Machine Learning techniques to Model Data Intensive Application Performance

A. Battistello P. Ferretti

Contents

1 Aggregated, $ncores^{-1}$, shuffled, all the features

1.1 Query R1

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0510	0.9981	13892	0.0559
Linear SVR	0.0609	0.9976	17813	0.0837
Polynomial SVR (2)	0.3462	0.9300	112648	0.6455
Polynomial SVR (3)	0.1502	0.9851	41999	0.2049
Polynomial SVR (4)	0.3528	0.9175	105727	0.5594
Polynomial SVR (6)	0.6948	0.7417	235987	1.7585
Gaussian SVR	0.0846	0.9949	20910	0.1143

Table 1: Results for R1

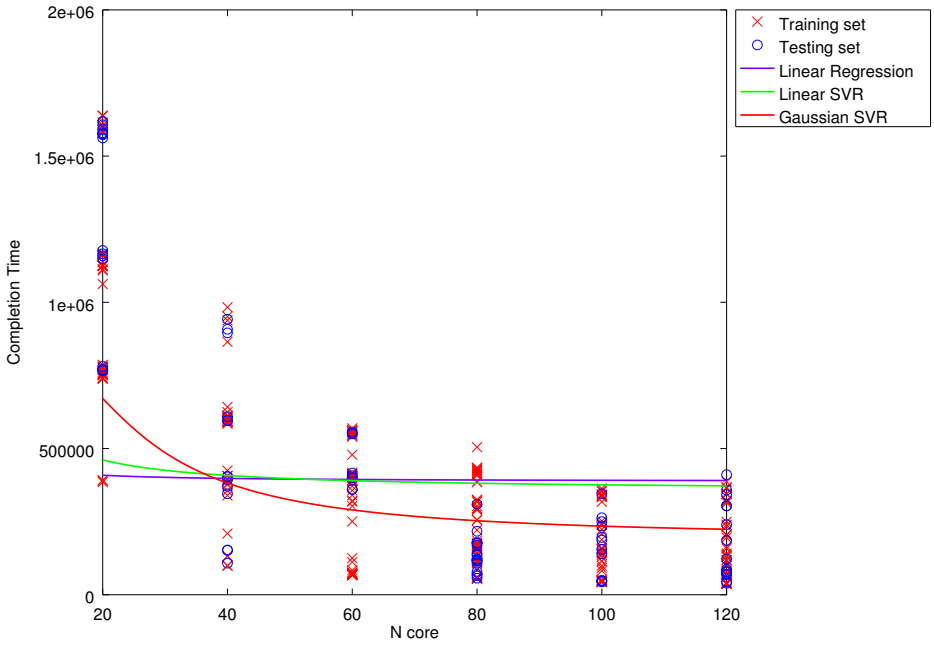

Figure 1: Completion time vs ncores for query R1

1.2 Query R2

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	31696101.8346	-1774765885793179.0000	2628192528196	18532934.6384
Linear SVR	0.0513	0.9964	32606	0.3625
Polynomial SVR (2)	0.0525	0.9956	32061	0.3298
Polynomial SVR (3)	0.0803	0.9980	59476	0.7051
Polynomial SVR (4)	0.0791	0.9971	59282	0.6862
Polynomial SVR (6)	0.0948	0.9920	66967	0.7164
Gaussian SVR	0.0765	0.9922	45367	0.4765

Table 2: Results for R2

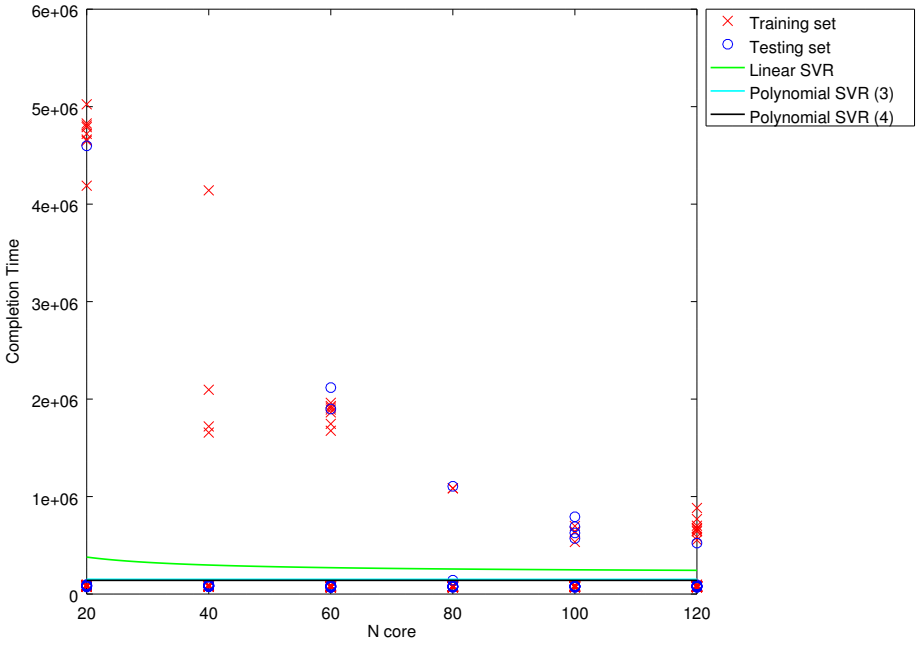

Figure 2: Completion time vs ncores for query R2

1.3 Query R3

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0177	0.9997	12613	0.0164
Linear SVR	0.0469	0.9982	36052	0.0511
Polynomial SVR (2)	0.3299	0.8952	231563	0.3527
Polynomial SVR (3)	0.1458	0.9796	109997	0.1726
Polynomial SVR (4)	0.4108	0.8806	310820	0.5327
Polynomial SVR (6)	0.5565	0.8020	447862	0.7438
Gaussian SVR	0.0859	0.9933	61991	0.0921

Table 3: Results for R3

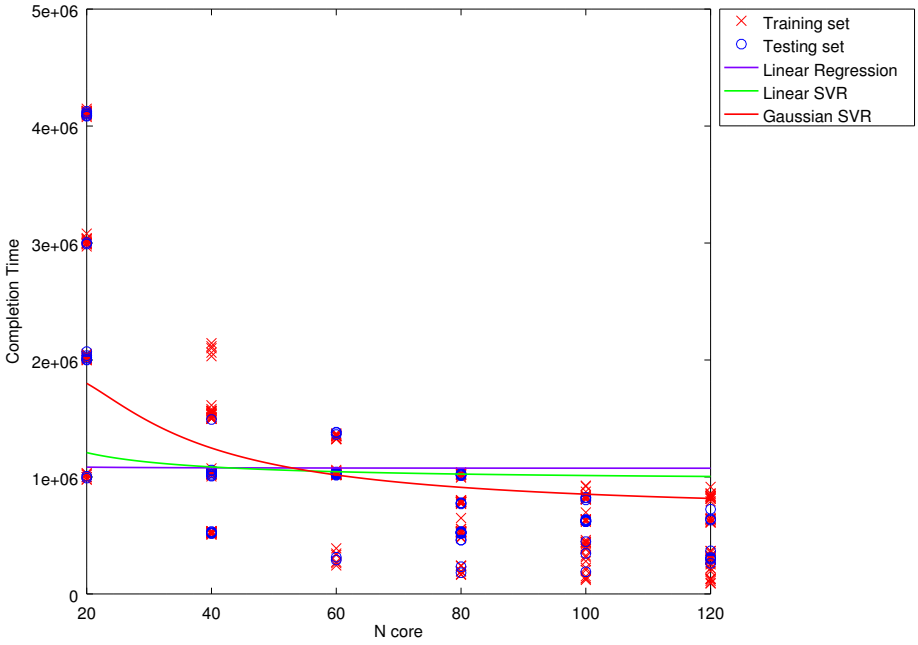

Figure 3: Completion time vs ncores for query R3

1.4 Query R4

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0390	0.9982	7187	0.0223
Linear SVR	0.0653	0.9952	14648	0.0380
Polynomial SVR (2)	0.2105	0.9531	44342	0.1911
Polynomial SVR (3)	0.1363	0.9784	30221	0.0991
Polynomial SVR (4)	0.2271	0.9534	49567	0.1563
Polynomial SVR (6)	0.5010	0.7036	104774	0.3027
Gaussian SVR	0.0907	0.9919	18768	0.0635

Table 4: Results for R4

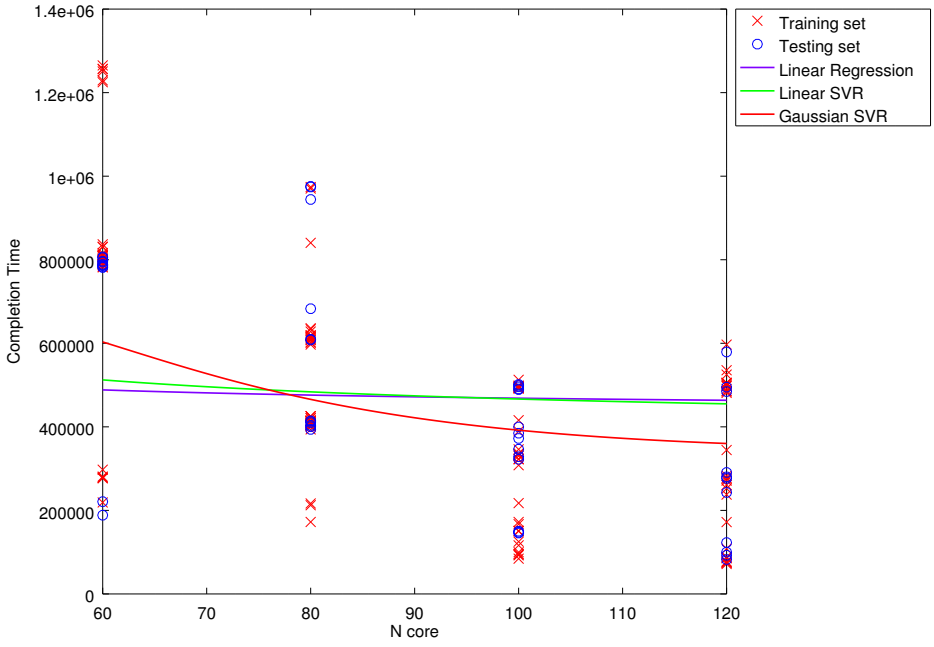

Figure 4: Completion time vs ncores for query R4

1.5 Query R5

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.1925	0.9727	751	0.0248
Linear SVR	0.1939	0.9742	720	0.0238
Polynomial SVR (2)	0.2190	0.9648	890	0.0318
Polynomial SVR (3)	0.2212	0.9640	943	0.0328
Polynomial SVR (4)	0.3425	0.9345	1276	0.0421
Polynomial SVR (6)	0.5267	0.8749	1561	0.0520
Gaussian SVR	0.2227	0.9649	888	0.0299

Table 5: Results for R5

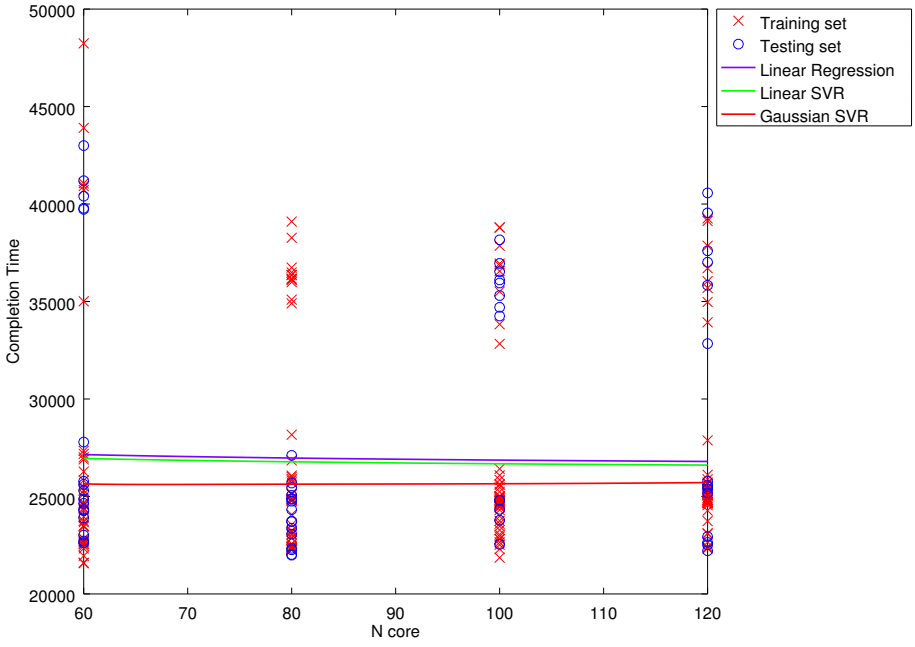

Figure 5: Completion time vs ncores for query R5

2 Aggregated, $ncores^{-1}$, shuffled, all the features with $nmap/ncores$ and $nreduce/ncores$

2.1 Query R1

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0408	0.9988	10695	0.0548
Linear SVR	0.0590	0.9978	16647	0.1022
Polynomial SVR (2)	0.2929	0.9385	61709	0.2828
Polynomial SVR (3)	0.1316	0.9881	35917	0.1967
Polynomial SVR (4)	0.3272	0.9245	99500	0.5172
Polynomial SVR (6)	0.3640	0.9055	105745	0.5524
Gaussian SVR	0.0867	0.9946	22449	0.1132

