

Dynamic Web Performance Optimization Measurement

Using Machine Learning Analytics — Report

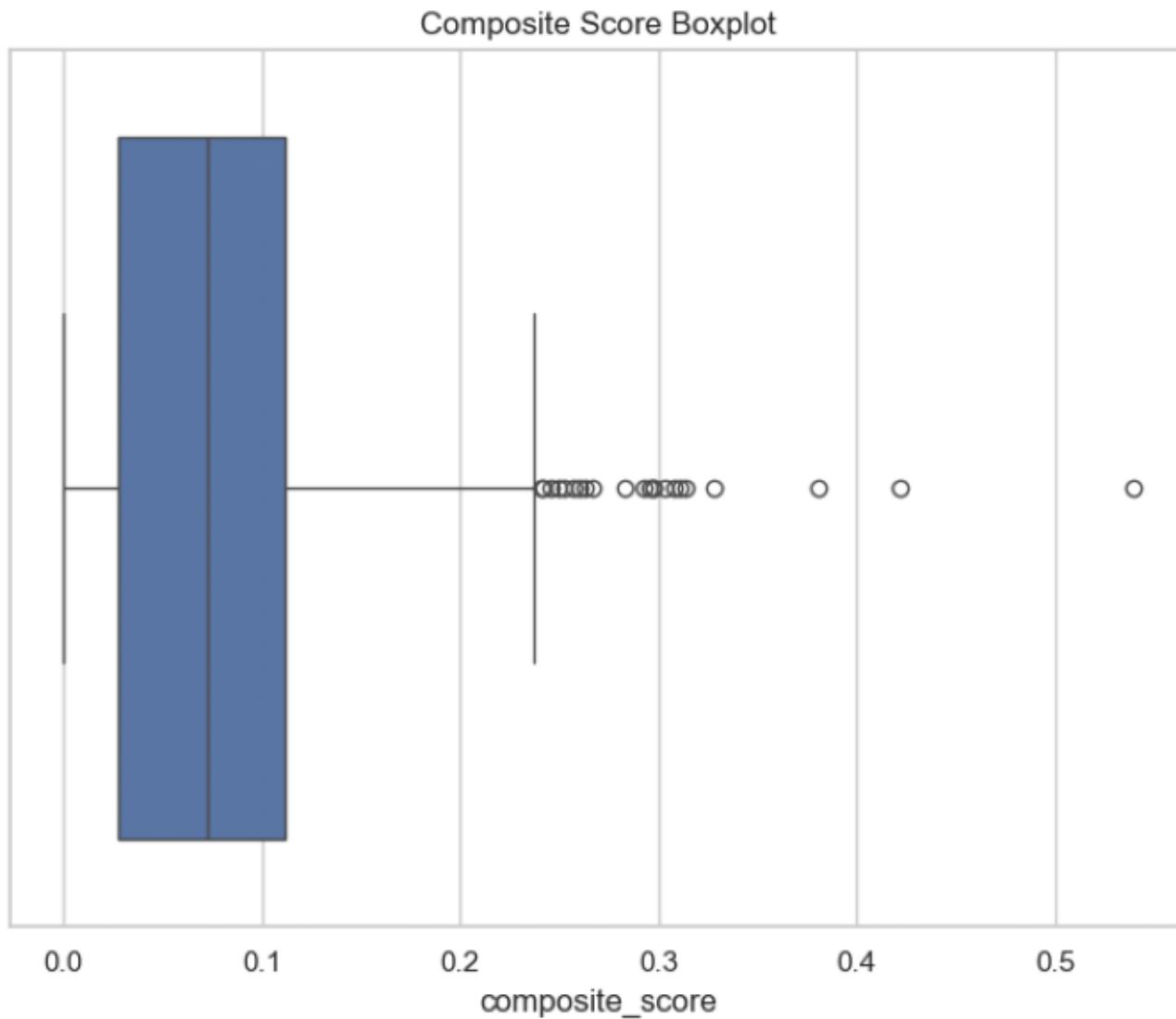
Author: (generated)

