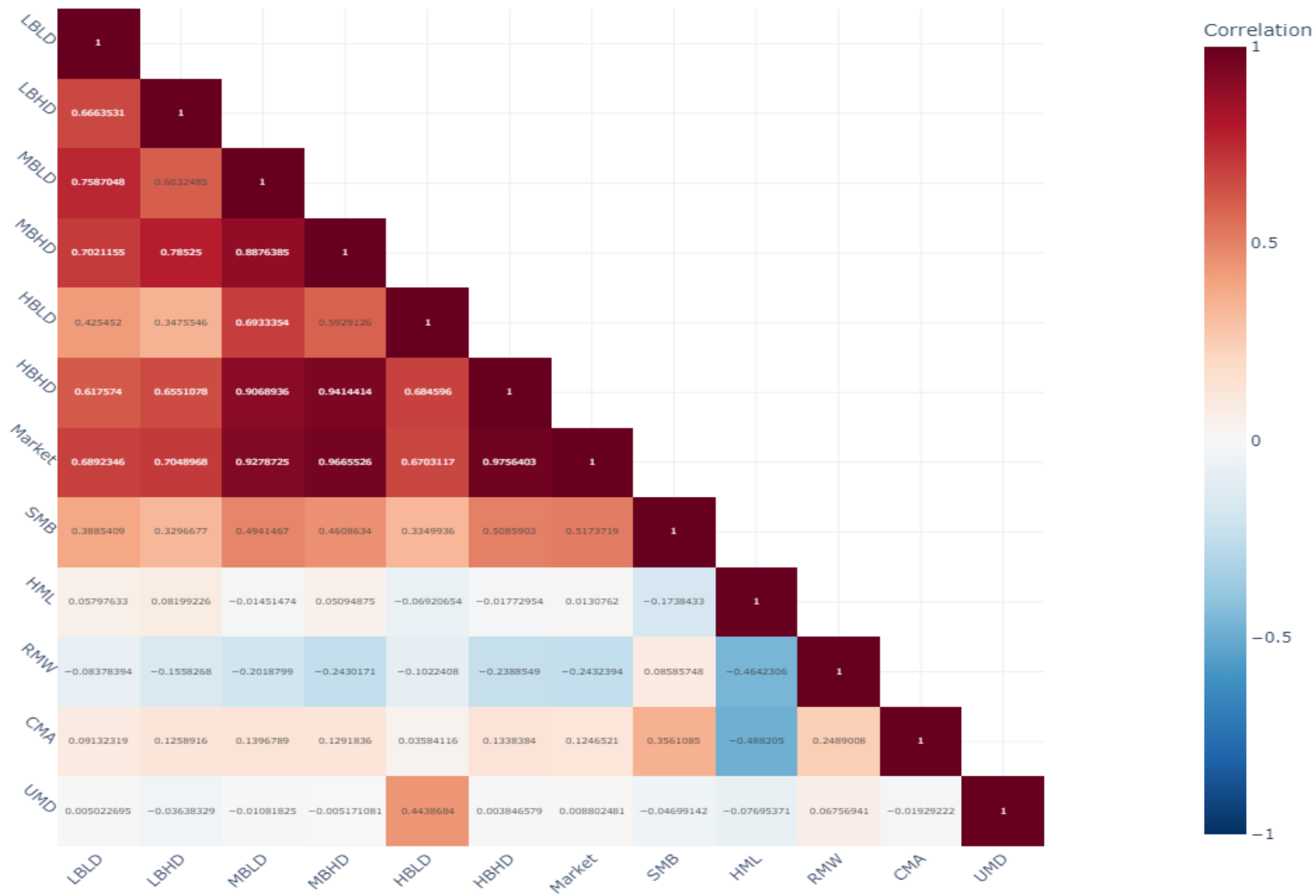
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Appendix I. Correlation heatmap.



Appendix II. Surrogate values tree.

