

Table 1: Raw result (Mean and Standard Error) for MARIADB under different tuning budgets. The best is highlighted in blue.

Performance Objective	Optimizer	S_{100}		S_{200}		S_{300}		S_{400}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
Query runtime (s)	IRACE	3523.7699	9.2823	3488.2279	8.7306	3467.1302	7.7481	3462.9879	7.9207
	GA	3532.0604	70.4278	3418.7475	6.2907	3410.9170	5.2294	3406.1658	4.6500
	RS	3535.2548	9.4643	3486.2006	7.8706	3457.1584	7.1157	3439.2897	5.7296
	PARAMILS	3674.7002	24.9233	3552.2880	15.0823	3498.6522	12.9740	3433.5337	13.2415
	MMO	3448.4601	6.6857	3416.0676	5.6966	3406.4546	4.7645	3399.6531	4.6623
	PMO	3533.8645	70.4721	3431.3216	7.0886	3409.9621	5.9484	3400.7701	4.9186
	FLASH	3517.0915	11.1567	3451.4423	4.9088	3438.3215	3.1606	3433.7415	2.9522
	BOCA	3546.0420	10.2021	3478.5462	7.8258	3456.2617	6.8024	3441.4682	5.8388
	SMAC	3546.8572	12.2623	3500.1356	8.0900	3477.0133	8.0153	3463.8276	7.1174
	AdMMO	3447.1735	7.6400	3401.2368	5.0468	3388.5766	4.1755	3385.8897	3.9094
CPU load (%)	IRACE	120.8272	1.1562	113.3690	1.4131	107.4053	1.2299	104.9817	1.0522
	GA	112.2781	1.3890	103.4599	0.7719	101.9646	0.4943	100.8885	0.5181
	RS	118.1397	1.6491	112.0937	1.2554	109.6011	1.1365	106.0456	1.0021
	PARAMILS	141.6914	2.4069	129.4567	1.3521	124.3093	0.6944	122.4463	0.6028
	MMO	111.8856	1.3132	102.9398	0.7038	101.6180	0.5604	100.7307	0.5581
	PMO	119.0669	1.3012	113.3299	1.3112	110.2528	1.3188	106.8715	1.1285
	FLASH	121.0158	1.2240	104.3903	1.0833	100.6508	0.4212	100.5153	0.4173
	BOCA	117.9311	1.6059	112.0759	1.2977	108.8237	1.1984	108.3274	1.1728
	SMAC	122.1649	1.5893	113.6397	1.5651	109.6310	1.3810	108.2180	1.1647
	AdMMO	112.1386	1.5602	105.4267	1.0402	103.2077	0.8067	101.6199	0.4489

Table 2: Raw result (Mean and Standard Error) for STORM under different tuning budgets. The best is highlighted in blue.

Performance Objective	Optimizer	S_{100}		S_{200}		S_{300}		S_{400}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
Throughput (req/min)	IRACE	30949.5200	301.1946	32195.5400	247.1569	32865.9600	230.8223	33555.6400	170.4004
	GA	34106.8000	144.0463	34459.0600	24.3928	34523.4000	20.7839	34577.2727	23.9217
	RS	31795.6800	300.1514	32941.5200	216.0825	33506.4000	163.8473	33677.5200	134.8653
	PARAMILS	31995.8000	265.8597	33145.6000	194.8250	34046.6200	140.9580	34487.9592	86.3635
	MMO	34295.3000	76.9783	34518.7000	27.2955	34575.0000	21.7094	34615.4000	21.1513
	PMO	32268.6000	368.1045	34024.6400	104.8081	34393.6200	57.8030	34558.2000	15.7014
	FLASH	31429.5000	279.1050	34557.7200	40.9643	34740.0000	0.0000	34740.0000	0.0000
	BOCA	33480.4400	155.7451	34086.2200	104.7592	34388.0800	61.4465	34556.1800	43.4592
	SMAC	30956.0200	277.3214	32158.5600	188.0225	33049.1400	167.2067	33623.9600	125.3660
	AdMMO	34271.1400	119.3830	34626.6200	21.0885	34674.6000	15.3055	34718.2000	9.8537
Latency (ms)	IRACE	3756.6040	53.7962	3579.7120	31.7903	3493.9500	21.4499	3439.4280	9.3815
	GA	3340.6660	5.0778	3317.2000	0.0000	3317.2000	0.0000	3317.2000	0.0000
	RS	3657.0740	42.3152	3538.9980	29.3963	3492.1000	23.8086	3448.4960	12.9591
	PARAMILS	5213.7580	226.8126	4680.1600	187.9441	4073.2560	84.2054	3802.8120	56.7630
	MMO	3398.1700	27.8259	3320.2880	2.1394	3317.2000	0.0000	3317.2000	0.0000
	PMO	3850.7720	171.0120	3457.5840	37.6043	3358.2200	9.5002	3337.6620	8.6208
	FLASH	4156.0540	58.4950	3490.4100	3.0547	3490.4100	3.0547	3490.4100	3.0547
	BOCA	3793.2520	55.5327	3568.4300	37.5073	3503.3800	26.9663	3471.5320	21.7659
	SMAC	3734.0580	48.7208	3514.4880	26.6696	3462.8660	13.3571	3442.2700	13.2584
	AdMMO	3396.1800	20.5327	3326.3980	3.5231	3317.2000	0.0000	3317.2000	0.0000