Table 6: Results for R1

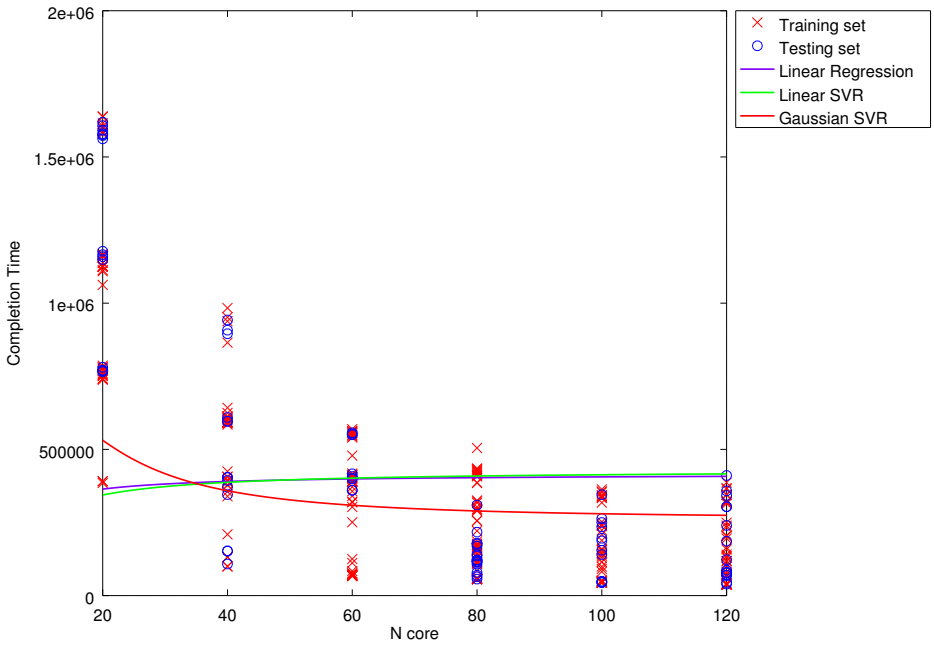

Figure 6: Completion time vs ncores for query R1

2.2 Query R2

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	141254430.2732	-352479221665367 04.0000	11712602369606	82592463.0763
Linear SVR	0.0652	0.9949	44793	0.5310
Polynomial SVR (2)	0.0566	0.9979	38621	0.4541
Polynomial SVR (3)	0.0834	0.9983	61626	0.7285
Polynomial SVR (4)	0.0881	0.9965	63683	0.6933
Polynomial SVR (6)	0.1073	0.9932	69083	0.7153
Gaussian SVR	0.0702	0.9934	43009	0.4534

Table 7: Results for R2

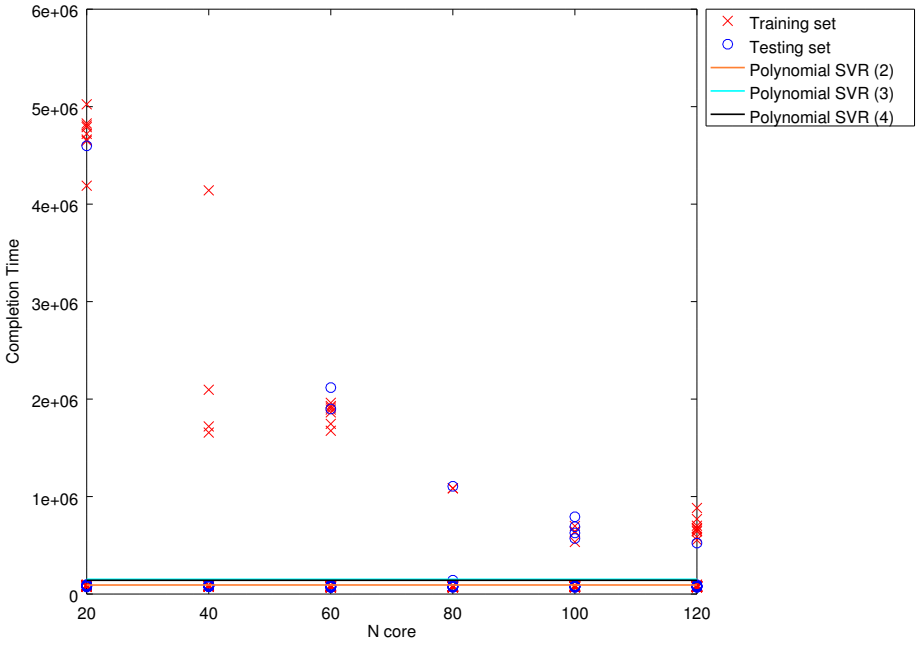

Figure 7: Completion time vs ncores for query R2

2.3 Query R3

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0233	0.9995	16407	0.0201
Linear SVR	0.0720	0.9971	60794	0.0887
Polynomial SVR (2)	0.2749	0.9263	210129	0.3235
Polynomial SVR (3)	0.1525	0.9774	114466	0.1793
Polynomial SVR (4)	0.4167	0.8702	318274	0.5577
Polynomial SVR (6)	0.2594	0.9335	185731	0.2797
Gaussian SVR	0.0835	0.9937	60492	0.0869

Table 8: Results for R3

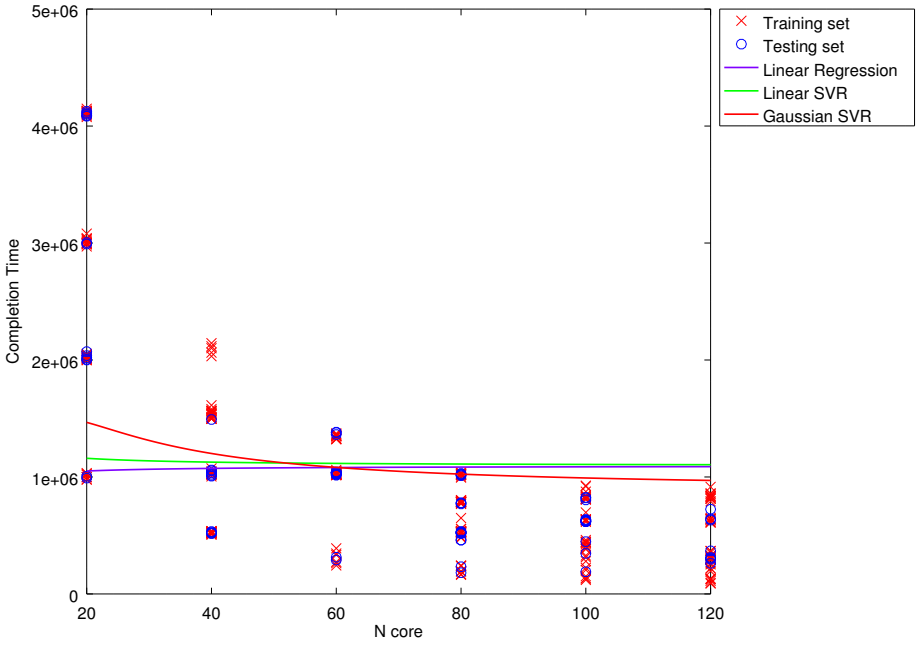

Figure 8: Completion time vs ncores for query R3

2.4 Query R4

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0293	0.9990	5346	0.0216
Linear SVR	0.0592	0.9965	13612	0.0382
Polynomial SVR (2)	0.1709	0.9694	36814	0.1412
Polynomial SVR (3)	0.1492	0.9744	34029	0.1024
Polynomial SVR (4)	0.2079	0.9528	42265	0.1215
Polynomial SVR (6)	0.3445	0.8696	75300	0.1964
Gaussian SVR	0.0949	0.9903	19607	0.0685

Table 9: Results for R4

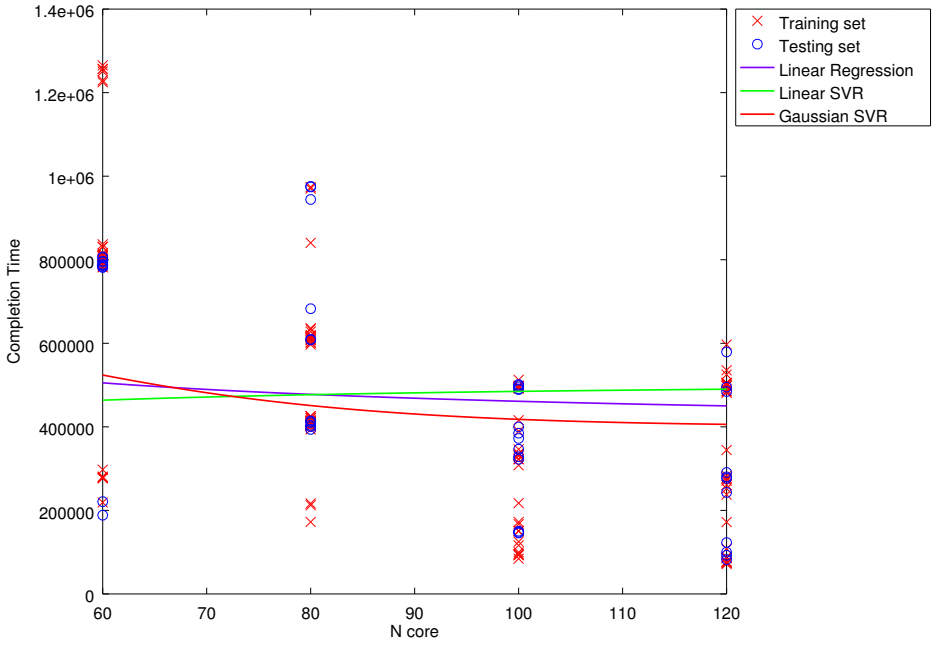

Figure 9: Completion time vs ncores for query R4

2.5 Query R5

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.2237	0.9631	984	0.0318
Linear SVR	0.0814	0.9953	368	0.0130
Polynomial SVR (2)	0.2115	0.9672	796	0.0269
Polynomial SVR (3)	0.2313	0.9607	843	0.0285
Polynomial SVR (4)	0.3812	0.9216	1222	0.0396
Polynomial SVR (6)	0.7677	0.7502	1751	0.0561
Gaussian SVR	0.1504	0.9836	603	0.0205

Table 10: Results for R5

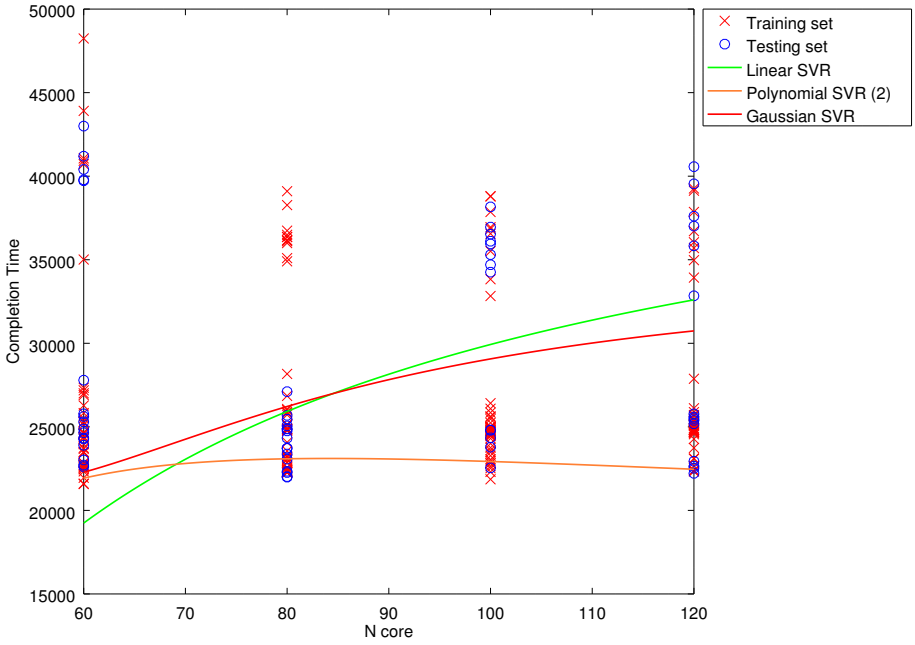

Figure 10: Completion time vs ncores for query R5

3 Aggregated, $ncores^{-1}$, test on ncores, all the features

3.1 Query R1

3.1.1 Query R1 — testing on 40, 60 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.1247	0.9557	33092	0.1029
Linear SVR	0.0852	0.9884	23713	0.0721
Polynomial SVR (2)	0.6955	0.4622	222000	0.5448
Polynomial SVR (3)	0.5586	0.5885	150310	0.3694
Polynomial SVR (4)	1.0502	0.0154	233402	0.5234
Polynomial SVR (6)	7.5600	0.2170	767551	1.1037
Gaussian SVR	0.2249	0.8789	53503	0.1642