Data: D:\Thesis\My Thesis\All thesis data - set4.cleaned.imputed.csv

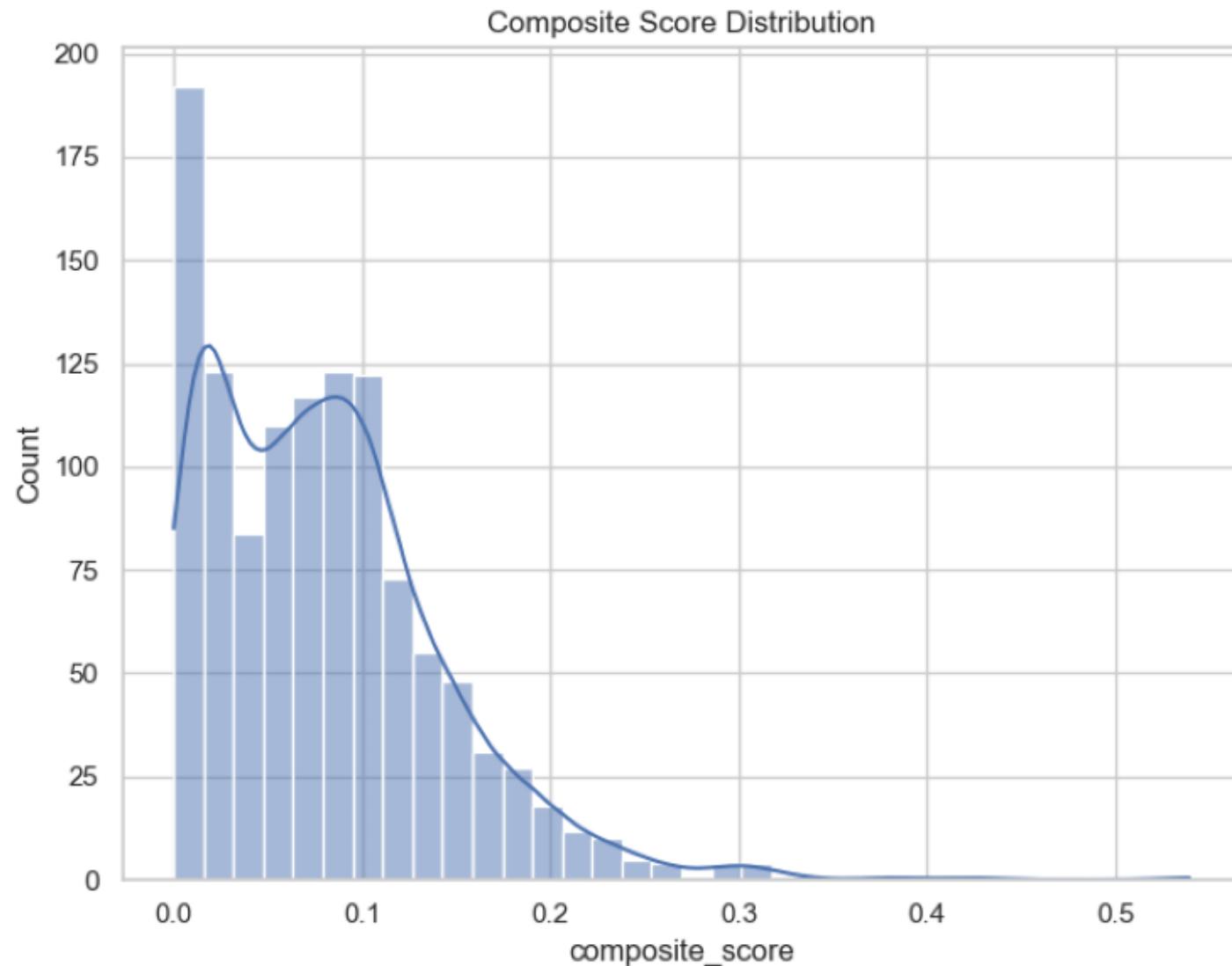
Dataset Basic Statistics

	Unnamed: 0	count	unique	top	freq	mean	std	min	25%	50%	75%	max
DOM_Content_Loaded	0 url	1167.0	1161	https://qualcomm	3.0	nan	nan	nan	nan	nan	nan	nan
	Response_time	1167.0	nan	nan	nan	370.97	1192.173	0.0	24.0	126.0	357.5	25080.0
	2 Load_time_m	1167.0	nan	nan	nan	4088.651	4025.015	76.0	1675.5	3308.0	5335.57	49848.0
	Content_Loaded	1167.0	nan	nan	nan	2489.925	2974.745	61.0	928.0	1713.0	3047.5	35214.0
	First_byte_TTFB	1167.0	nan	nan	nan	346.755	1161.842	0.0	27.5	112.0	322.5	23972.0
	5 Total_links	1167.0	nan	nan	nan	1039.256	2298.412	0.0	75.0	188.0	507.5	23613.0
	6 No_of_request	1167.0	nan	nan	nan	572.236	1298.939	0.0	41.0	92.0	239.0	14600.0
Largest_contentful_paint	7 Byte_in_bytes	1167.0	nan	nan	nan	1935125.727	4274507.754	0.0	269.0	597536.0	2189798.0	71211927.0
	8 Page_size_MB	1167.0	nan	nan	nan	39.529	98.963	0.0	0.306	1.648	6.954	1051.0
	9 contentful_paint	1167.0	nan	nan	nan	10351.592	15011.03	0.0	92.5	7738.578	15151.973	330536.188
	Cumulative_Layout_S	1167.0	nan	nan	nan	776866.249	8012336.486	0.0	0.001	0.101	6090.69	36990595.0
	First_Contentful_Paint	1167.0	nan	nan	nan	4093.012	3928.883	0.0	258.5	3736.211	5719.513	34944.798
	Time_to_interactive	1167.0	nan	nan	nan	22528.647	17929.198	826.114	11791.618	18229.071	28389.835	334797.238
	Speed_Index_r	1167.0	nan	nan	nan	6710.084	6739.612	0.0	0.078	6324.049	10019.614	40008.064
Interaction_to_Next_Page	104 to_Next_Page	1167.0	nan	nan	nan	5462.525	2442.617	800.754	4438.493	4704.264	5873.05	40308.096
	Design_optimization	1167.0	nan	nan	nan	9338.848	16271.072	0.0	27.0	36.0	15727.546	104991.311
	JavaScript_Execution	1167.0	nan	nan	nan	18545.648	16989.548	469.336	7693.369	12493.512	22914.142	135620.152
	Main_thread_Work	1167.0	nan	nan	nan	7079.624	8355.718	0.0	1884.848	4100.646	9893.053	78840.325
	CSS_Blocking_Time	1167.0	nan	nan	nan	1161.931	2021.232	0.0	26.0	269.0	1654.5	27764.0
	Broken_link_count	1167.0	nan	nan	nan	8481.321	16921.347	0.0	1.0	15.0	11304.818	129881.424
	Start_render_time	1167.0	nan	nan	nan	7023.208	7378.517	0.0	3337.853	5004.288	7768.837	79090.088
Document_complete	Document_complete	1167.0	nan	nan	nan	3018.869	3687.513	0.0	867.0	2123.0	3947.5	49848.0