--- Market <= -0.20 --- Market <= -1.07 --- Market <= -1.81 --- CMA <= -0.39 --- Market <= -2.42 --- Value: [-0.42] --- Market > -2.42 --- Value: [-0.37] --- CMA > -0.39 --- Market <= -2.27 --- Value: [-0.34] --- Market > -2.27 --- Value: [-0.28] --- Market > -1.81 --- UMD <= -0.33 --- RMW <= 1.54 --- Value: [-0.26] --- RMW > 1.54 --- Value: [-0.22] --- UMD > -0.33 --- Market <= -1.56 --- Value: [-0.23] --- Market > -1.56 --- Value: [-0.17]	--- Market > -0.20 --- Market <= 1.09 --- Market <= 0.54 --- Market <= 0.24 --- CMA <= 0.97 --- Value: [0.02] --- CMA > 0.97 --- Value: [-0.03] --- Market > 0.24 --- HML <= 1.19 --- Value: [0.07] --- HML > 1.19 --- Value: [0.01] --- Market > 0.54 --- SMB <= 1.59 --- Market <= 0.63 --- Value: [0.07] --- Market > 0.63 --- Value: [0.12] --- SMB > 1.59 --- Market <= 0.63 --- Value: [0.21] --- Market > 0.63 --- Value: [0.18]	--- Market > -1.07 --- Market <= -0.44 --- Market <= -0.82 --- RMW <= 1.79 --- Value: [-0.13] --- RMW > 1.79 --- Value: [-0.20] --- Market > -0.82 --- RMW <= 0.80 --- Value: [-0.10] --- RMW > 0.80 --- Value: [-0.02] --- Market > -0.44 --- Market <= -0.35 --- UMD <= 0.02 --- Value: [-0.06] --- UMD > 0.02 --- Value: [-0.04] --- Market > -0.35 --- UMD <= -0.03 --- Value: [-0.04] --- UMD > -0.03 --- Value: [-0.02]	--- Market > 1.09 --- CMA <= 1.60 --- Market <= 1.87 --- Market <= 1.52 --- Value: [0.18] --- Market > 1.52 --- Value: [0.23] --- Market > 1.87 --- Market <= 1.95 --- Value: [0.43] --- Market > 1.95 --- Value: [0.29] --- CMA > 1.60 --- Value: [0.74]
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Appendix III. Performance of different machine learning models.

	Random Forest				Xgboost				SVR				ANN				LSTM			
Portfo	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test	Test
lio	MAE	MSE	RMSE	R ²	MAE	MSE	RMSE	R ²	MAE	MSE	RMSE	R ²	MAE	MSE	RMSE	R ²	MAE	MSE	RMSE	R ²
1,1	0.031	0.003	0.054	0.079	0.034	0.003	0.057	0.006	0.032	0.003	0.055	0.046	0.0295	0.0020	0.0451	-0.8731	0.032	0.003	0.055	0.072
1,2	0.019	0.001	0.025	0.554	0.020	0.001	0.026	0.517	0.019	0.001	0.025	0.569	0.0158	0.0004	0.0206	0.5764	0.018	0.001	0.023	0.630
1,3	0.026	0.001	0.033	0.557	0.026	0.001	0.034	0.525	0.023	0.001	0.031	0.601	0.0313	0.0019	0.0430	0.2336	0.025	0.001	0.033	0.543
LBLD	0.025	0.002	0.037	0.397	0.027	0.002	0.039	0.349	0.025	0.002	0.037	0.405	0.0255	0.0014	0.0363	-0.0210	0.025	0.002	0.037	0.415
1,4	0.037	0.003	0.054	0.471	0.036	0.003	0.055	0.447	0.038	0.003	0.054	0.458	0.0399	0.0029	0.0536	0.3683	0.040	0.003	0.057	0.404