Table 11: Results for R1, testing on 40, 60 cores

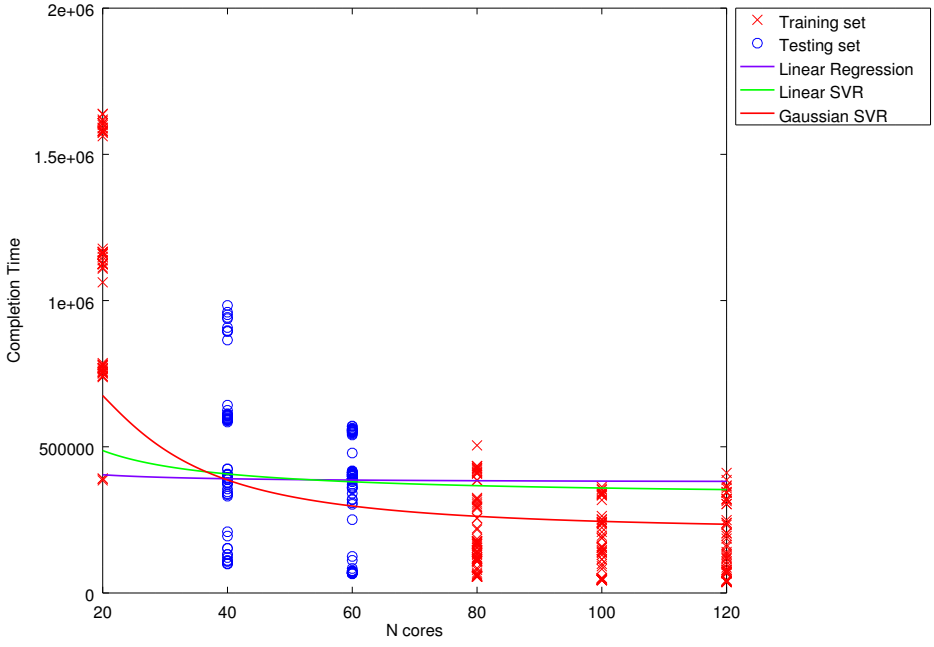

Figure 11: Completion time vs ncores for R1, testing on 40, 60 cores

3.1.2 Query R1 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	105500227698.9657	-589650333324778930176000.0000	3175253374984796	2410896386.0282
Linear SVR	0.0659	0.9827	18295	0.0918
Polynomial SVR (2)	0.3443	0.4801	97177	0.3662
Polynomial SVR (3)	0.1285	0.9255	39809	0.2457
Polynomial SVR (4)	0.2884	0.6858	94338	0.4752
Polynomial SVR (6)	0.5442	0.6017	167805	1.5509
Gaussian SVR	0.0986	0.9655	29741	0.1838

Table 12: Results for R1, testing on 60, 80 cores

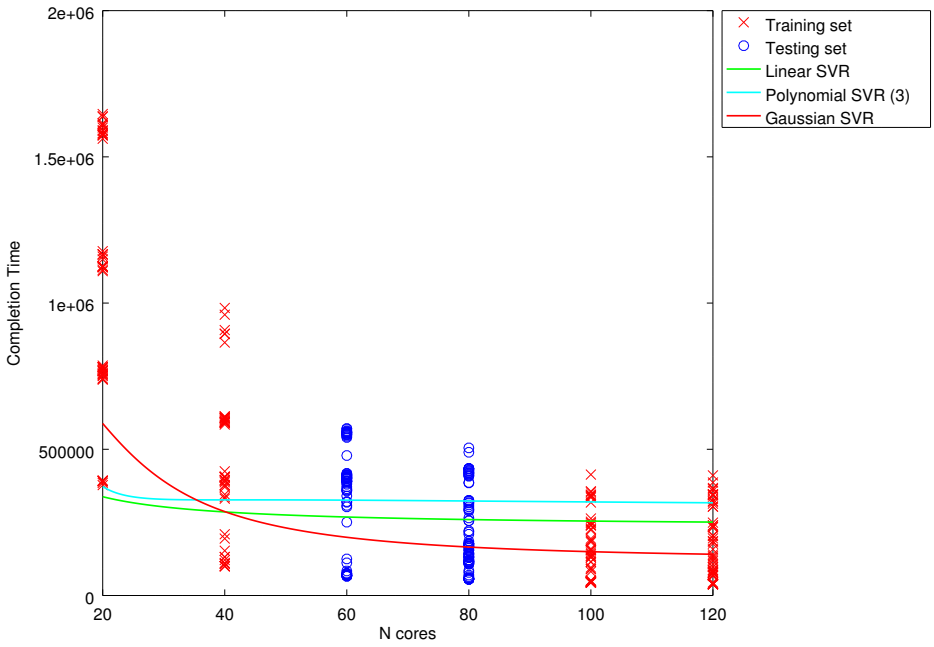

Figure 12: Completion time vs ncores for R1, testing on 60, 80 cores

3.1.3 Query R1 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	81093785305.9790	-6067915127177458640486 4.0000	24799947647760796	93386457.6269
Linear SVR	0.0566	0.9722	15772	0.1235
Polynomial SVR (2)	0.4172	0.3455	80796	0.4664
Polynomial SVR (3)	0.1800	0.8708	56679	0.4903
Polynomial SVR (4)	0.1759	0.8201	50073	0.3139
Polynomial SVR (6)	0.3494	0.7125	121803	1.0087
Gaussian SVR	0.0969	0.9483	25220	0.1510

Table 13: Results for R1, testing on 80, 100 cores

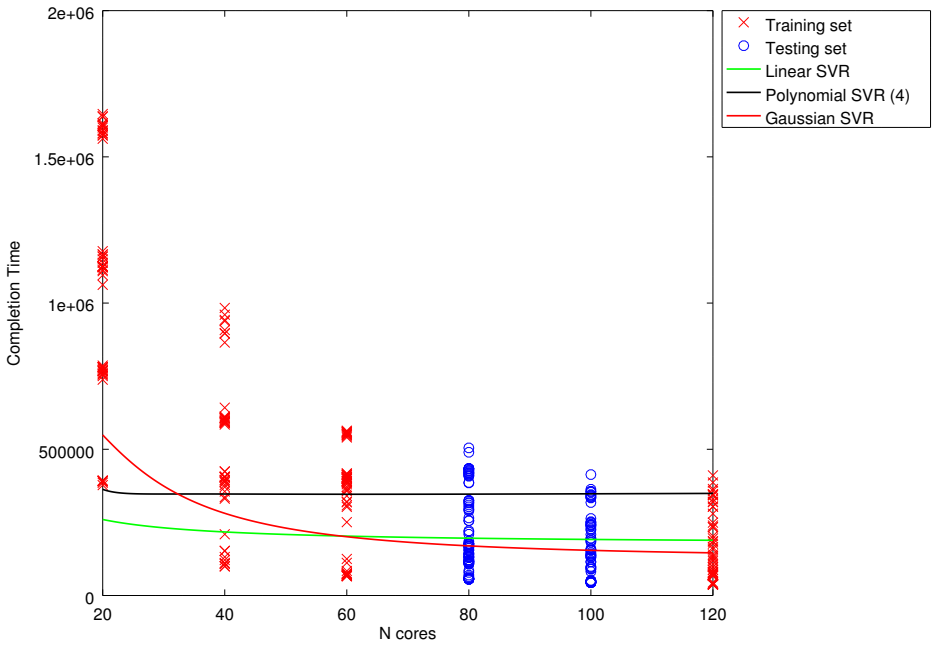

Figure 13: Completion time vs ncores for R1, testing on 80, 100 cores

3.2 Query R2

3.2.1 Query R2 — testing on 40, 60 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0992	0.9867	20402	0.0330
Linear SVR	0.1892	0.9898	67020	0.3618
Polynomial SVR (2)	0.1271	0.9845	31888	0.2404
Polynomial SVR (3)	0.2483	0.9525	93774	0.7416
Polynomial SVR (4)	0.4597	0.8865	124491	0.6870
Polynomial SVR (6)	1.2287	0.6821	199763	0.7420
Gaussian SVR	0.3705	0.9156	150483	1.0533

Table 14: Results for R2, testing on 40, 60 cores

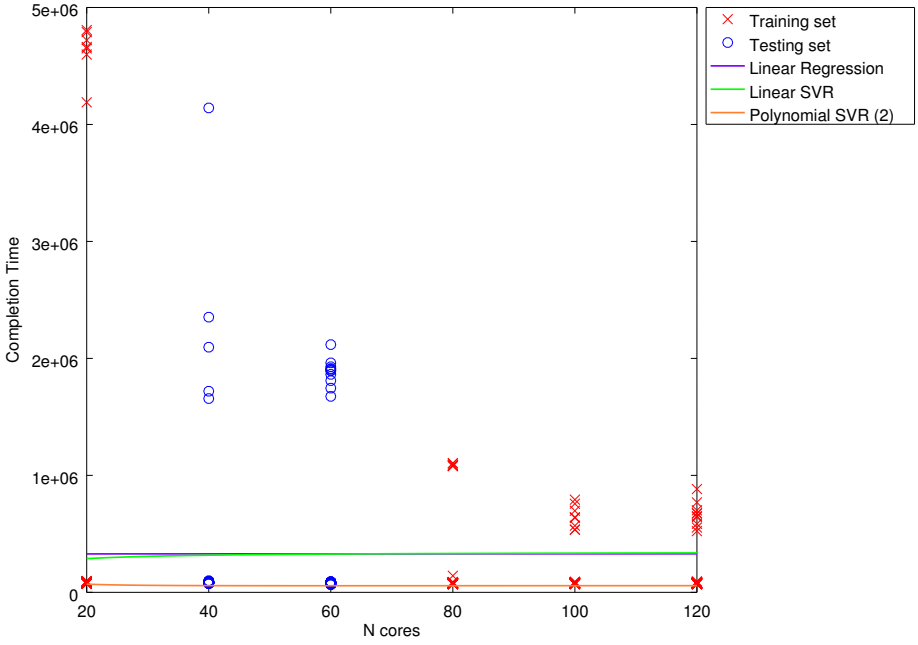

Figure 14: Completion time vs ncores for R2, testing on 40, 60 cores

3.2.2 Query R2 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	242433824.4683	-14094679214143406 4.0000	15071207360392	106275966.3491
Linear SVR	0.1225	0.9988	37869	0.1133
Polynomial SVR (2)	0.1179	0.9936	55476	0.4418
Polynomial SVR (3)	0.1470	0.9949	86021	0.7697
Polynomial SVR (4)	0.0977	0.9975	69666	0.7582
Polynomial SVR (6)	0.1437	0.9879	83284	0.7788
Gaussian SVR	0.0805	0.9856	35464	0.2694

Table 15: Results for R2, testing on 60, 80 cores

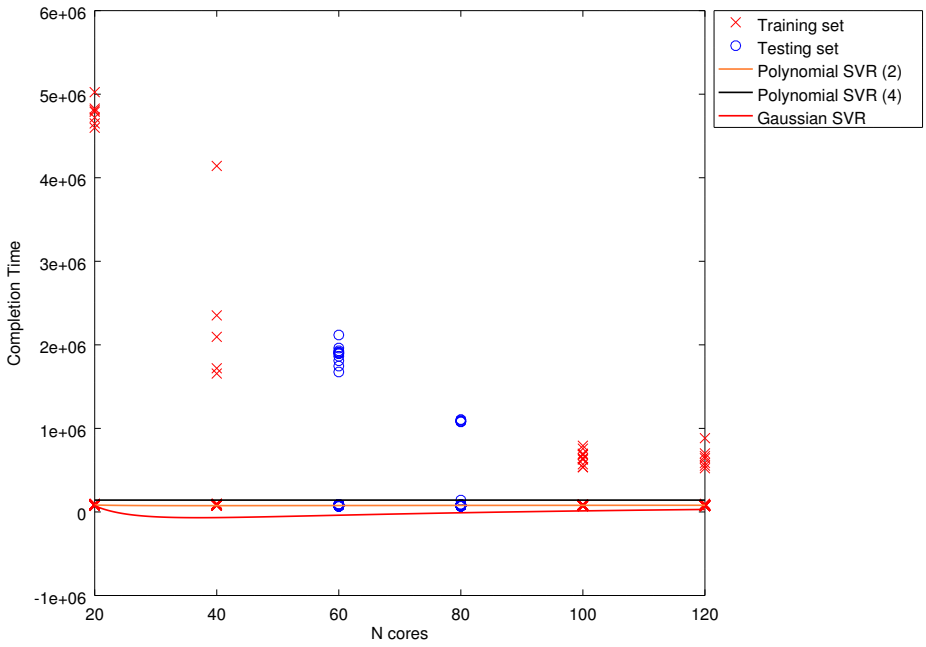

Figure 15: Completion time vs ncores for R2, testing on 60, 80 cores

3.2.3 Query R2 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	645430717.9662	-426504671649048166 4.0000	401240222802 41	282938131.3920
Linear SVR	0.0668	0.9967	48931	0.5881
Polynomial SVR (2)	0.0488	0.9870	28067	0.3441
Polynomial SVR (3)	0.0832	0.9970	62122	0.7601
Polynomial SVR (4)	0.0820	0.9944	61809	0.7482
Polynomial SVR (6)	0.3397	0.9288	259491	3.0687
Gaussian SVR	0.0715	0.9922	46797	0.4953