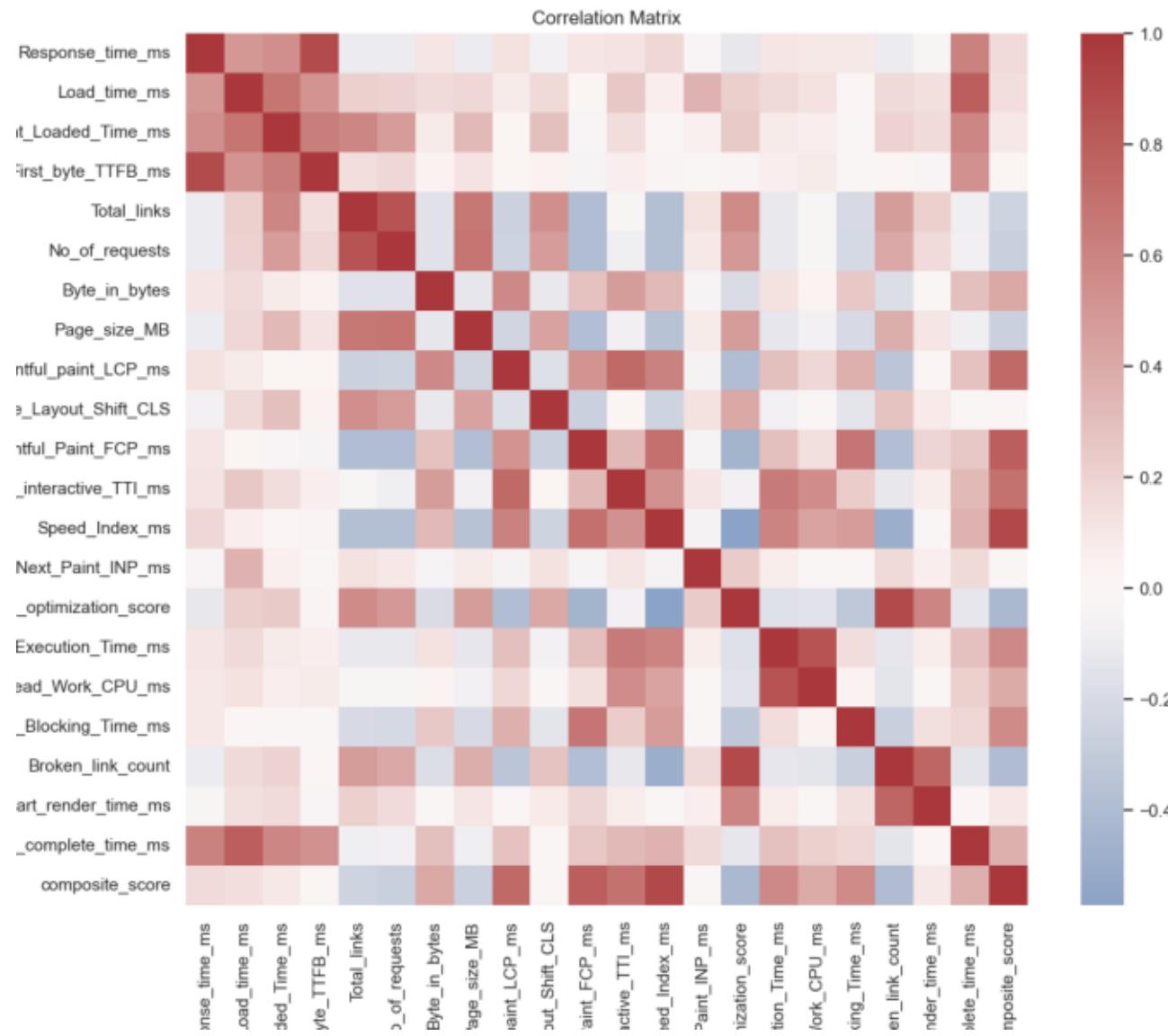
Composite Boxplot



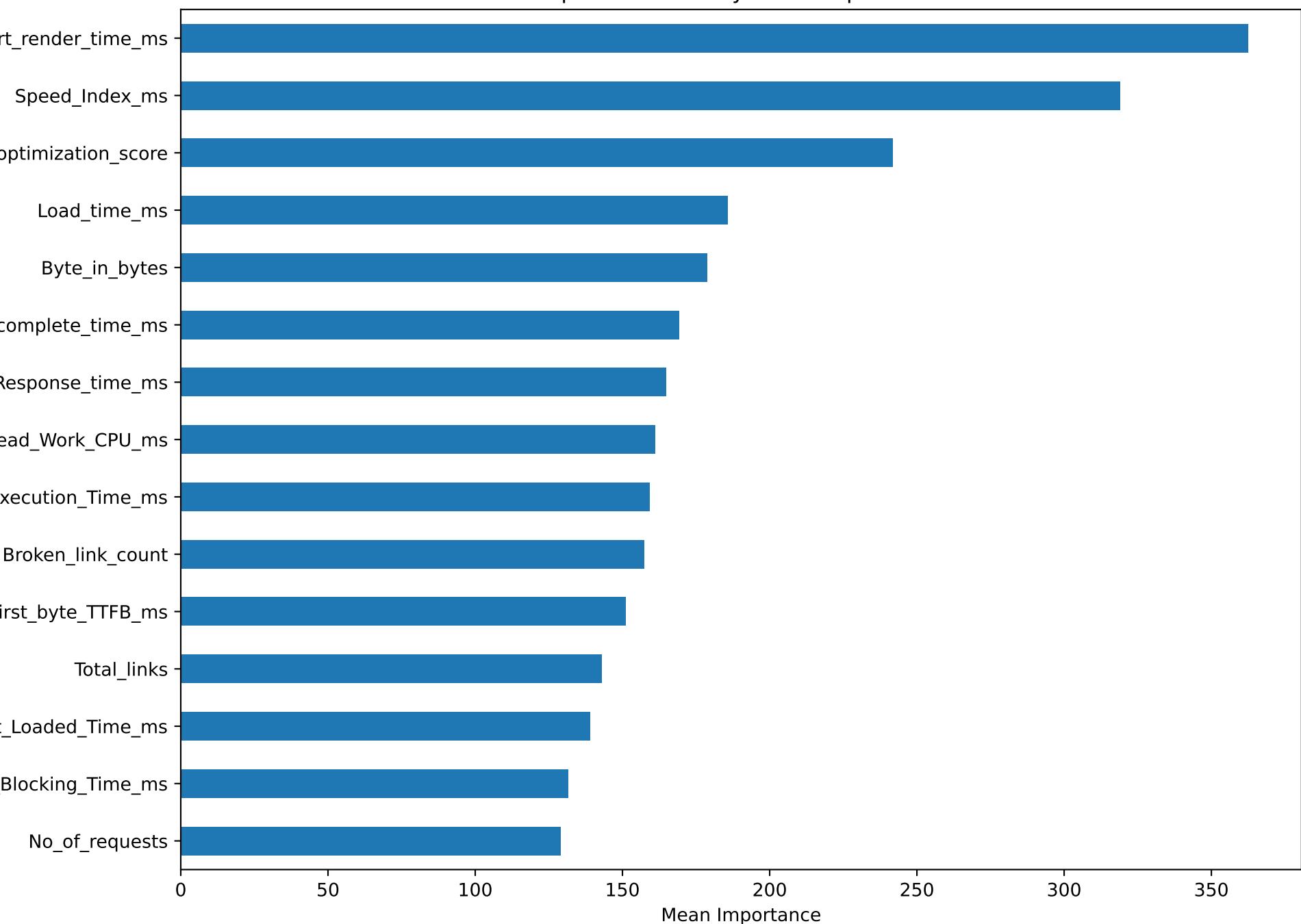
Composite Hist



Correlation Matrix



Top 15 Features by Mean Importance

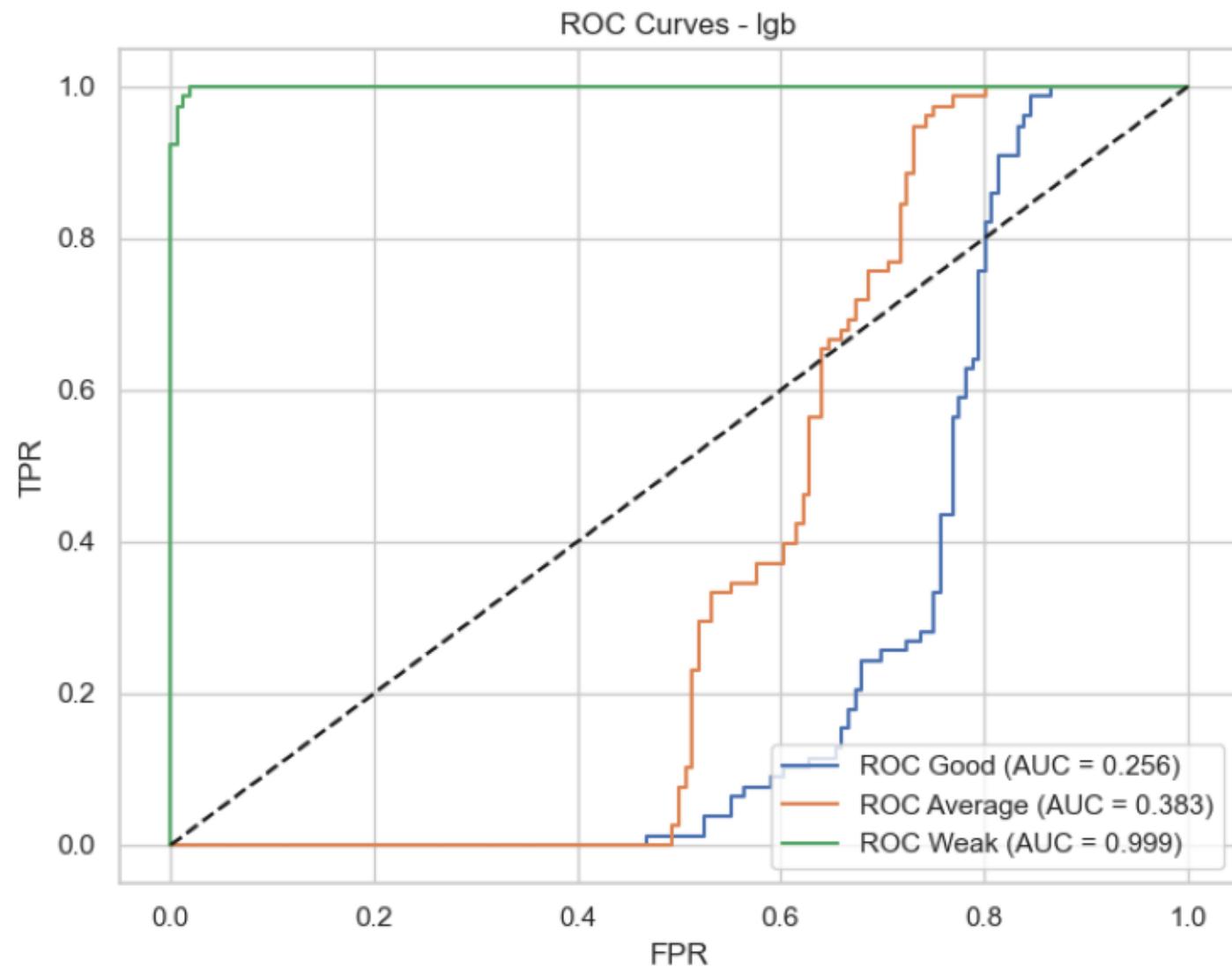


Model	MAE	RMSE
rf	185807.42	1277758.89
lgbm	190320.49	1085288.86
keras	204530.30	1392463.05

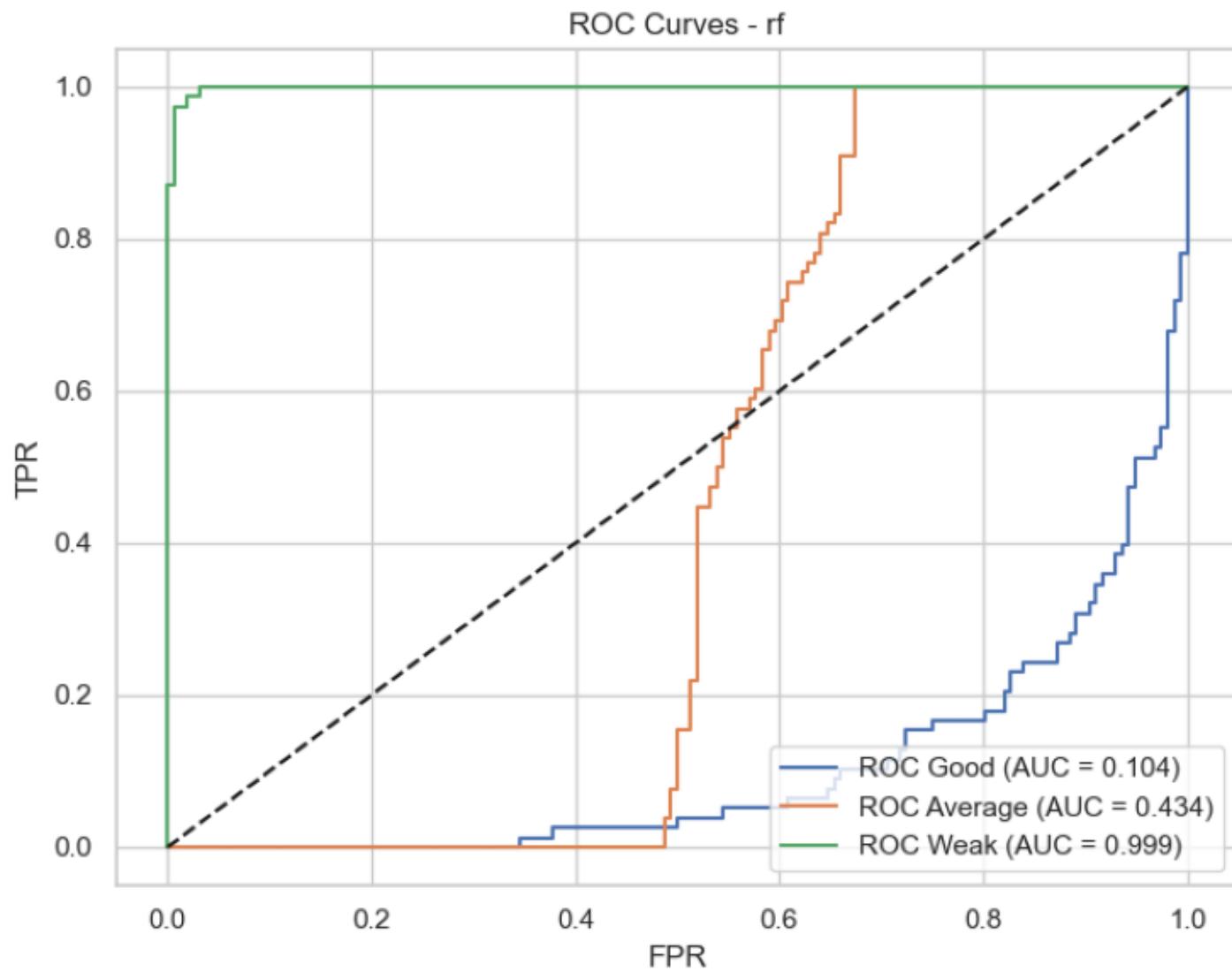
Classifier F1 Macro Scores

strategy	model	f1_macro
label_tertiles	rf	0.9572
label_tertiles	lgbm	0.9571
label_tertiles	keras	0.9699
label_weighted	rf	0.9438
label_weighted	lgbm	0.9485
label_weighted	keras	0.9658
label_kmeans	rf	0.9755
label_kmeans	lgbm	0.9847
label_kmeans	keras	0.9021