Table 3: Raw result (Mean and Standard Error) for VP9 under different tuning budgets. The best is highlighted in blue.

Performance Objective	Optimizer	S_{100}		S_{200}		S_{300}		S_{400}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
Runtime (s)	IRACE	38106.1080	1442.2595	34479.8880	1195.5680	32418.1600	955.3975	31168.2280	790.0485
	GA	40307.7080	2057.8499	33576.3280	1340.1566	30713.7000	939.1404	29047.8440	489.2220
	RS	43097.6560	1937.9700	34117.5520	1147.7321	31028.0560	709.5907	30661.8360	661.7887
	PARAMILS	118260.9600	6383.7877	117370.7080	6366.4671	115668.3960	6309.8297	108375.4920	5983.8763
	MMO	45788.4880	3061.9204	33101.5640	1583.8079	30766.0440	1089.5602	28542.1120	7.9241
	PMO	44584.1880	2540.0065	37673.5800	2066.4579	34993.5640	1736.1290	33167.8400	1394.0772
	FLASH	42011.4640	1751.2021	34316.2520	1162.5485	32091.0000	852.3765	29964.4400	448.8745
	BOCA	43112.6640	2619.0913	33895.8160	1087.9183	32629.3720	993.8858	30636.4520	692.8169
	SMAC	44183.0680	2024.5104	37521.0920	1477.2283	32896.5520	1025.5856	30835.2160	781.2134
	AdMMO	36232.1600	1880.2497	32554.7200	1569.9656	29040.0360	461.2054	28509.2360	6.8676
CPU load (%)	IRACE	357.3968	1.9294	349.6382	0.5727	348.6171	0.4885	348.0647	0.4635
	GA	358.8644	2.4383	350.0292	1.8845	344.3913	0.4537	343.4090	0.1664
	RS	360.3046	2.3208	352.3494	0.8645	350.2382	0.7189	348.8319	0.3419
	PARAMILS	631.4400	17.7830	626.6396	17.7651	624.9118	15.9293	596.0734	14.7331
	MMO	367.3333	2.1911	358.7037	1.4301	355.6360	1.1209	353.5156	0.7077
	PMO	367.0194	3.1156	360.2686	2.1655	356.0271	1.5391	354.0907	1.4856
	FLASH	357.8843	1.5157	351.7508	0.8031	349.4122	0.5461	348.1329	0.5341
	BOCA	364.9531	2.3809	355.7281	1.3442	351.0058	0.9154	348.3662	0.3730
	SMAC	358.6781	2.6494	351.6101	1.1035	349.4780	0.7040	348.8693	0.6868
	AdMMO	356.2889	2.3809	348.9602	1.2104	346.8667	1.0256	345.5688	0.9469

Table 4: Raw result (Mean and Standard Error) for KERAS under different tuning budgets. The best is highlighted in blue.