Table 16: Results for R2, testing on 80, 100 cores

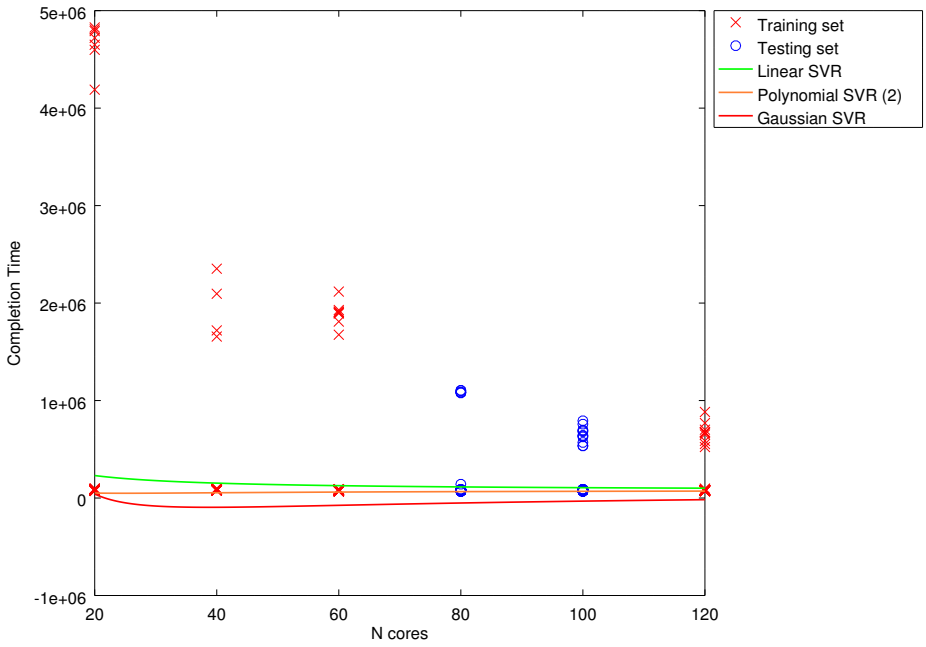

Figure 16: Completion time vs ncores for R2, testing on 80, 100 cores

3.3 Query R3

3.3.1 Query R3 — testing on 40, 60 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	2109777008.2634	-185798394687969157 12.0000	1638049437278597 7359277.8832	
Linear SVR	0.0612	0.9905	44053	0.0665
Polynomial SVR (2)	0.6552	0.7213	523068	0.4656
Polynomial SVR (3)	0.4691	0.6019	341195	0.2891
Polynomial SVR (4)	0.7328	0.0137	468559	0.4010
Polynomial SVR (6)	1.4800	0.0183	574082	0.4560
Gaussian SVR	0.2115	0.9243	155527	0.1568

Table 17: Results for R3, testing on 40, 60 cores

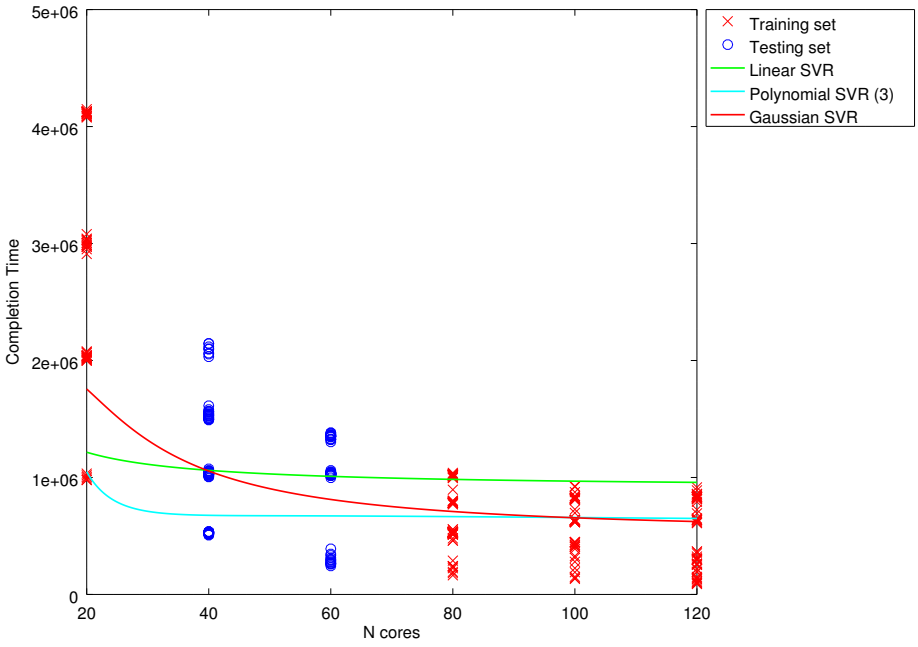

Figure 17: Completion time vs ncores for R3, testing on 40, 60 cores

3.3.2 Query R3 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0287	0.9941	20273	0.0271
Linear SVR	0.0545	0.9878	39858	0.0565
Polynomial SVR (2)	0.3491	0.2021	250305	0.3809
Polynomial SVR (3)	0.2125	0.7835	154895	0.3077
Polynomial SVR (4)	0.3395	0.3326	254005	0.4458
Polynomial SVR (6)	0.3642	0.1503	277418	0.5486
Gaussian SVR	0.1498	0.8487	102576	0.1422

Table 18: Results for R3, testing on 60, 80 cores

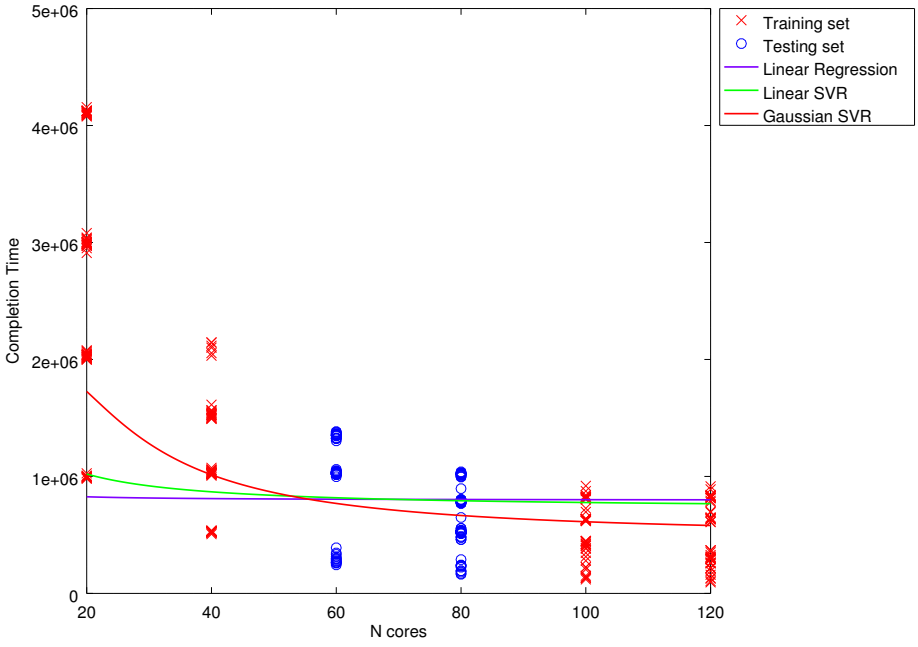

Figure 18: Completion time vs ncores for R3, testing on 60, 80 cores

3.3.3 Query R3 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.2665	0.0065	215923	0.5091
Linear SVR	0.0484	0.9856	39503	0.0871
Polynomial SVR (2)	0.4084	0.1800	266683	0.5973
Polynomial SVR (3)	0.2804	0.5496	203950	0.4150
Polynomial SVR (4)	0.3061	0.4897	225611	0.4813
Polynomial SVR (6)	0.4750	0.3271	367846	0.8362
Gaussian SVR	0.1121	0.9442	90575	0.1881

Table 19: Results for R3, testing on 80, 100 cores

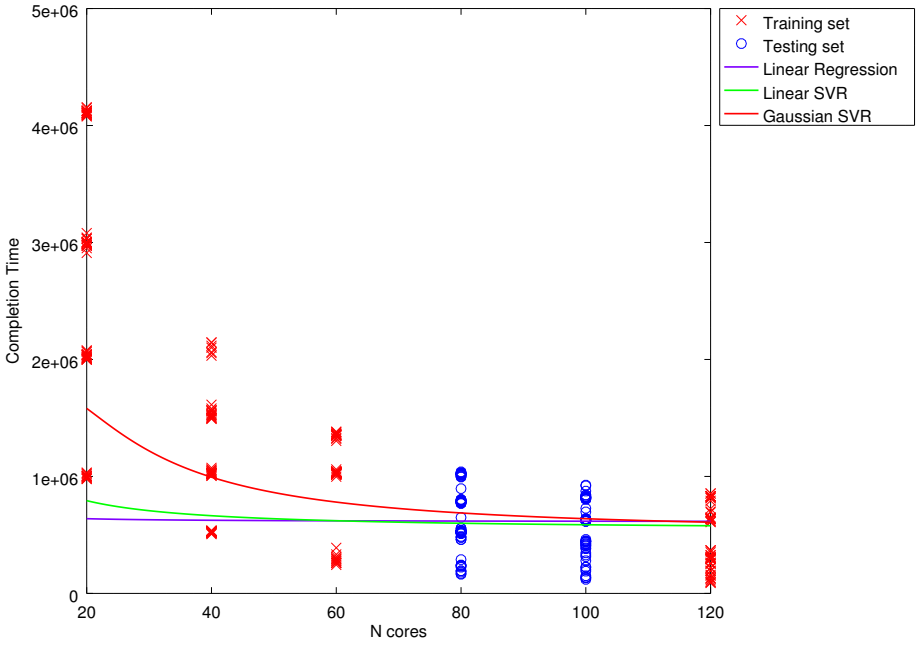

Figure 19: Completion time vs ncores for R3, testing on 80, 100 cores

3.4 Query R4

3.4.1 Query R4 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	1410943060176.0935	-209578810867790255646310 4.0000	1321634874455130265566500910.6936	
Linear SVR	0.5032	0.9093	106298	0.1645
Polynomial SVR (2)	3.0092	0.4816	473376	0.6266
Polynomial SVR (3)	1.5542	0.5303	255695	0.3468
Polynomial SVR (4)	5.8116	0.4196	696047	0.8400
Polynomial SVR (6)	13.0538	0.3619	1192820	1.2742
Gaussian SVR	1.3741	0.0950	277639	0.3654

Table 20: Results for R4, testing on 60, 80 cores

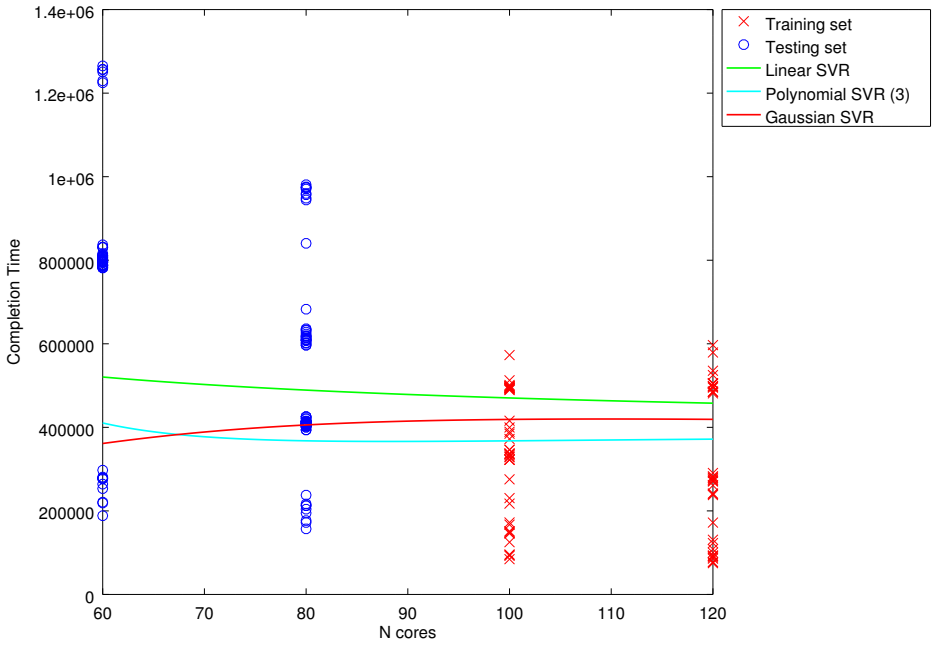

Figure 20: Completion time vs ncores for R4, testing on 60, 80 cores

3.4.2 Query R4 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	2838270277220.0449	-135750473195577368515706880.0000	68701581370465283	2345758120.5559
Linear SVR	0.1298	0.9734	17079	0.0520
Polynomial SVR (2)	0.9369	0.7817	165945	0.4215
Polynomial SVR (3)	1.2024	0.0715	141446	0.2864
Polynomial SVR (4)	2.7438	0.6051	278355	0.4810
Polynomial SVR (6)	4.5996	0.5493	448202	0.7860
Gaussian SVR	0.2613	0.9277	49965	0.1636