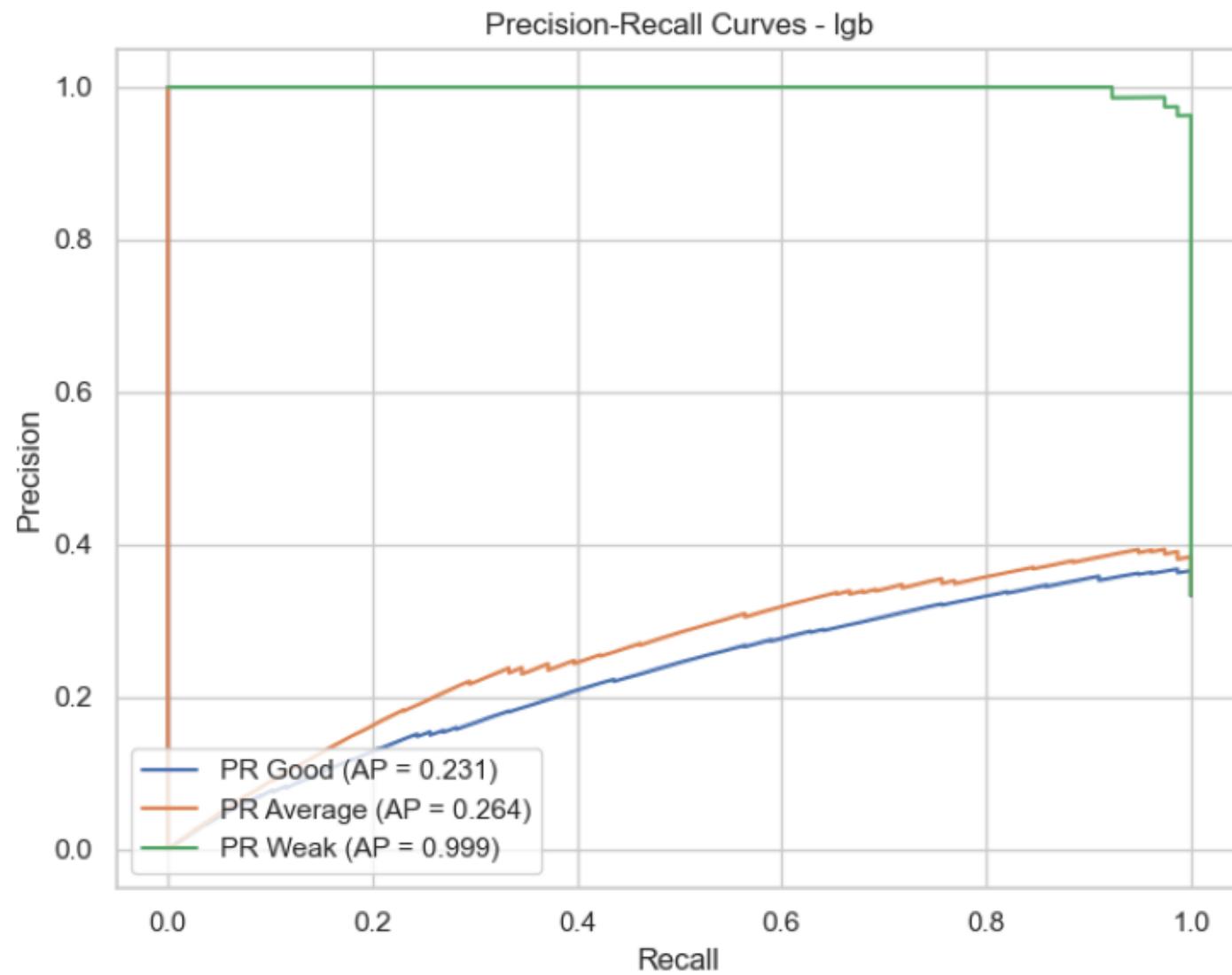
roc_lgb.png



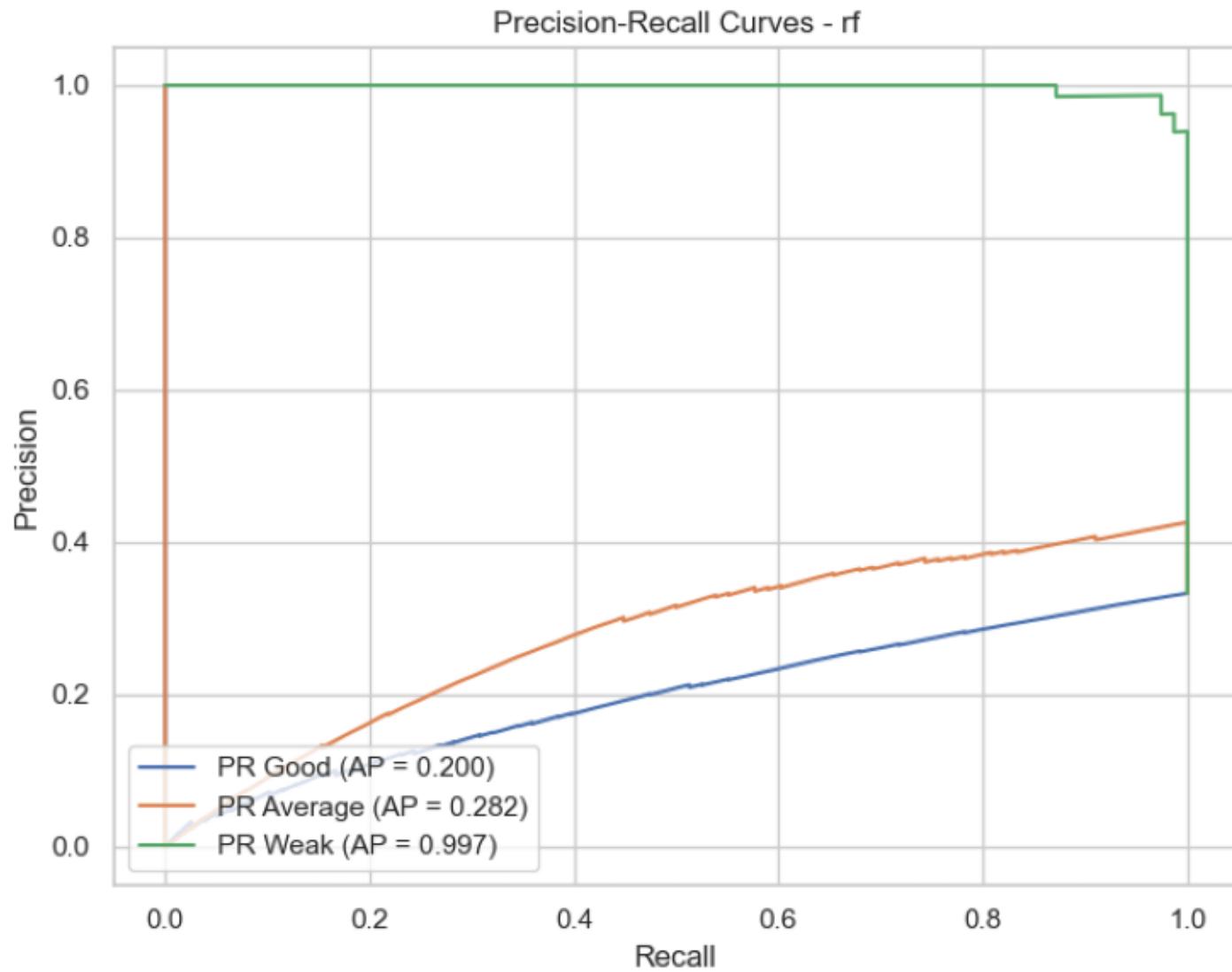
roc_rf.png



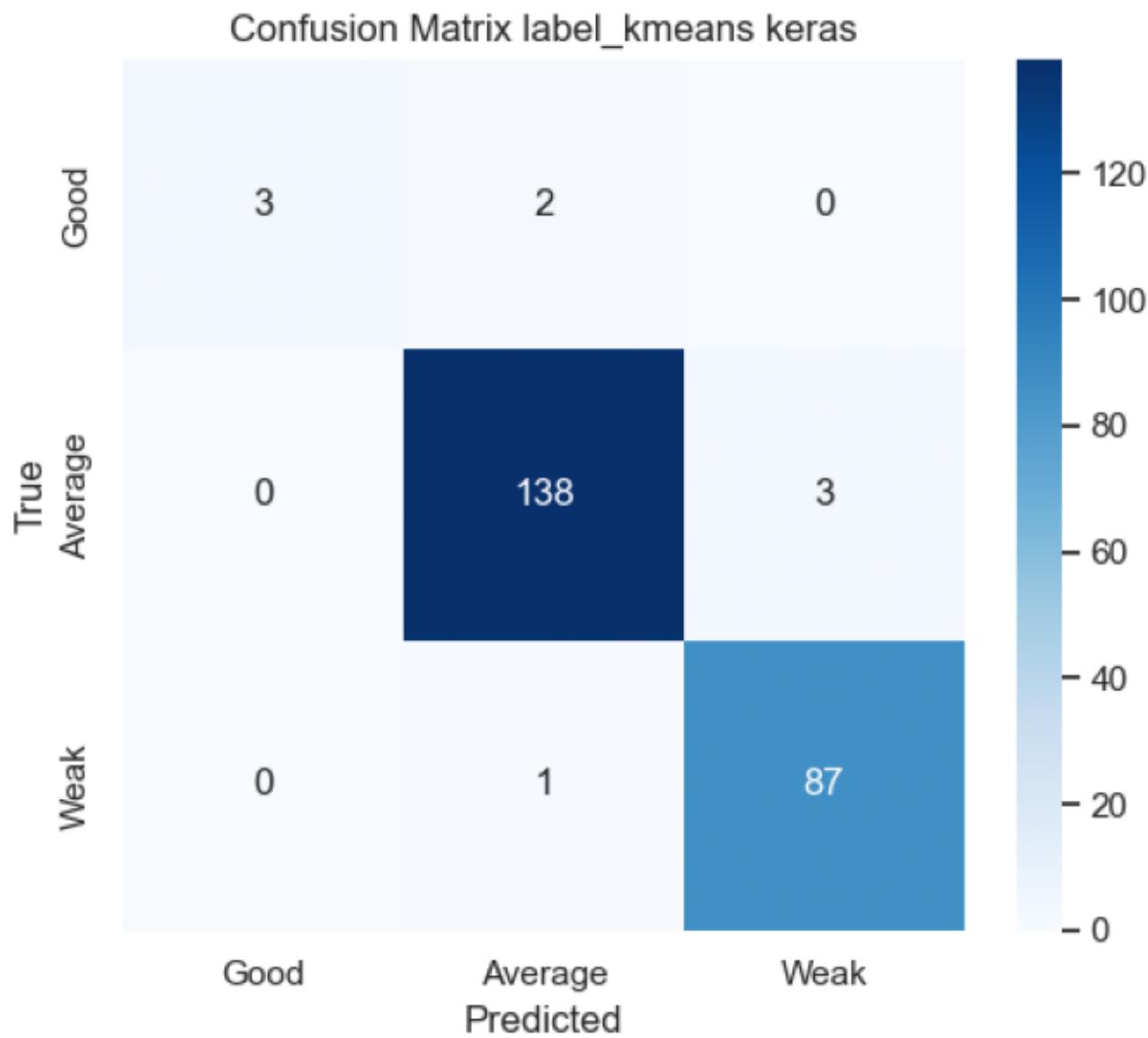
pr_lgb.png



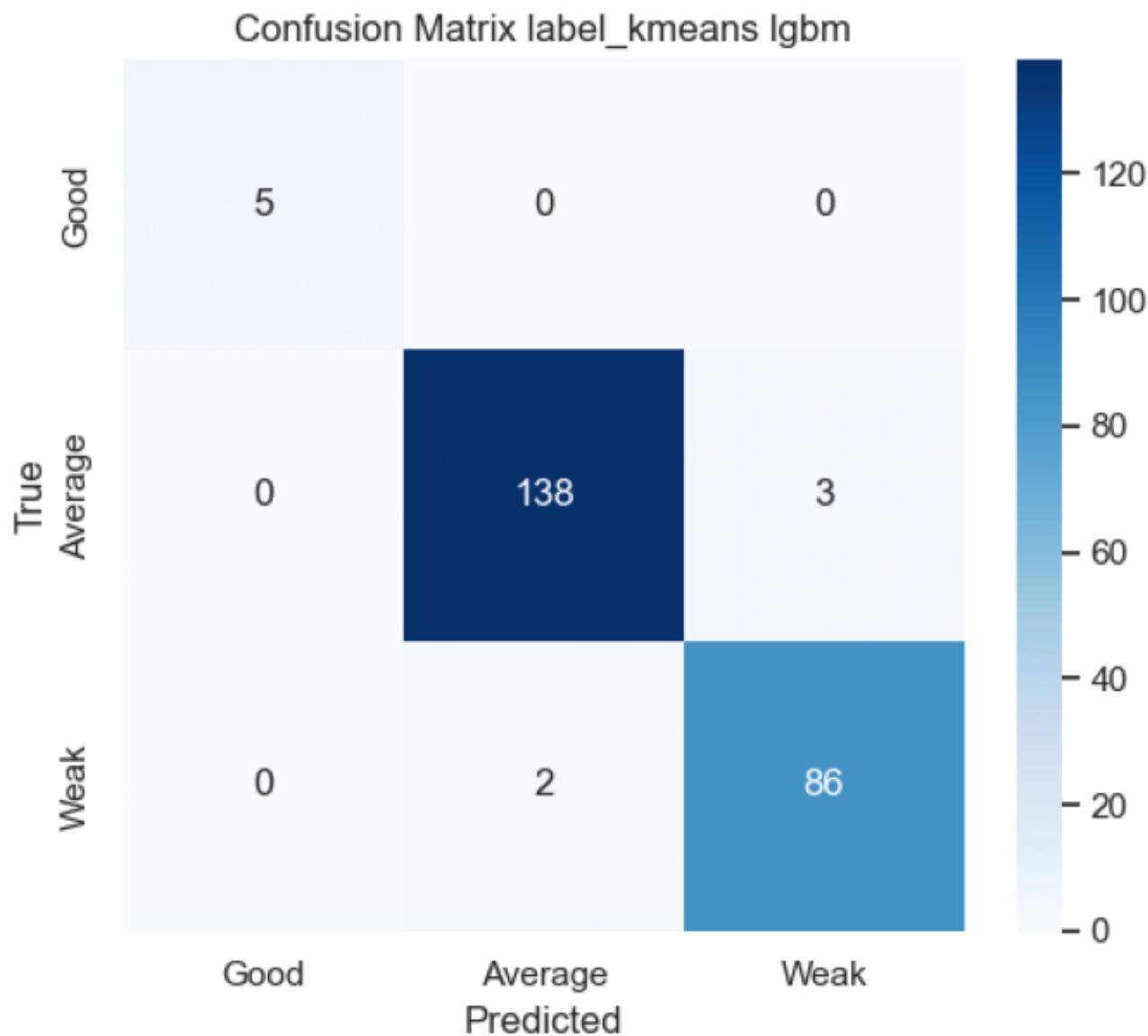
pr_rf.png