1,5	0.043	0.003	0.053	0.525	0.043	0.003	0.056	0.483	0.043	0.003	0.055	0.485	0.0435	0.0034	0.0585	0.3528	0.043	0.003	0.054	0.508
1,6	0.050	0.005	0.067	0.392	0.059	0.006	0.080	0.128	0.051	0.005	0.073	0.276	0.0507	0.0048	0.0695	0.3310	0.057	0.006	0.078	0.176
LBHD	0.043	0.003	0.058	0.462	0.046	0.004	0.064	0.353	0.044	0.004	0.061	0.406	0.0447	0.0037	0.0605	0.3507	0.047	0.004	0.063	0.363
2,1	0.049	0.004	0.061	0.521	0.048	0.003	0.059	0.548	0.045	0.003	0.056	0.595	0.0504	0.0038	0.0615	0.5450	0.045	0.003	0.056	0.584
2,2	0.026	0.001	0.036	0.787	0.023	0.001	0.030	0.852	0.019	0.001	0.025	0.898	0.0237	0.0011	0.0331	0.8188	0.019	0.001	0.023	0.909
2,3	0.023	0.001	0.034	0.837	0.019	0.001	0.025	0.906	0.014	0.000	0.020	0.943	0.0247	0.0011	0.0336	0.8445	0.014	0.000	0.020	0.940
MBLD	0.033	0.002	0.043	0.715	0.030	0.002	0.038	0.769	0.026	0.001	0.033	0.812	0.0329	0.0020	0.0427	0.7361	0.026	0.001	0.033	0.811
2,4	0.017	0.001	0.023	0.927	0.014	0.000	0.019	0.950	0.012	0.000	0.015	0.968	0.0235	0.0011	0.0332	0.8618	0.012	0.000	0.015	0.971
2,5	0.020	0.001	0.027	0.911	0.018	0.001	0.024	0.931	0.015	0.000	0.022	0.942	0.0234	0.0009	0.0305	0.8989	0.015	0.000	0.019	0.956
2,6	0.032	0.002	0.044	0.807	0.035	0.002	0.045	0.801	0.032	0.001	0.039	0.854	0.0339	0.0020	0.0443	0.8085	0.031	0.001	0.038	0.859
MBHD	0.023	0.001	0.032	0.882	0.023	0.001	0.029	0.894	0.019	0.001	0.025	0.921	0.0269	0.0013	0.0360	0.8564	0.019	0.001	0.024	0.929
3,1	0.109	0.021	0.145	0.307	0.124	0.038	0.196	-0.265	0.086	0.016	0.126	0.480	0.0945	0.0164	0.1282	0.5513	0.097	0.016	0.127	0.467
3,2	0.076	0.012	0.111	0.495	0.083	0.014	0.117	0.433	0.062	0.010	0.098	0.608	0.0554	0.0052	0.0720	0.8069	0.064	0.010	0.102	0.571
3,3	0.048	0.004	0.063	0.785	0.042	0.003	0.057	0.820	0.033	0.003	0.051	0.860	0.0329	0.0023	0.0484	0.9013	0.037	0.003	0.051	0.858
HBLD	0.078	0.012	0.106	0.529	0.083	0.019	0.124	0.329	0.060	0.009	0.091	0.650	0.0610	0.0080	0.0829	0.7532	0.066	0.010	0.094	0.632
3,4	0.030	0.002	0.041	0.878	0.034	0.002	0.049	0.822	0.025	0.001	0.034	0.917	0.0318	0.0020	0.0452	0.9017	0.028	0.001	0.037	0.901
3,5	0.030	0.002	0.039	0.904	0.023	0.001	0.030	0.945	0.023	0.001	0.028	0.950	0.0323	0.0028	0.0533	0.8772	0.022	0.001	0.028	0.950
3,6	0.035	0.003	0.052	0.867	0.029	0.002	0.041	0.918	0.029	0.001	0.038	0.928	0.0419	0.0029	0.0536	0.9050	0.029	0.002	0.040	0.921
HBHD	0.032	0.002	0.044	0.883	0.029	0.002	0.040	0.895	0.025	0.001	0.033	0.932	0.0353	0.0026	0.0507	0.8946	0.026	0.001	0.035	0.924