Table 21: Results for R4, testing on 80, 100 cores

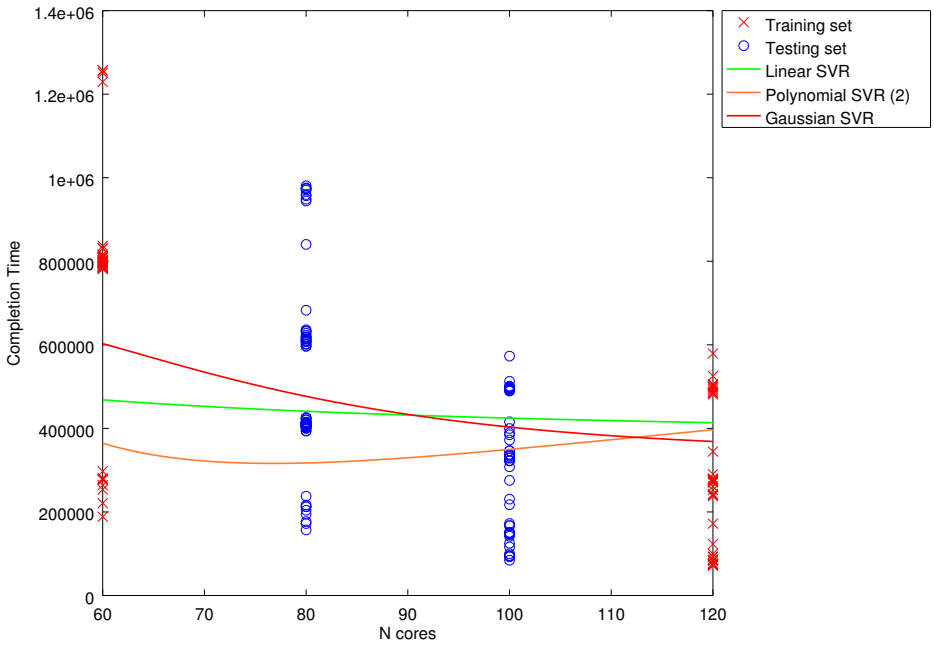

Figure 21: Completion time vs ncores for R4, testing on 80, 100 cores

3.4.3 Query R4 — testing on 100, 120 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	22342843126.7855	-1404867061542501482496.0000	5963697353251371722984506.6546	
Linear SVR	0.0880	0.9961	19232	0.1341
Polynomial SVR (2)	1.9487	0.4156	370859	3.2237
Polynomial SVR (3)	1.1944	0.7641	214089	1.9088
Polynomial SVR (4)	2.0631	0.4164	362174	3.1477
Polynomial SVR (6)	2.4342	0.4084	424756	3.7219
Gaussian SVR	0.8484	0.1003	170168	1.3915

Table 22: Results for R4, testing on 100, 120 cores

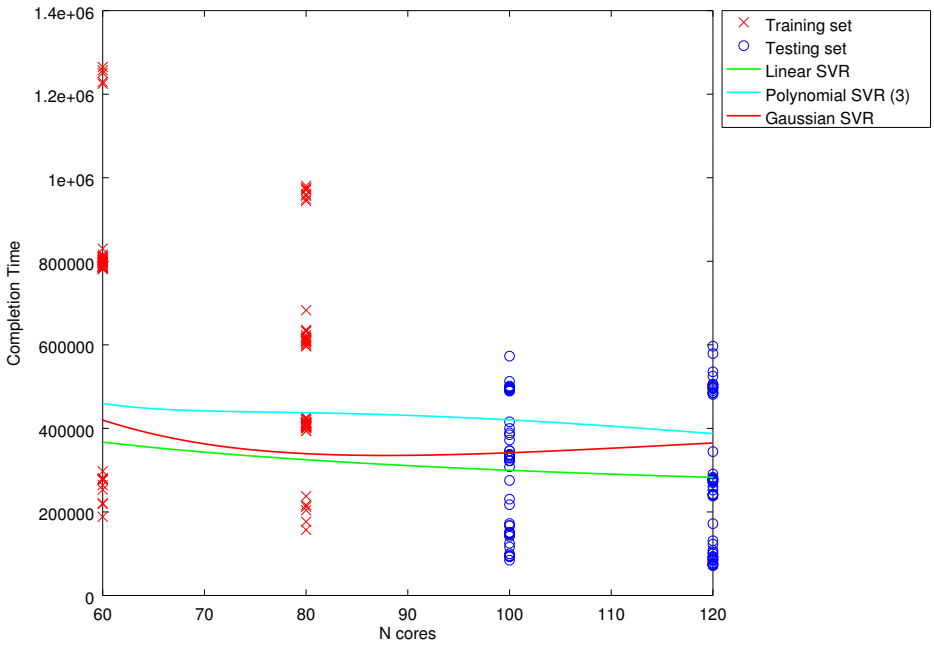

Figure 22: Completion time vs ncores for R4, testing on 100, 120 cores

3.5 Query R5

3.5.1 Query R5 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.3618	0.8736	1377	0.0489
Linear SVR	0.2929	0.9276	923	0.0312
Polynomial SVR (2)	1.8005	0.2041	4007	0.1150
Polynomial SVR (3)	3.9004	0.5976	6129	0.1615
Polynomial SVR (4)	13.3983	0.4349	19012	0.4672
Polynomial SVR (6)	190.6030	0.3249	198361	4.5714
Gaussian SVR	0.6425	0.7369	2142	0.0707

Table 23: Results for R5, testing on 60, 80 cores

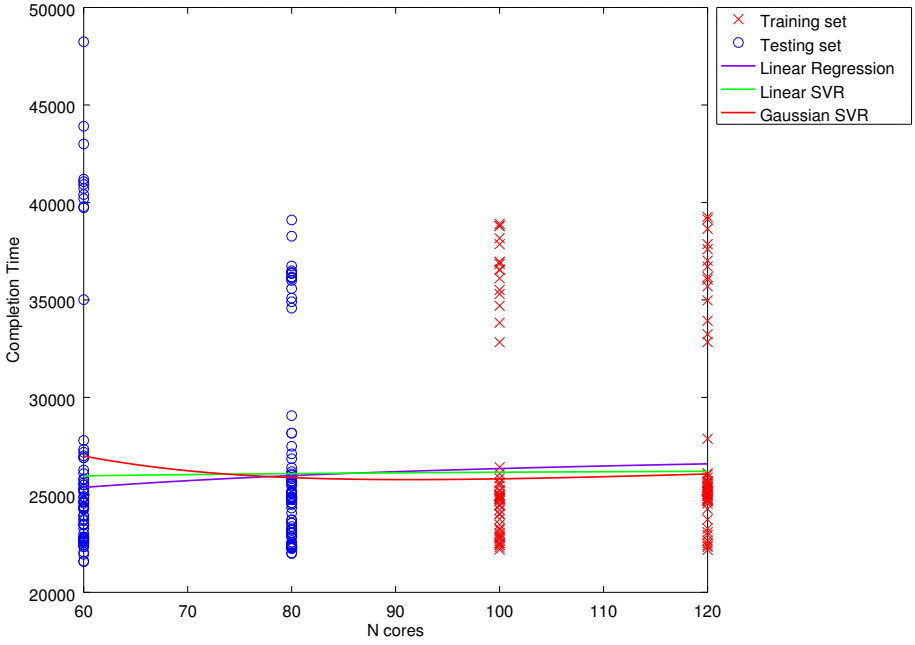

Figure 23: Completion time vs ncores for R5, testing on 60, 80 cores

3.5.2 Query R5 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.7412	0.3332	2949	0.0986
Linear SVR	0.2029	0.9511	676	0.0236
Polynomial SVR (2)	0.3090	0.9322	1251	0.0472
Polynomial SVR (3)	0.2611	0.9250	1046	0.0394
Polynomial SVR (4)	0.2805	0.9084	1167	0.0443
Polynomial SVR (6)	0.3825	0.8920	1710	0.0673
Gaussian SVR	0.2464	0.9495	976	0.0365

Table 24: Results for R5, testing on 80, 100 cores

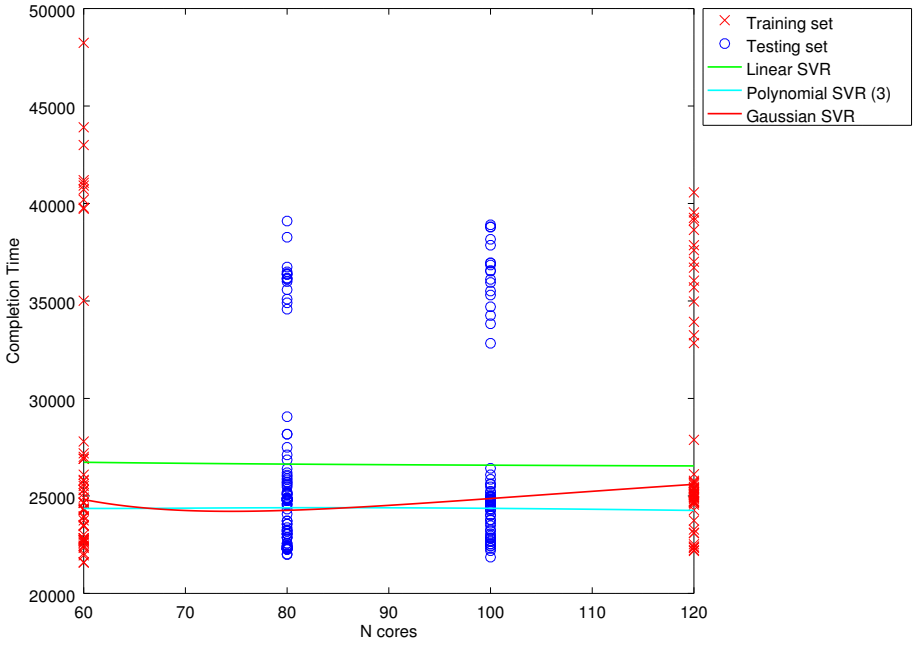

Figure 24: Completion time vs ncores for R5, testing on 80, 100 cores

3.5.3 Query R5 — testing on 100, 120 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.4198	0.8132	1449	0.0463
Linear SVR	0.3659	0.8984	1183	0.0380
Polynomial SVR (2)	0.3911	0.8832	1743	0.0645
Polynomial SVR (3)	0.4260	0.8857	1584	0.0527
Polynomial SVR (4)	0.5594	0.8533	2084	0.0686
Polynomial SVR (6)	0.7069	0.8221	3158	0.1096
Gaussian SVR	0.4440	0.9066	2190	0.0845

Table 25: Results for R5, testing on 100, 120 cores

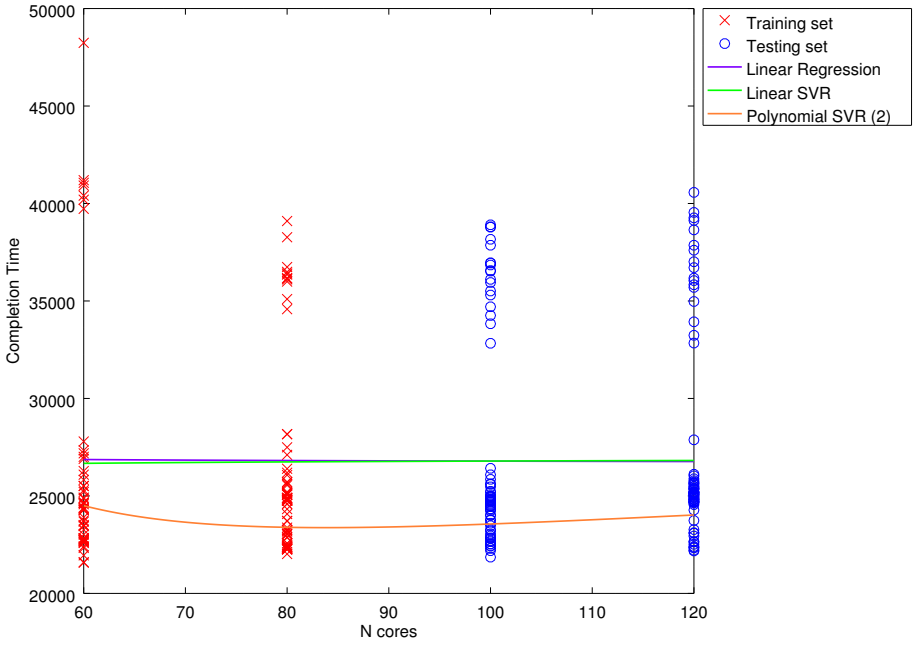

Figure 25: Completion time vs ncores for R5, testing on 100, 120 cores

4 Aggregated, $ncores^{-1}$, test on ncores, all the features with $nmap/ncores$ and $nreduce/ncores$

4.1 Query R1

4.1.1 Query R1 — testing on 40, 60 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.1535	0.9330	41837	0.0925
Linear SVR	0.1486	0.9822	42661	0.1153
Polynomial SVR (2)	0.7083	0.4433	224444	0.5348
Polynomial SVR (3)	0.4869	0.6552	141976	0.3365
Polynomial SVR (4)	1.2881	0.1500	270879	0.5939
Polynomial SVR (6)	3.1152	0.2343	443243	0.7583
Gaussian SVR	0.2588	0.9139	73762	0.1994

