

## Supplementary Material to the manuscript “The Second Competition on Spatial Statistics for Large Datasets”

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Table S1: Summary of the teams who participated in the competition. 1

Team Name	Members	Affiliations
AppStatUZH	Federico Blasi Leila Schuh Michael Hediger Reinhard Furrer Roman Flury	Institute of Mathematics, University of Zurich Institute of Mathematics, University of Zurich Institute of Mathematics, University of Zurich Institute of Mathematics, University of Zurich Institute of Mathematics, University of Zurich
Chessplayers	Alexander Litvinenko Dmitry Kabanov Kirill Kalmutskiy Ronald Kriemann Vladimir Berikov	RWTH Aachen RWTH Aachen Novosibirsk State University MIS MPG Leipzig Novosibirsk State University
Chile-Team (GeoModels)	Christian Caamaño-Carrillo Emilio Porcu Moreno Bevilacqua Victor Morales-Oñate	Universidad del Bío-Bío, Concepción Khalifa University Universidad Adolfo Ibañez Universidad de Valparaíso
Envstat.ai	Pratik Nag <sup>2</sup>	KAUST
GpGp	Joe Guinness Youssef Fahmy	Cornell University Cornell University
JPTIKKS	Daisuke Murakami Hajime Seya Toshihiro Hirano Yasumasa Matsuda	Institute of Statistical Mathematics Kobe University Kanto Gakuin University Tohoku University
RESSTE	Denis Allard Lionel Benoit Lucia Clarotto Nicolas Desassis Thomas Opitz Thomas Romary	BioSP, INRAE BioSP, INRAE Mines de Paris Mines de Paris BioSP, INRAE Mines de Paris
Spatial Special	Bing-Ru Jhou Lai Heng Sim Yen-Shiu Chin	Institute of Statistics, National Tsing Hua University Institute of Statistics, National Tsing Hua University Institute of Statistics, National Tsing Hua University
SubSample	Wenlin Dai Yan Song	Renmin University Renmin University

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<sup>1</sup>The names are ordered alphabetically for each team.

<sup>2</sup>Pratik Nag was only involved in preparing Sub-competitions 1a and 1b. Thus, he was allowed to participate in Sub-competitions 2a, 2b, 3a, and 3b.

Team IITK	Arnab Hazra Mayank Pathak Ritwik Vashistha Sagar Arora	Indian Institute of Technology Kanpur Indian Institute of Technology Kanpur Indian Institute of Technology Kanpur Indian Institute of Technology Kanpur
Triple-U	David Lin Hao-Yun Hsu Yi-Ting Lin Yu-Ting Fan	National Tsing Hua University National Sun Yat-sen University Johns Hopkins University Biostatistics National Yang Ming Chaio Tung University
UH Cougars	Meng Li Muhammad Chaudry	University of Houston University of Houston
UOW	Alan Pearse Andrew Zammit-Mangion Quan Vu Yi Cao	University of Wollongong University of Wollongong University of Wollongong University of Wollongong
BU	Julio Castrillon	BMERC, Boston University

Table S2: Root Mean Square Error (RMSE) values of different teams in Sub-competition 1-a. ExaGeoStat (with estimated parameters using true underlying model 1a-2, hence incorrect model under 1a-1) is listed for reference purpose.

Rank	Team Name	(1a-1)	(1a-2)	MCRMSE
1	RESSTE	0.102297	0.073592	0.087944
2	GeoModels	0.102353	0.073583	0.087960
3	TripleU	0.102398	0.073587	0.087993
4	IITK	0.102444	0.073602	0.088023
5	GpGp	0.102744	0.073590	0.088167
6	AppStatUZH	0.102204	0.074312	0.088258
7	Spatial Special	0.102081	0.074699	0.088390
-	<b>ExaGeoStat</b>	<b>0.114269</b>	<b>0.073587</b>	<b>0.093928</b>
8	UOW	0.116689	0.078605	0.097647
9	Chessplayers	0.103553	0.120793	0.112173
10	UH Cougars	0.108244	0.200206	0.154225
11	Subsample	0.148540	0.288939	0.218740

Table S3: Root Mean Square Error (RMSE) values of different teams in Sub-competition 1-b.