Performance Objective	Optimizer	S_{100}		S_{200}		S_{300}		S_{400}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
AUC	IRACE	0.6000	0.0129	0.6364	0.0143	0.6657	0.0148	0.6921	0.0140
	GA	0.5907	0.0111	0.6143	0.0121	0.6264	0.0126	0.6329	0.0127
	RS	0.5893	0.0127	0.6214	0.0137	0.6464	0.0147	0.6650	0.0150
	PARAMILS	0.5407	0.0049	0.5429	0.0052	0.5429	0.0052	0.5443	0.0053
	MMO	0.5786	0.0096	0.5986	0.0107	0.6171	0.0111	0.6357	0.0124
	PMO	0.7193	0.0152	0.7857	0.0000	0.7857	0.0000	0.7857	0.0000
	FLASH	0.5479	0.0055	0.5479	0.0055	0.5479	0.0055	0.5479	0.0055
	BOCA	0.6000	0.0129	0.6386	0.0142	0.6507	0.0142	0.6657	0.0136
	SMAC	0.6014	0.0135	0.6464	0.0146	0.6579	0.0139	0.6757	0.0134
	AdMMO	0.6121	0.0143	0.6493	0.0155	0.6779	0.0150	0.6836	0.0147
Inference time (s)	IRACE	256.9060	1.5441	250.4278	0.9668	249.0602	0.8964	247.6945	0.8402
	GA	242.2968	0.2739	241.1141	0.1176	240.8636	0.0703	240.7794	0.0608
	RS	259.3662	5.0605	249.5539	0.9765	247.0359	0.6957	246.0990	0.5147
	PARAMILS	478.3842	32.2908	388.6682	19.2988	340.0961	15.4033	320.4957	12.9677
	MMO	241.9621	0.2472	241.0555	0.1198	240.8090	0.0735	240.6508	0.0651
	PMO	243.3757	0.5392	240.8950	0.0894	240.7488	0.0560	240.6494	0.0528
	FLASH	259.3674	0.7102	245.1438	0.0956	244.7661	0.0424	244.7661	0.0424
	BOCA	251.7490	1.1255	247.0141	0.6604	245.8557	0.5937	244.9237	0.4723
	SMAC	254.6410	1.2312	249.6532	0.8723	248.2984	0.7535	247.3048	0.6866
	AdMMO	241.7390	0.2372	240.6335	0.1234	240.4102	0.0491	240.3384	0.0376

Table 5: Raw result (Mean and Standard Error) for MongoDB under different tuning budgets. The best is highlighted in blue.

Performance Objective	Optimizer	S_{100}		S_{200}		S_{300}		S_{400}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
Query runtime (s)	IRACE	282107.0800	5806.1047	254066.7440	4940.1002	245482.9560	4469.1472	236088.3320	3313.7581
	GA	281298.7080	5273.4272	256008.2200	3238.4685	246736.0400	2548.2792	236399.5080	2518.7285
	RS	277585.4280	6207.4587	256392.5320	5269.6693	246003.3560	4422.2903	239898.8080	3938.2774
	PARAMILS	336575.6520	13354.0952	336575.6520	13354.0952	336575.6520	13354.0952	336575.6520	13354.0952
	MMO	286712.2880	6612.1754	263436.8600	4432.4525	244281.1480	3853.6348	232419.8760	2990.1584
	PMO	282236.8760	6180.8604	254460.8160	3660.1134	243555.6920	2748.9344	233743.6040	2271.9352
	FLASH	289849.7600	6190.7308	258447.7360	5393.4313	249258.7680	4631.5009	240881.4640	4181.4288
	BOCA	292841.4960	5931.4127	274550.1000	5631.2819	255654.0240	4731.7972	245000.9880	4125.9087
	SMAC	288599.9800	6184.3914	263216.4440	4913.2493	250078.1920	3915.1902	238119.2640	2618.5230
	AdMMO	273195.2280	5300.5817	239485.4400	3517.9368	228797.0120	2056.5262	224758.9800	1734.1277
CPU load (%)	IRACE	3740.8415	55.9788	3362.2511	63.6645	3216.6013	49.6435	3171.3887	48.3085
	GA	3837.3333	48.6733	3504.0935	37.7178	3293.3091	42.9394	3122.6120	30.9031
	RS	3831.2340	79.2468	3476.0180	55.5532	3343.9224	57.8081	3143.2538	47.3423
	PARAMILS	4713.9338	88.9399	4703.1497	147.9066	4703.1497	147.9066	4703.1497	147.9066
	MMO	3848.4740	69.7687	3510.6279	43.9271	3348.0578	38.7441	3234.4663	33.5393
	PMO	3820.2060	56.1888	3410.7857	34.8779	3283.0415	29.5854	3136.9318	29.5384
	FLASH	3838.1967	82.5368	3403.3581	51.0462	3229.2750	51.4120	3170.2534	50.7837
	BOCA	3802.5185	45.3067	3501.4420	43.8187	3324.8806	37.8240	3229.8063	51.4728
	SMAC	3935.8611	65.6802	3470.3228	46.1296	3304.9210	42.2457	3191.8131	41.5214
	AdMMO	3678.2265	52.1172	3306.0192	37.0260	3080.6613	40.0114	3035.5476	33.6296

Table 6: Raw result (Mean and Standard Error) for Storm under different tuning budgets. The best is highlighted in blue.