Table 26: Results for R1, testing on 40, 60 cores

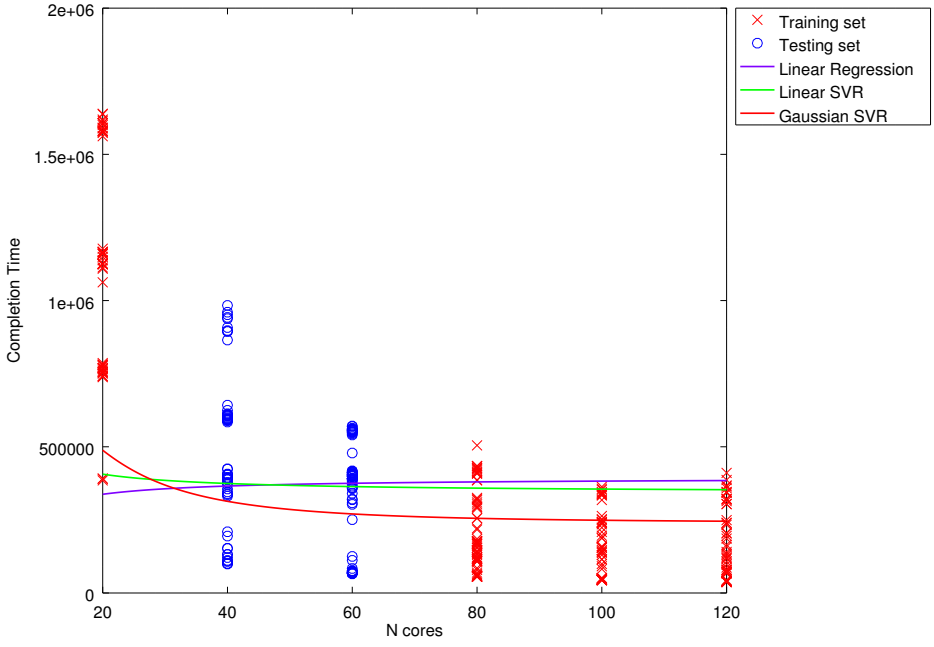

Figure 26: Completion time vs ncores for R1, testing on 40, 60 cores

4.1.2 Query R1 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	3786246634.2809	-75946113679659433984.0000	1139551323020614	45408656.4600
Linear SVR	0.0772	0.9724	18298	0.0681
Polynomial SVR (2)	0.3718	0.4071	98206	0.3443
Polynomial SVR (3)	0.1223	0.9319	39769	0.2226
Polynomial SVR (4)	0.2978	0.7775	101397	0.6710
Polynomial SVR (6)	0.5304	0.6509	159290	1.5160
Gaussian SVR	0.1089	0.9646	33965	0.2010

Table 27: Results for R1, testing on 60, 80 cores

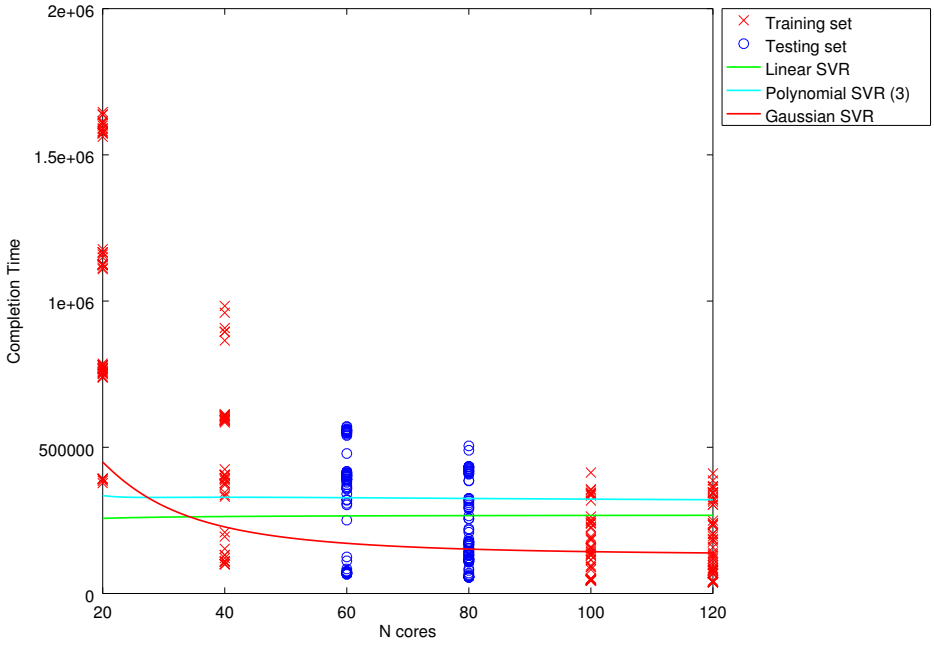

Figure 27: Completion time vs ncores for R1, testing on 60, 80 cores

4.1.3 Query R1 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	256498461462.4014	-607063163346277688672256.0000	784418730974694630660040141.0751	
Linear SVR	0.0590	0.9810	18411	0.1500
Polynomial SVR (2)	0.3800	0.4622	75848	0.4278
Polynomial SVR (3)	0.1385	0.9192	41558	0.4420
Polynomial SVR (4)	0.2054	0.8140	56771	0.3410
Polynomial SVR (6)	0.6226	0.6150	210381	2.2715
Gaussian SVR	0.0985	0.9489	26664	0.1581

Table 28: Results for R1, testing on 80, 100 cores

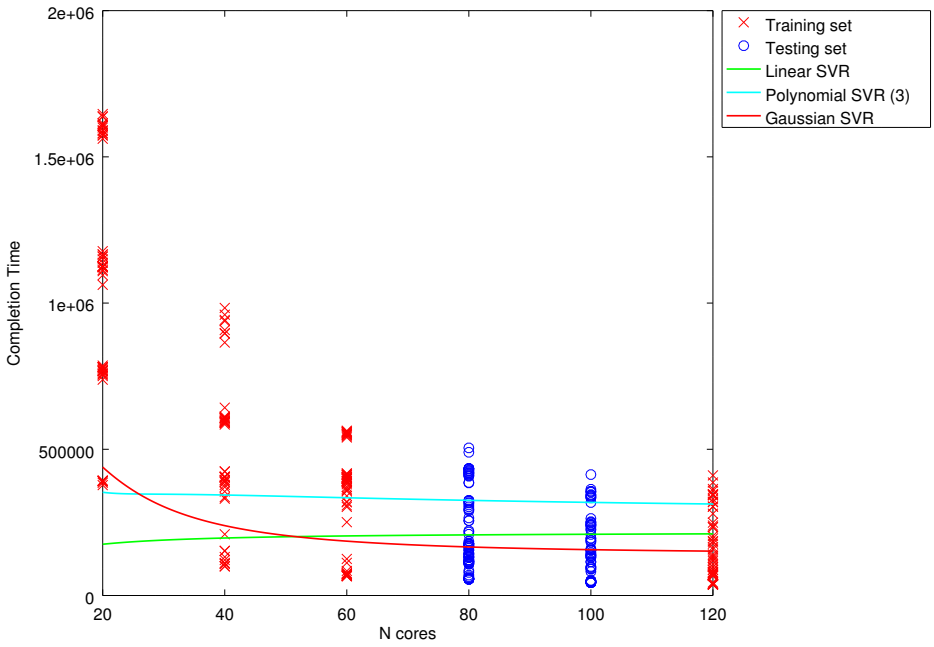

Figure 28: Completion time vs ncores for R1, testing on 80, 100 cores

4.2 Query R2

4.2.1 Query R2 — testing on 40, 60 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.1994	0.9462	46616	0.0485
Linear SVR	0.0700	0.9962	41491	0.3915
Polynomial SVR (2)	0.1512	0.9919	71892	0.4799
Polynomial SVR (3)	0.2061	0.9525	98887	0.7513
Polynomial SVR (4)	0.2493	0.9198	105227	0.7021
Polynomial SVR (6)	0.3787	0.8433	130548	0.7243
Gaussian SVR	0.3790	0.9177	152659	1.0339

Table 29: Results for R2, testing on 40, 60 cores

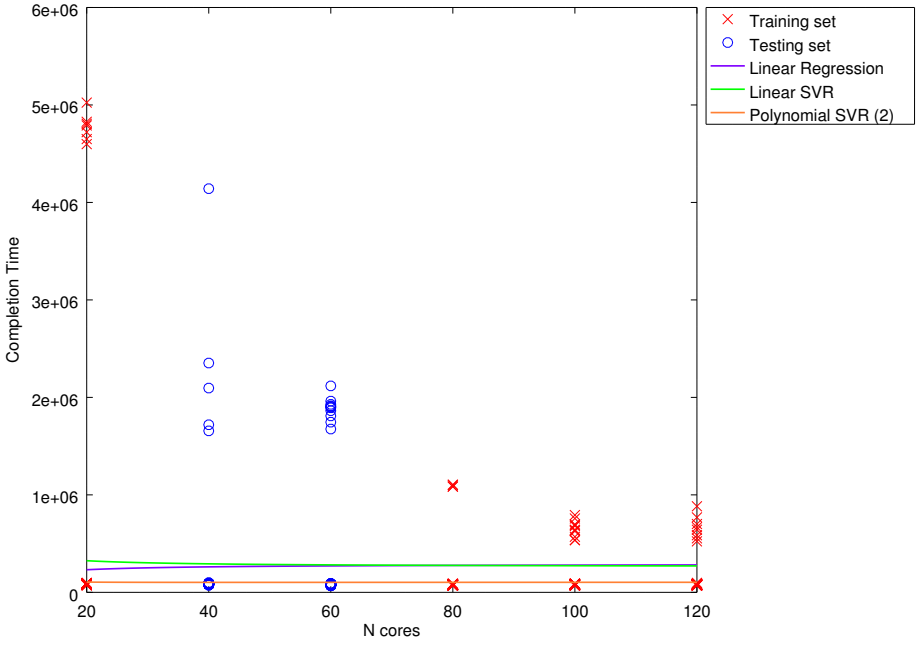

Figure 29: Completion time vs ncores for R2, testing on 40, 60 cores

4.2.2 Query R2 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	256738853.2883	-15807091417027724 8.0000	15960497680449	112546876.6037
Linear SVR	0.0570	0.9974	31817	0.2979
Polynomial SVR (2)	0.0656	0.9978	45889	0.5673
Polynomial SVR (3)	0.0924	0.9964	66904	0.7676
Polynomial SVR (4)	0.0907	0.9949	66105	0.7624
Polynomial SVR (6)	1.3187	0.8668	990958	12.1463
Gaussian SVR	0.0715	0.9892	33492	0.2721

Table 30: Results for R2, testing on 60, 80 cores

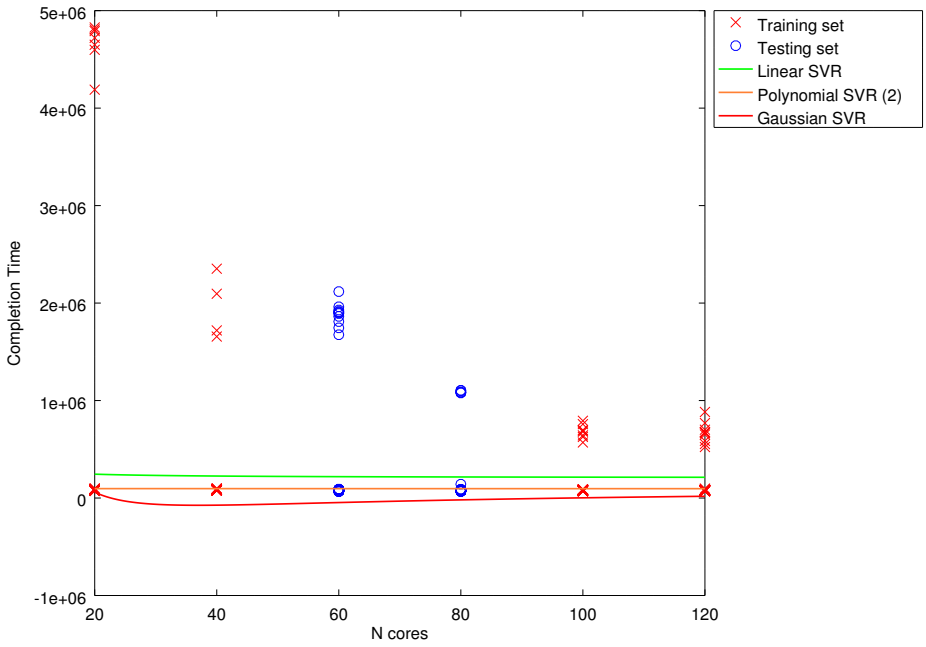

Figure 30: Completion time vs ncores for R2, testing on 60, 80 cores

4.2.3 Query R2 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	373199185.2676	-142595527655993267 2.0000	23200402486459	163599713.0101
Linear SVR	0.0769	0.9984	57286	0.7054
Polynomial SVR (2)	0.0639	0.9928	44703	0.5603
Polynomial SVR (3)	0.0840	0.9980	62540	0.7799
Polynomial SVR (4)	0.0819	0.9944	61609	0.7525
Polynomial SVR (6)	0.0851	0.9901	64442	0.7715
Gaussian SVR	0.0701	0.9917	42586	0.4304