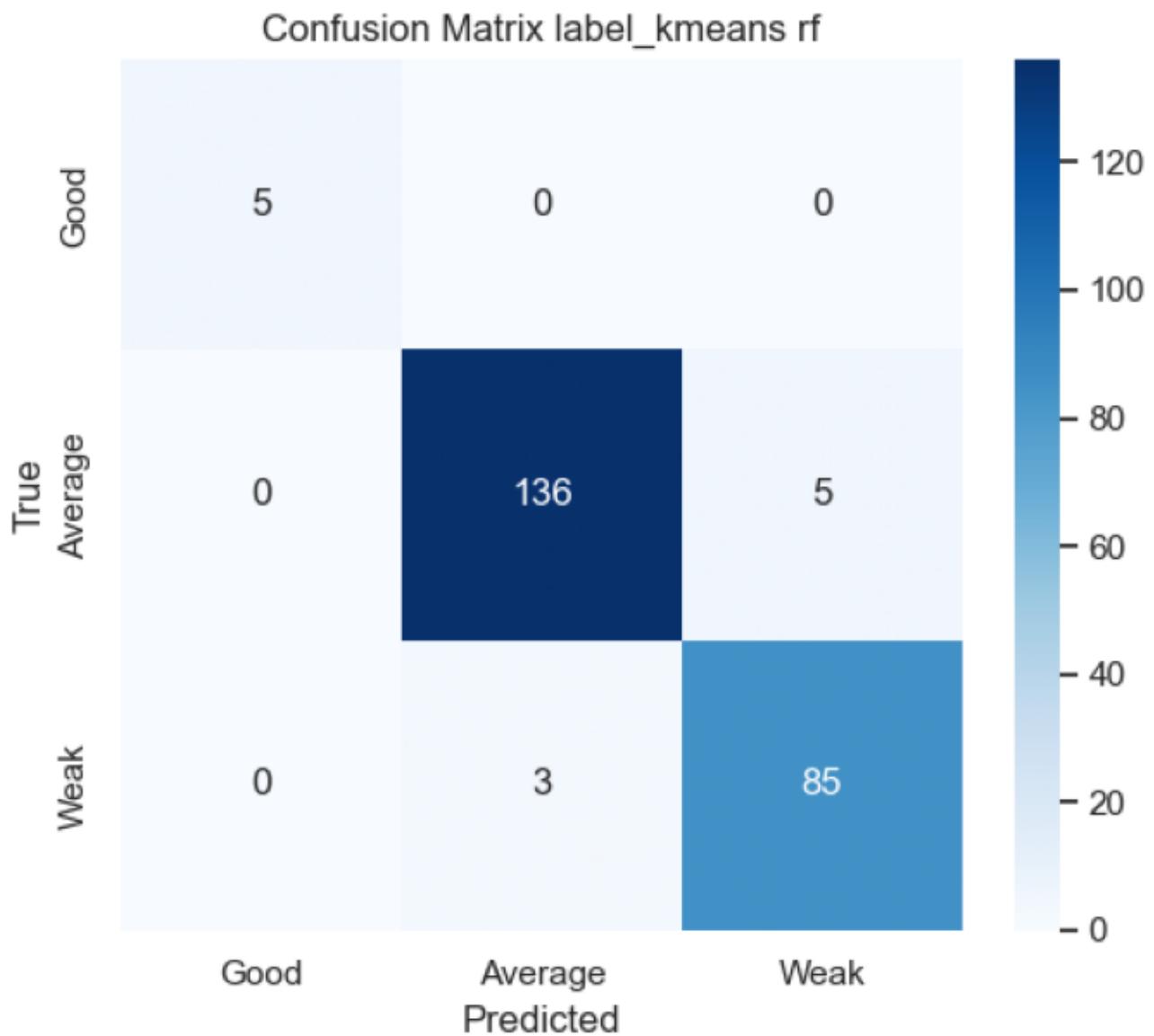
confusion_label_kmeans_keras.png



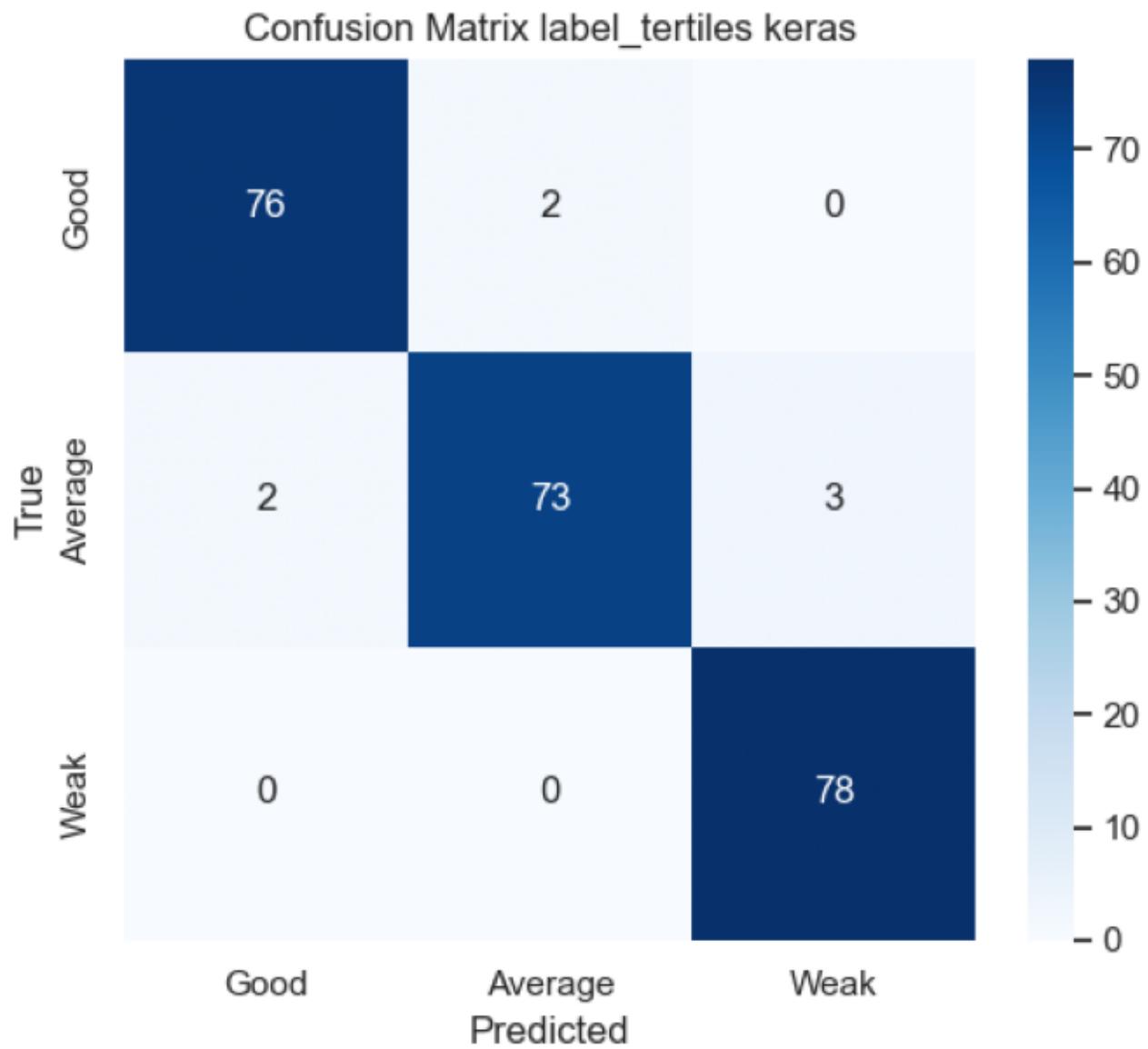
confusion_label_kmeans_lgbm.png



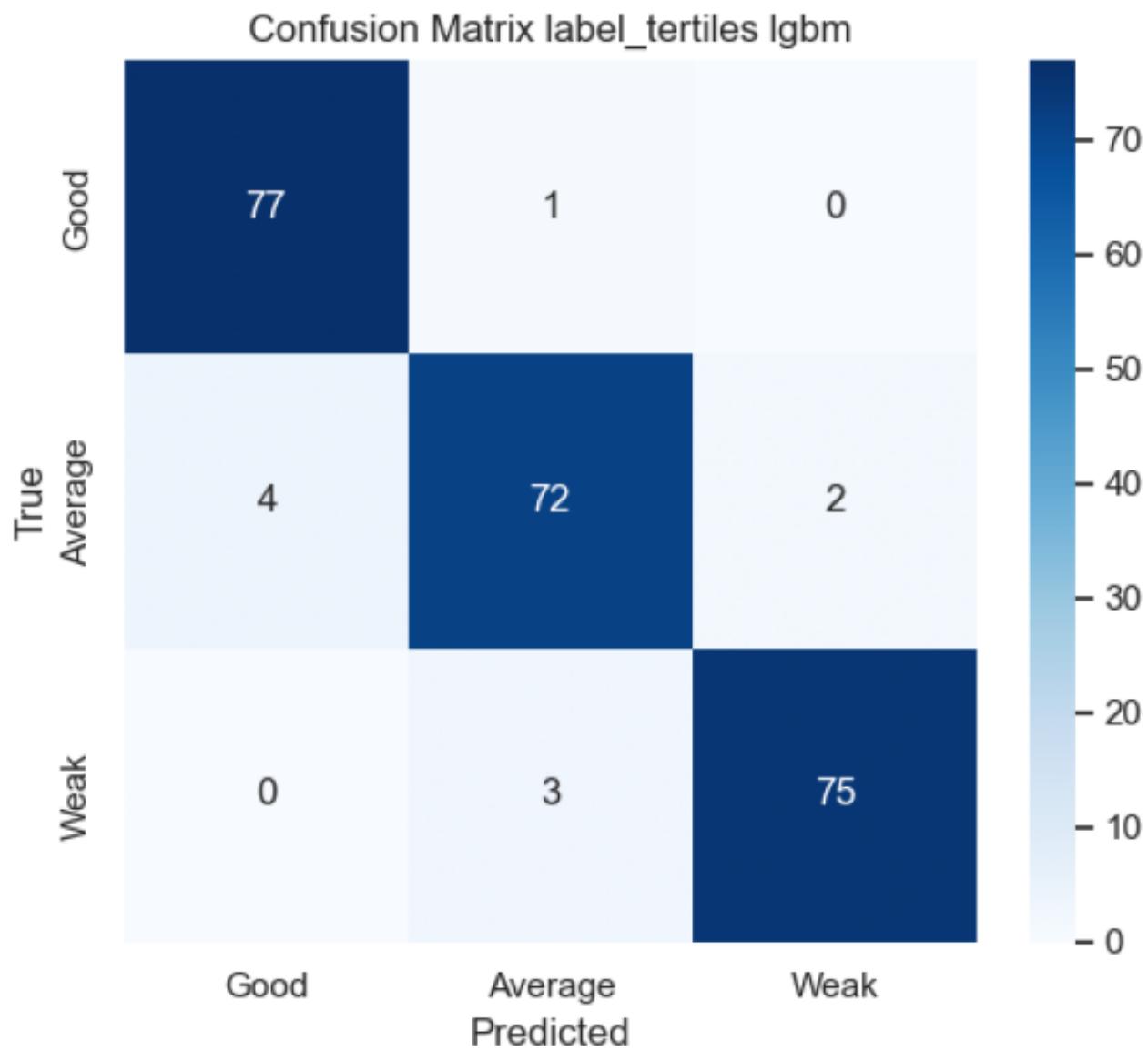
confusion_label_kmeans_rf.png