Performance Objective	Optimizer	S_{100}		S_{200}		S_{300}		S_{400}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
PSNR	IRACE	51.8380	0.0000	51.8380	0.0000	51.8380	0.0000	51.8380	0.0000
	GA	53.1106	0.1627	53.8719	0.1111	53.9868	0.1096	54.0906	0.1067
	RS	47.1160	0.0000	47.1160	0.0000	47.1160	0.0000	47.1160	0.0000
	PARAMILS	47.1160	0.0000	47.1160	0.0000	47.1160	0.0000	47.1160	0.0000
	MMO	52.8554	0.1827	53.7144	0.1548	54.0652	0.1406	54.2174	0.1351
	PMO	52.4350	0.1456	53.4388	0.1954	53.8098	0.1948	54.1868	0.1859
	FLASH	51.8380	0.0000	51.8380	0.0000	51.8380	0.0000	51.8380	0.0000
	BOCA	51.8380	0.0000	51.8380	0.0000	51.8380	0.0000	51.8380	0.0000
	SMAC	51.8380	0.0000	51.8380	0.0000	51.8380	0.0000	51.8380	0.0000
	AdMMO	53.2062	0.2043	53.6626	0.1769	54.0798	0.1514	54.1877	0.1394
Energy (watt)	IRACE	404.4444	0.0000	404.4444	0.0000	404.4444	0.0000	404.4444	0.0000
	GA	368.3216	3.1704	360.4234	2.5212	357.9398	2.2083	357.5916	2.1809
	RS	1064.8273	0.0000	1064.8273	0.0000	1064.8273	0.0000	1064.8273	0.0000
	PARAMILS	7816.7361	0.0000	7816.7361	0.0000	7816.7361	0.0000	7816.7361	0.0000
	MMO	379.8048	3.0210	358.6232	1.9588	357.0871	1.7792	354.9966	1.3085
	PMO	384.7304	3.2251	362.2583	3.6066	354.7791	2.7392	352.2850	2.6486
	FLASH	404.4444	0.0000	404.4444	0.0000	404.4444	0.0000	404.4444	0.0000
	BOCA	404.4444	0.0000	404.4444	0.0000	404.4444	0.0000	404.4444	0.0000
	SMAC	404.4444	0.0000	404.4444	0.0000	404.4444	0.0000	404.4444	0.0000
	AdMMO	370.7666	3.3163	355.6593	2.9328	347.6165	2.6216	346.6839	2.5544

Table 7: Raw result (Mean and Standard Error) for LLVM under different tuning budgets. The best is highlighted in blue.

Performance Objective	Optimizer	S_{100}		S_{200}		S_{300}		S_{400}	
		Mean	SE	Mean	SE	Mean	SE	Mean	SE
Runtime (s)	IRACE	58240.9920	218.2634	56999.3200	233.8150	56633.5920	215.0531	56299.1280	204.8131
	GA	53170.3600	188.0886	52285.4000	0.0000	52285.4000	0.0000	52285.4000	0.0000
	RS	59141.2000	286.2022	57668.6560	213.0426	57175.6640	171.2419	56785.6800	175.7107
	PARAMILS	63716.1600	474.0102	63406.4400	434.2812	63156.4960	413.2009	62924.0449	390.6426
	MMO	53331.5640	162.1071	52285.4000	0.0000	52285.4000	0.0000	52285.4000	0.0000
	PMO	55272.1640	309.5325	53377.8680	220.3760	52600.8040	122.7912	52462.7520	96.6985
	FLASH	57180.1280	150.8118	52285.4000	0.0000	52285.4000	0.0000	52285.4000	0.0000
	BOCA	56824.7480	183.5406	56042.6040	164.3958	55670.1760	159.7172	55394.6320	149.5879
	SMAC	58066.9280	255.1976	56729.7800	200.4163	55948.2520	205.8857	55611.2840	204.1015
	AdMMO	53606.9680	211.1056	52307.3040	21.6839	52285.4000	0.0000	52285.4000	0.0000
CPU load (%)	IRACE	2546.6932	1.7108	2540.7845	1.4085	2537.8010	1.1850	2536.0102	1.1764
	GA	2542.9074	1.4137	2537.2727	1.0551	2535.3299	1.0241	2534.8099	1.0217
	RS	2550.6232	1.5666	2544.2044	1.2113	2540.3679	1.1361	2537.1310	1.1620
	PARAMILS	2555.3405	0.8671	2553.3613	0.7454	2552.1303	0.7399	2550.8647	0.7740
	MMO	2542.8061	1.4399	2536.7386	1.0643	2534.9862	0.9584	2533.7226	0.7842
	PMO	2544.2080	1.2054	2538.9905	0.8329	2537.0749	0.6296	2536.0428	0.5959
	FLASH	2542.2536	0.5230	2537.6275	0.3312	2534.0706	0.4376	2531.5548	0.2376
	BOCA	2549.0338	1.1506	2542.5844	1.1007	2539.0473	1.0012	2536.0874	1.0089
	SMAC	2548.2762	1.2664	2542.6598	1.1593	2538.7302	1.0831	2536.1512	1.0768
	AdMMO	2543.6360	1.3765	2536.6930	1.1261	2533.2844	0.9829	2530.8762	0.6674