Table 31: Results for R2, testing on 80, 100 cores

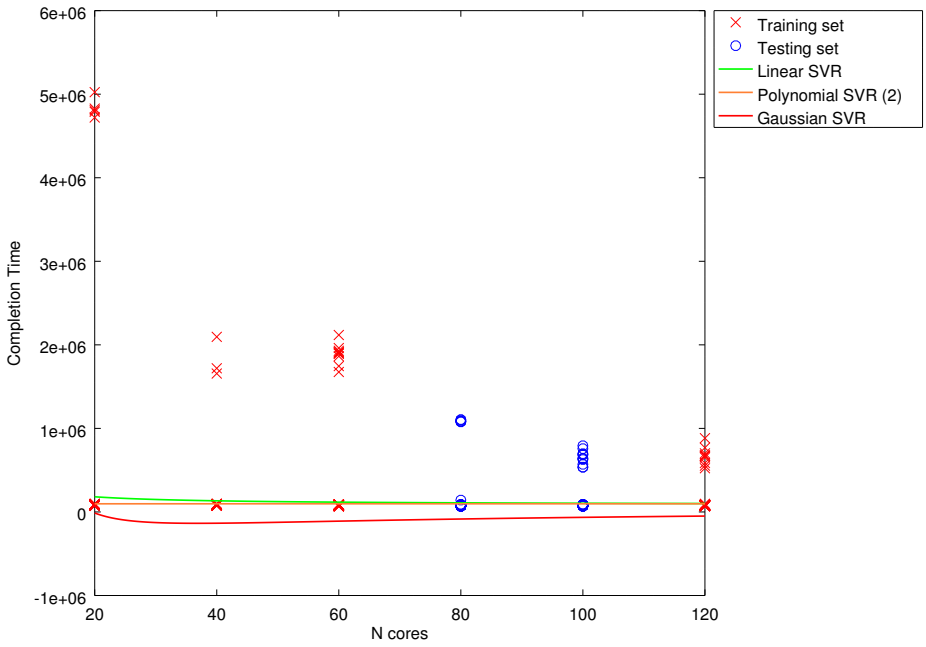

Figure 31: Completion time vs ncores for R2, testing on 80, 100 cores

4.3 Query R3

4.3.1 Query R3 — testing on 40, 60 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	156117492.7328	-10173537321044950 4.0000	12121099547593	5724366.3425
Linear SVR	0.1488	0.9740	116257	0.1333
Polynomial SVR (2)	0.6172	0.7191	490655	0.4264
Polynomial SVR (3)	0.4761	0.5428	346117	0.2920
Polynomial SVR (4)	0.7741	0.0034	495150	0.4195
Polynomial SVR (6)	0.8925	0.0108	518679	0.4286
Gaussian SVR	0.2917	0.9150	228260	0.2178

Table 32: Results for R3, testing on 40, 60 cores

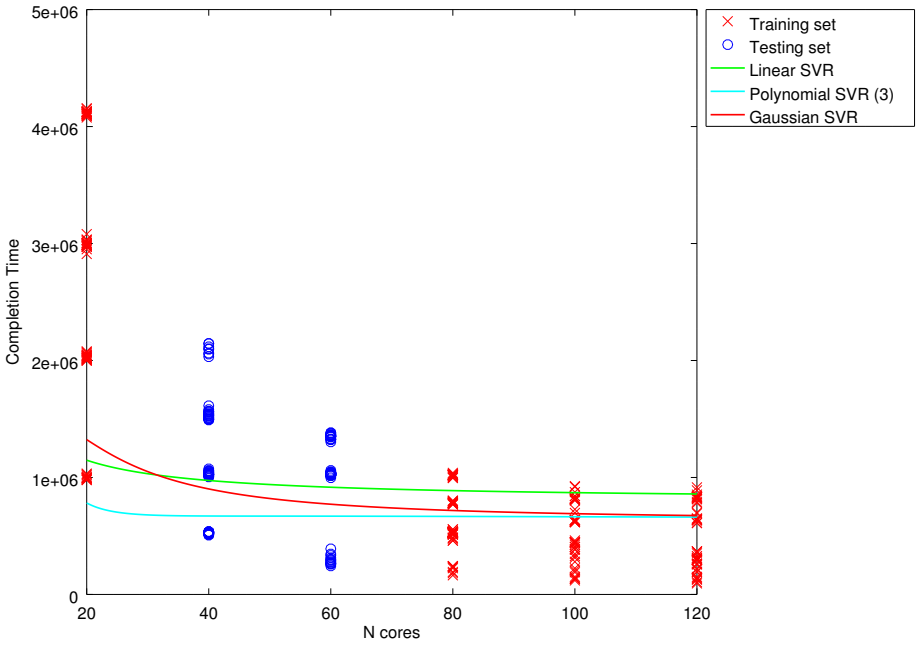

Figure 32: Completion time vs ncores for R3, testing on 40, 60 cores

4.3.2 Query R3 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0415	0.9877	27782	0.0321
Linear SVR	0.0975	0.9443	57244	0.0904
Polynomial SVR (2)	0.2753	0.4855	194936	0.3369
Polynomial SVR (3)	0.2200	0.7462	160341	0.3225
Polynomial SVR (4)	0.2872	0.4412	216008	0.3921
Polynomial SVR (6)	0.3239	0.2542	245918	0.4760
Gaussian SVR	0.1518	0.8501	103091	0.1401

Table 33: Results for R3, testing on 60, 80 cores

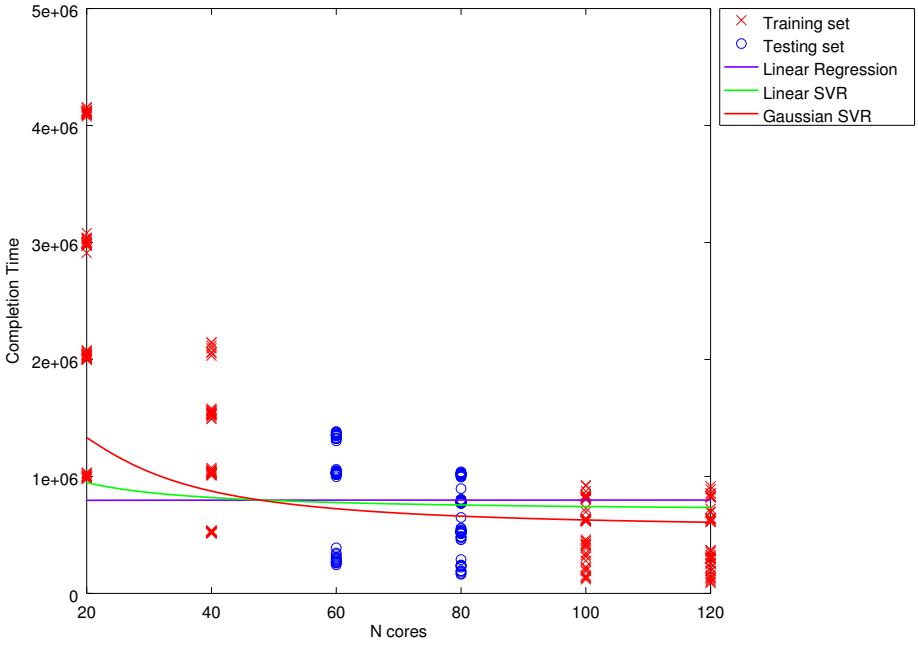

Figure 33: Completion time vs ncores for R3, testing on 60, 80 cores

4.3.3 Query R3 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.0153	0.9967	10870	0.0239
Linear SVR	0.1019	0.9909	88771	0.1530
Polynomial SVR (2)	0.3757	0.2824	240800	0.5376
Polynomial SVR (3)	0.3490	0.4411	249486	0.5407
Polynomial SVR (4)	0.3096	0.5307	226579	0.4852
Polynomial SVR (6)	0.3512	0.4936	265548	0.6025
Gaussian SVR	0.1381	0.9049	105468	0.2149

Table 34: Results for R3, testing on 80, 100 cores

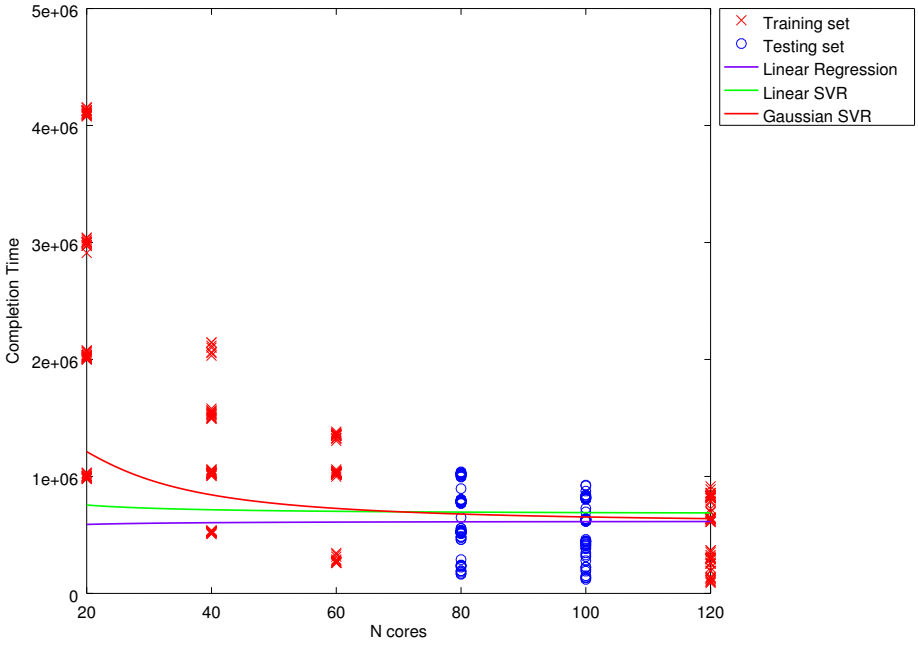

Figure 34: Completion time vs ncores for R3, testing on 80, 100 cores

4.4 Query R4

4.4.1 Query R4 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	2645782424181.0928	-7369476708312003628761088.0000	248281364888479288	104046429.2028
Linear SVR	0.4835	0.9158	100647	0.1547
Polynomial SVR (2)	2.9620	0.5340	471233	0.6060
Polynomial SVR (3)	2.2992	0.4938	271113	0.3194
Polynomial SVR (4)	9.7095	0.3819	965427	1.0367
Polynomial SVR (6)	35.8392	0.3153	2585292	2.3550
Gaussian SVR	1.3841	0.0744	278683	0.3639

Table 35: Results for R4, testing on 60, 80 cores

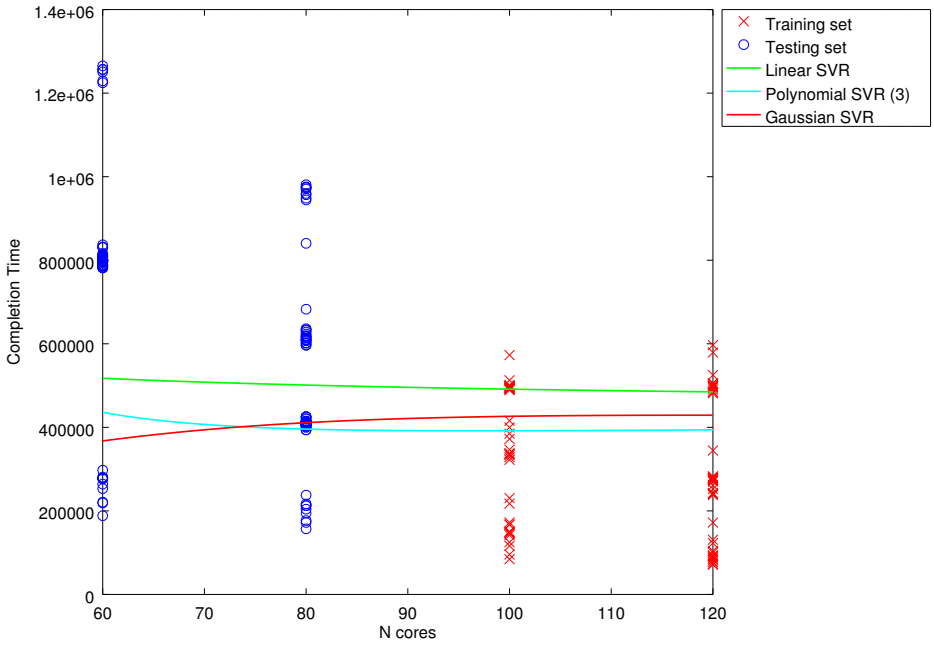

Figure 35: Completion time vs ncores for R4, testing on 60, 80 cores

4.4.2 Query R4 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	405370830077.1970	-27691012913682487391027 2.0000	98896322401265541985874384.2591	
Linear SVR	0.0977	0.9866	11508	0.0339
Polynomial SVR (2)	0.7732	0.7717	185530	0.4700
Polynomial SVR (3)	1.3255	0.1550	154729	0.3008
Polynomial SVR (4)	2.5474	0.5779	259881	0.4155
Polynomial SVR (6)	3.1667	0.5574	327292	0.5616
Gaussian SVR	0.1715	0.9604	35256	0.0953