confusion_label_tertiles_keras.png



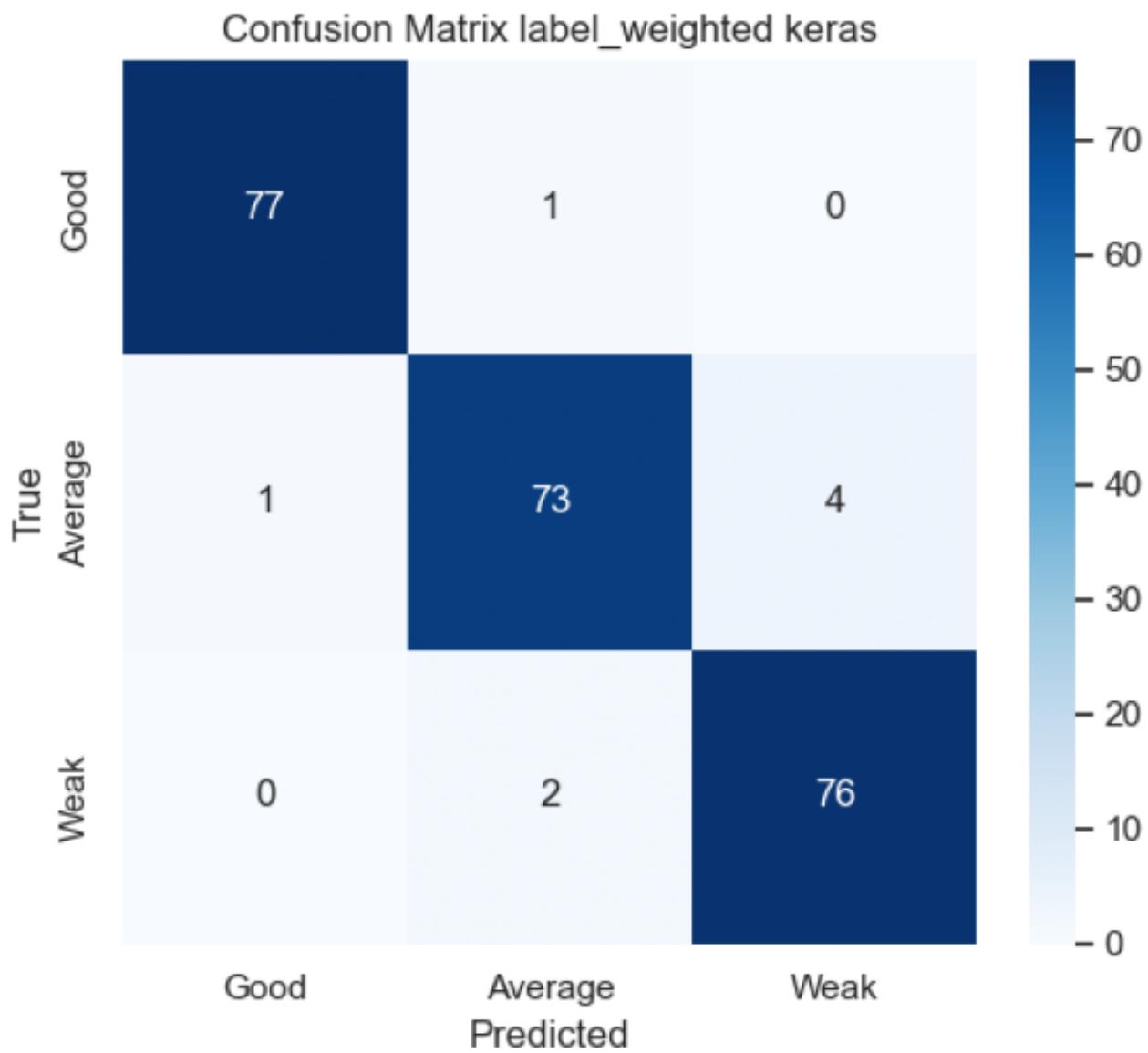
confusion_label_terniles_lgbm.png



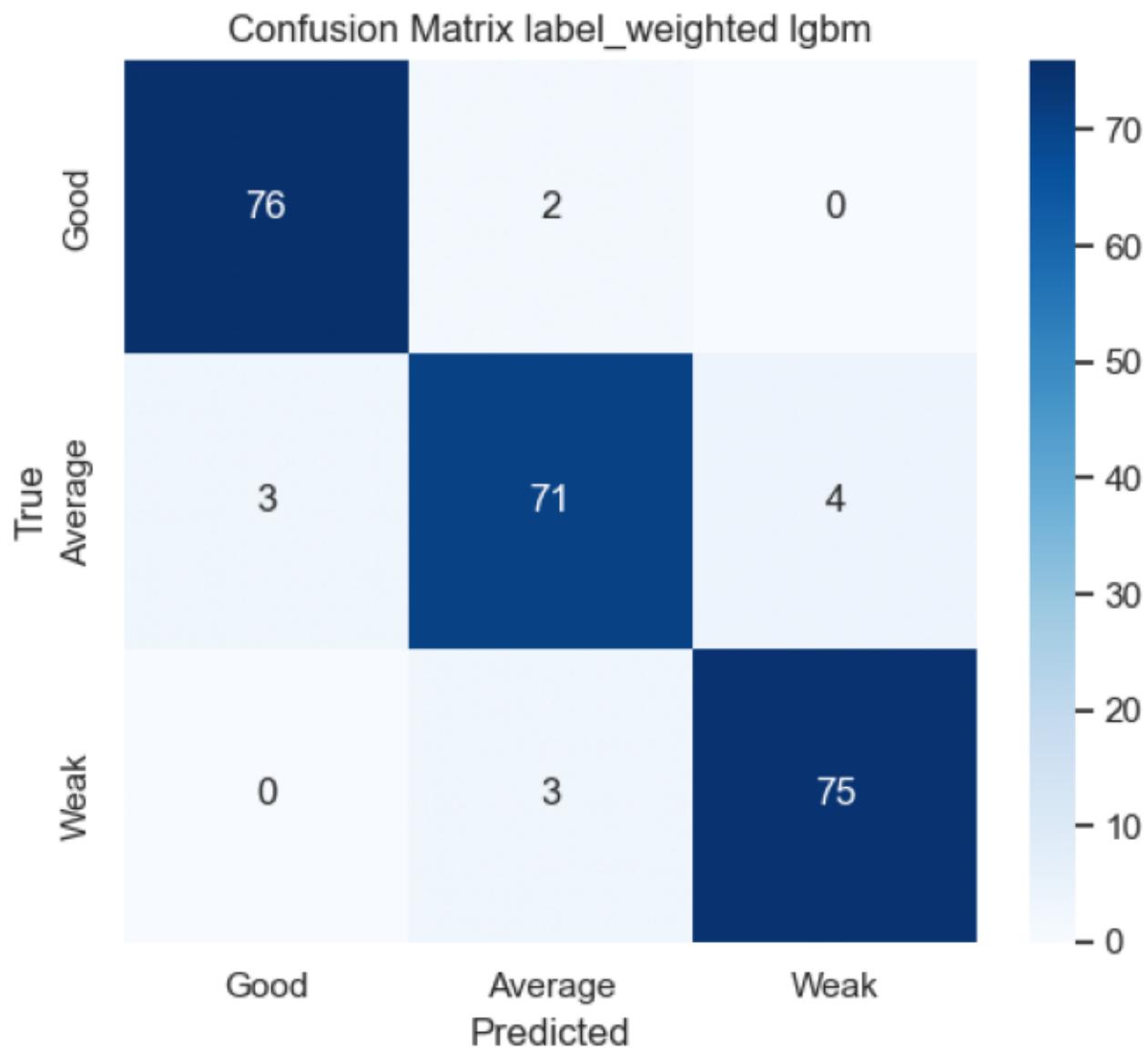
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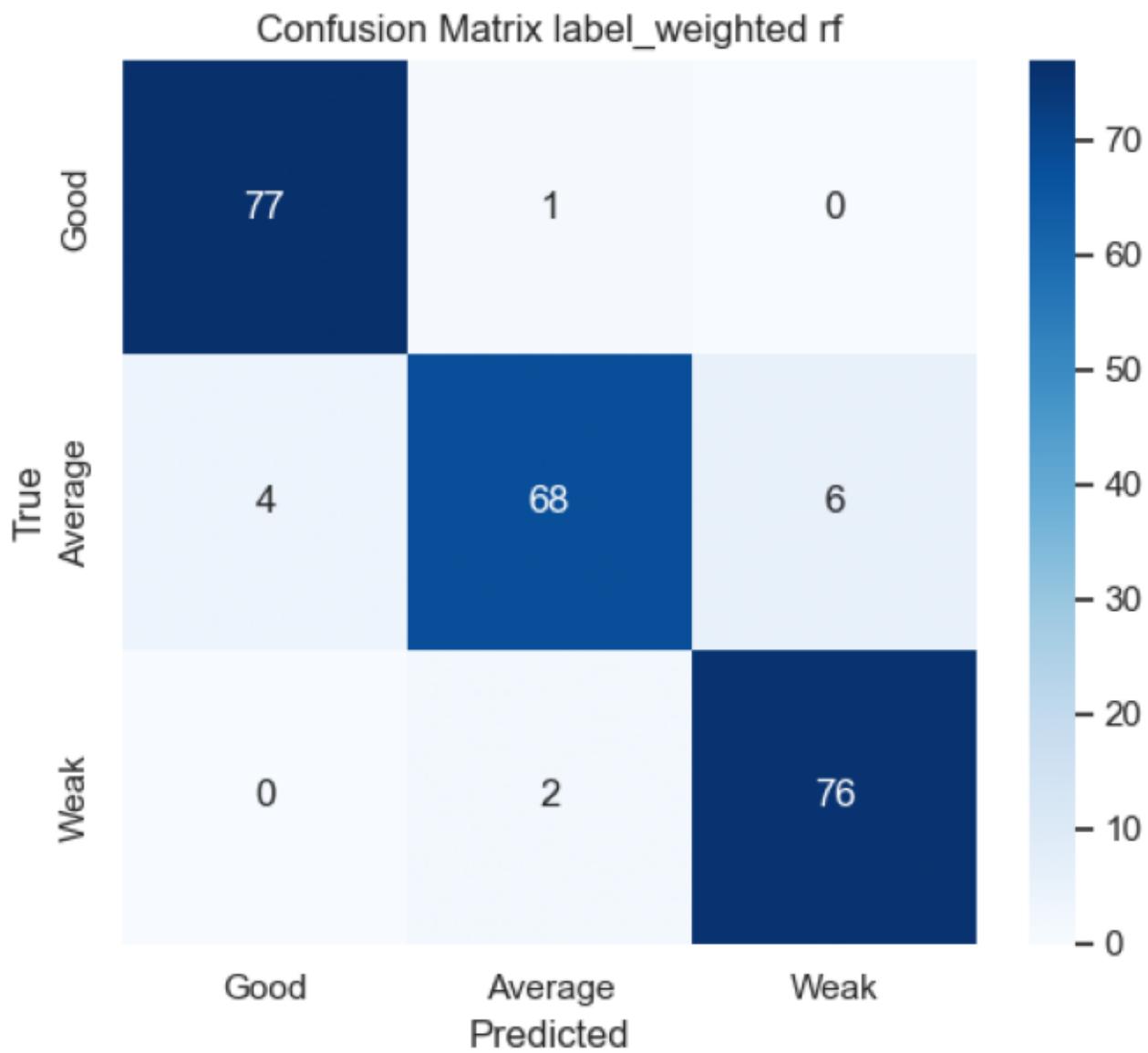
confusion_label_weighted_keras.png



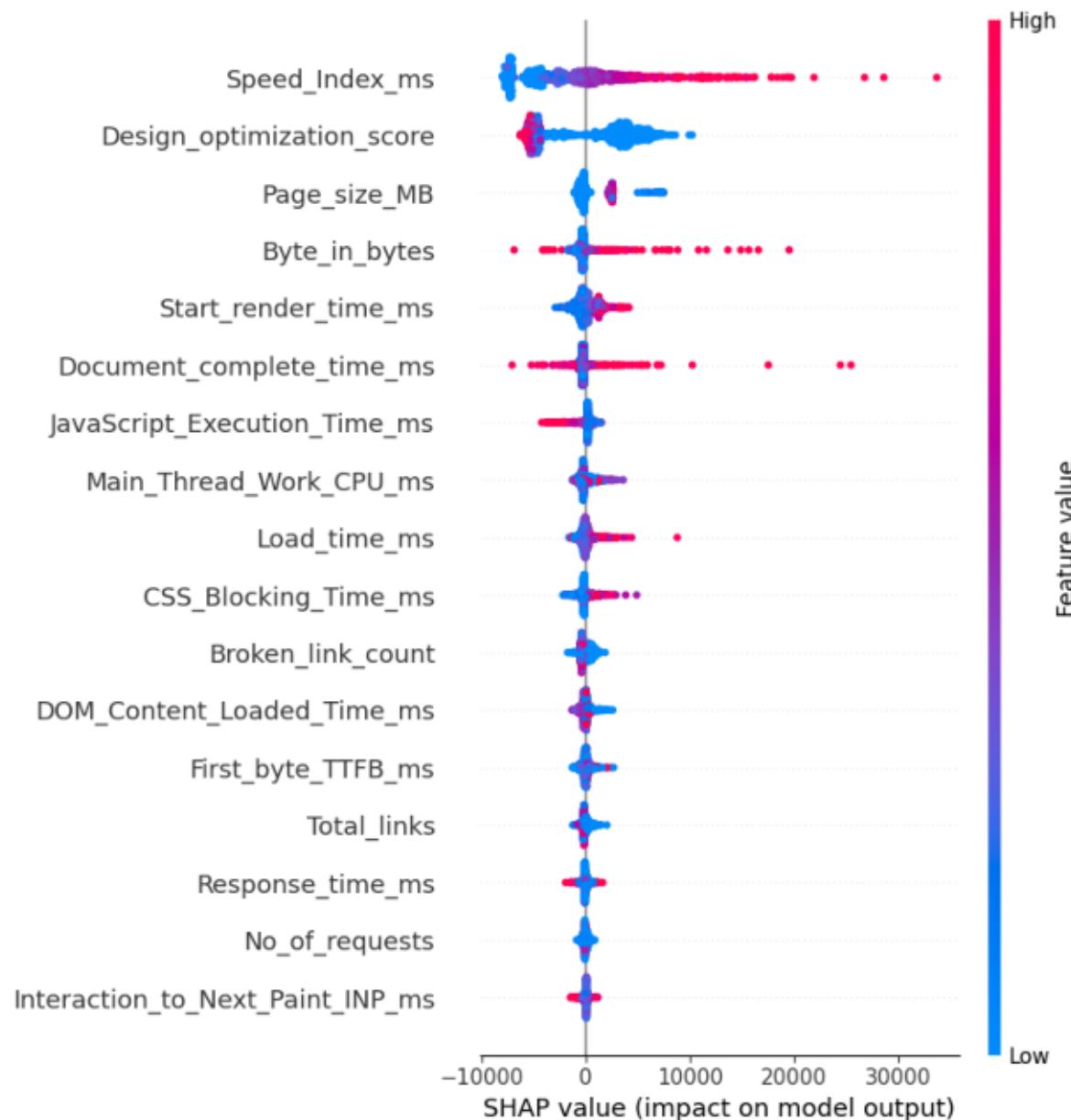
confusion_label_weighted_lgbm.png



confusion_label_weighted_rf.png



SHAP summary (example)



Conclusions:

- K-means labeling produced best classifier f1 (see classifiers tuning).
- LightGBM and Keras performed well; check per-target regression metrics for LCP/FCP/TTI.
- SHAP explanations available via API /explain to identify feature causes and suggested fixes.