Table 36: Results for R4, testing on 80, 100 cores

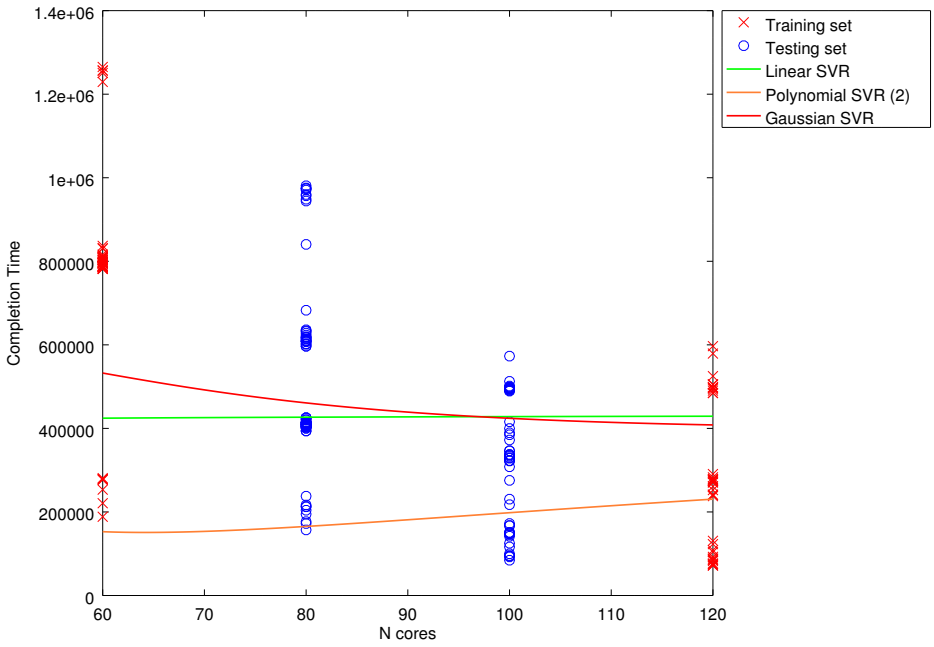

Figure 36: Completion time vs ncores for R4, testing on 80, 100 cores

4.4.3 Query R4 — testing on 100, 120 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	382336464.8720	-411386274915657792.0000	10205231977633	29484153.1158
Linear SVR	0.0650	0.9923	13936	0.0613
Polynomial SVR (2)	1.5065	0.0854	305788	2.4931
Polynomial SVR (3)	0.8199	0.7408	150500	1.2958
Polynomial SVR (4)	1.2333	0.1498	225608	1.9537
Polynomial SVR (6)	0.6367	0.2396	140165	0.9697
Gaussian SVR	0.6664	0.4415	134444	1.1080

Table 37: Results for R4, testing on 100, 120 cores

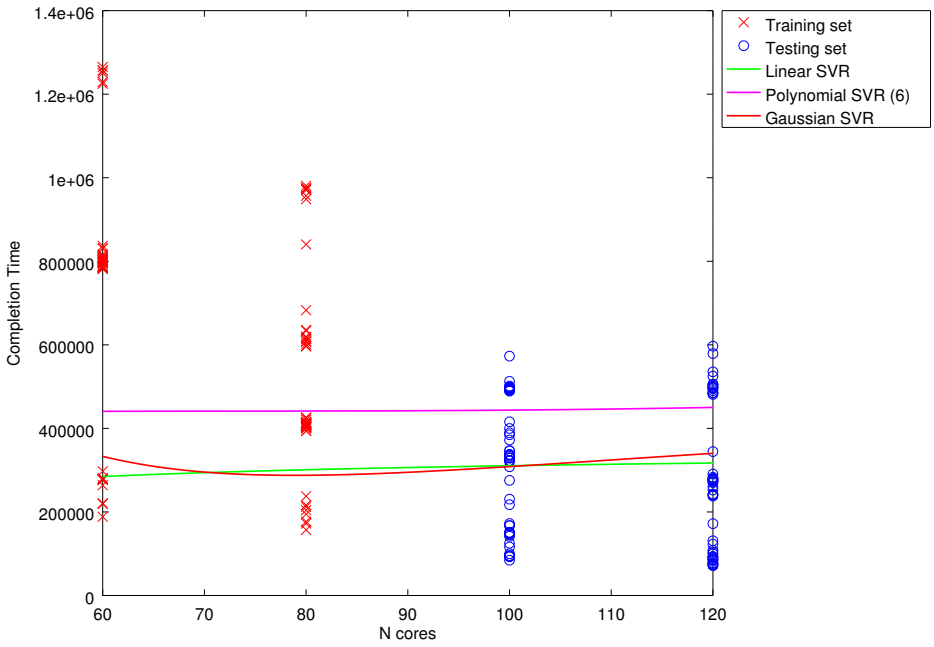

Figure 37: Completion time vs ncores for R4, testing on 100, 120 cores

4.5 Query R5

4.5.1 Query R5 — testing on 60, 80 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.2699	0.9296	874	0.0307
Linear SVR	0.2512	0.9907	946	0.0335
Polynomial SVR (2)	1.3461	0.0335	3565	0.1131
Polynomial SVR (3)	6.6169	0.6107	10270	0.2593
Polynomial SVR (4)	14.6726	0.4660	21403	0.5262
Polynomial SVR (6)	134.0262	0.3711	151137	3.5087
Gaussian SVR	0.7133	0.5966	2805	0.0976

Table 38: Results for R5, testing on 60, 80 cores

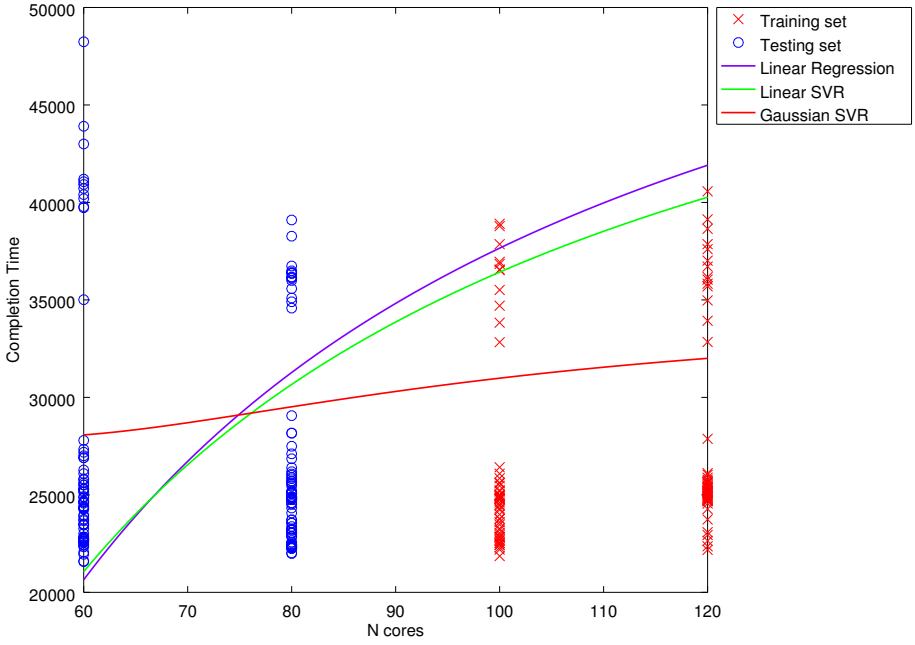

Figure 38: Completion time vs ncores for R5, testing on 60, 80 cores

4.5.2 Query R5 — testing on 80, 100 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.1570	0.9701	584	0.0190
Linear SVR	0.0767	0.9936	291	0.0106
Polynomial SVR (2)	0.3493	0.9353	1515	0.0557
Polynomial SVR (3)	0.2615	0.9190	1029	0.0396
Polynomial SVR (4)	0.3089	0.8990	1327	0.0502
Polynomial SVR (6)	0.6959	0.8043	3551	0.1428
Gaussian SVR	0.2303	0.9614	976	0.0361

Table 39: Results for R5, testing on 80, 100 cores

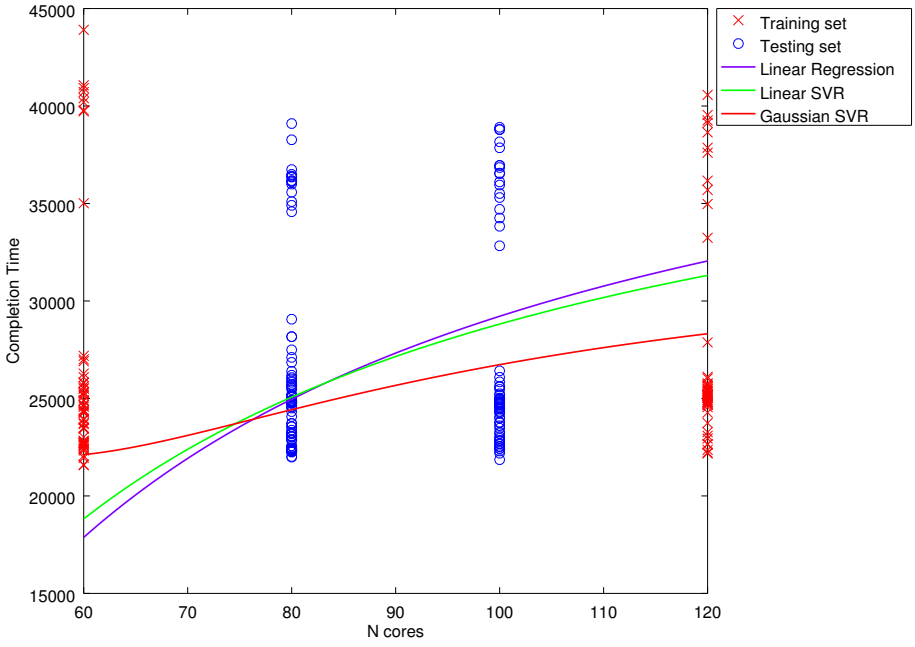

Figure 39: Completion time vs ncores for R5, testing on 80, 100 cores

4.5.3 Query R5 — testing on 100, 120 cores

Model	RMSE	R^2	Mean absolute error	Mean relative error
Linear regression	0.1290	0.9824	439	0.0154
Linear SVR	0.1550	0.9839	595	0.0215
Polynomial SVR (2)	0.3885	0.8765	1583	0.0561
Polynomial SVR (3)	0.5872	0.8833	2194	0.0696
Polynomial SVR (4)	0.5775	0.8648	2139	0.0685
Polynomial SVR (6)	0.7584	0.8059	2659	0.0826
Gaussian SVR	0.5054	0.9015	2564	0.0982

Table 40: Results for R5, testing on 100, 120 cores

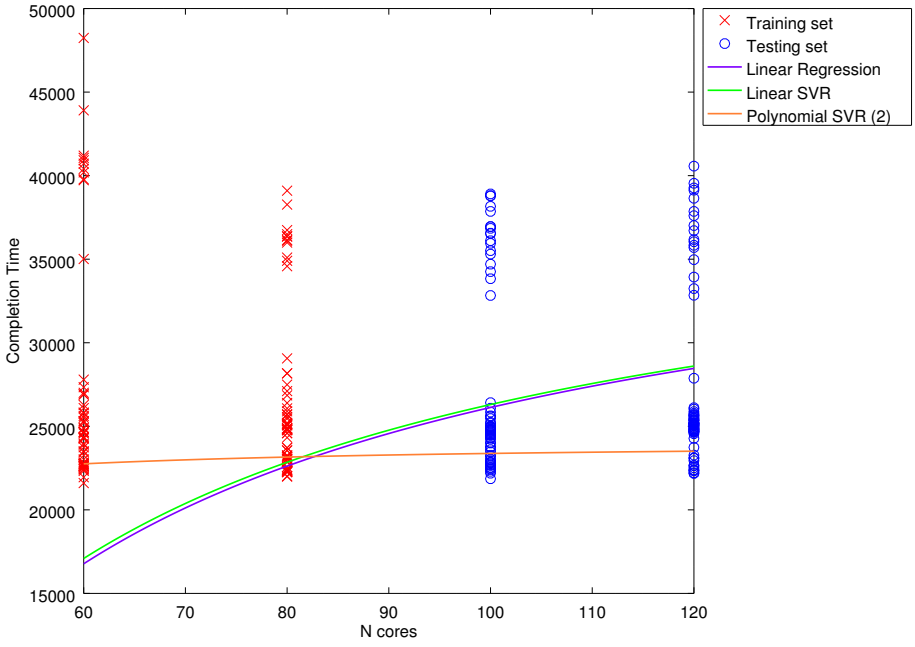

Figure 40: Completion time vs ncores for R5, testing on 100, 120 cores