Rank	Team Name	(1b-1)	(1b-2)	MCRMSE
1	Spatial Special	0.548069	0.192762	0.168768
2	GeoModels	0.548423	0.192763	0.168963
3	RESSTE	0.548800	0.192764	0.169170
4	AppStatUZH	0.549035	0.193982	0.169534
5	GpGp	0.549601	0.192763	0.169610
6	JPTIKKS	0.549670	0.192952	0.169684
7	TripleU	0.550895	0.200768	0.171897
8	Team IITK	0.549791	0.215203	0.174291
9	Chessplayers	0.549037	0.218244	0.174536
10	UOW	0.588488	0.193703	0.191920

Table S4: Root Mean Square Error (RMSE) values of different teams in Sub-competition 2-a (RS: 2a-1, 2a-2, and 2a-3). ExaGeoStat (with estimated parameters using true underlying model) and ExaGeoStat-true (with true parameters using true underlying model) are listed for reference purpose.

Rank	Team Name	(2a-1)	(2a-2)	(2a-3)	MCRMSE
1	Envstat.ai	0.498430	0.234124	0.049599	0.260718
-	<b>ExaGeoStat</b>	<b>0.696989</b>	<b>0.227171</b>	<b>0.046780</b>	<b>0.323647</b>
-	<b>ExaGeoStat-true</b>	<b>0.697026</b>	<b>0.227164</b>	<b>0.046779</b>	<b>0.323656</b>
2	GpGp	0.704227	0.227180	0.046766	0.326057
3	GeoModels	0.707068	0.227157	0.046756	0.326994
4	RESSTE	0.707320	0.227215	0.046766	0.327100
5	Team IITK	0.710399	0.227212	0.046754	0.328122
6	UOW	0.718778	0.239933	0.050317	0.336342
7	AppStatUZH	0.776551	0.283746	0.062347	0.374215

Table S5: Root Mean Square Error (RMSE) values of different teams in Sub-competition 2-a (RST: 2a-4, 2a-5, and 2a-6). ExaGeoStat (with estimated parameters using true underlying model) and ExaGeoStat-true (with true parameters using true underlying model) are listed for reference purpose.

Rank	Team Name	(2a-4)	(2a-5)	(2a-6)	MCRMSE
1	Envstat.ai	0.498357	0.229749	0.048786	0.258964
-	<b>ExaGeoStat</b>	<b>0.610297</b>	<b>0.221473</b>	<b>0.040588</b>	<b>0.290785</b>
-	<b>ExaGeoStat-true</b>	<b>0.610297</b>	<b>0.221471</b>	<b>0.040591</b>	<b>0.290786</b>
2	GpGp	0.625373	0.22219	0.046243	0.297935
3	RESSTE	0.629491	0.223098	0.041905	0.298165
4	GeoModels	0.710355	0.223078	0.046383	0.326605
5	UOW	0.721130	0.234356	0.049513	0.334999
6	AppStatUZH	0.631523	0.296303	0.096148	0.341325
7	Team IITK	0.719071	0.246689	0.077789	0.347850

Table S6: Root Mean Square Error (RMSE) values of different teams in Sub-competition 2-a (T10: 2a-7, 2a-8, and 2a-9). ExaGeoStat (with estimated parameters using true underlying model) and ExaGeoStat-true (with true parameters using true underlying model) are listed for reference purpose.

Rank	Team Name	(2a-7)	(2a-8)	(2a-9)	MCRMSE
1	Envstat.ai	0.494466	0.215682	0.046535	0.252228
2	GpGp	0.918490	0.932285	0.560411	0.803729
-	<b>ExaGeoStat</b>	<b>0.901485</b>	<b>0.932938</b>	<b>0.777060</b>	<b>0.870494</b>
-	<b>ExaGeoStat-true</b>	<b>0.902988</b>	<b>0.938028</b>	<b>0.774715</b>	<b>0.871910</b>
3	GeoModels	0.899362	0.942847	0.783789	0.875333
4	RESSTE	0.905556	0.97055	0.797877	0.891328
5	Team IITK	0.922285	0.934347	0.903152	0.919928
6	AppStatUZH	1.047468	1.189023	1.036783	1.091091
7	UOW	1.175779	1.434240	1.521685	1.377235

Table S7: Root Mean Square Error (RMSE) values of different teams in Sub-competition 2-b (RS: 2b-1, 2b-2, and 2b-3).

Rank	Team Name	(2b-1)	(2b-2)	(2b-3)	MCRMSE
1	GeoModels	0.276670	0.071517	0.014098	0.120762
2	RESSTE	0.276730	0.071523	0.014097	0.120783
3	GpGp	0.277007	0.071519	0.014096	0.120874
4	JPTIKKS	0.276732	0.072672	0.014227	0.121210
5	UOW	0.307416	0.076165	0.025623	0.136401
6	AppStatUZH	0.353216	0.155456	0.017163	0.175278
7	"Envstat.ai	0.536665	0.232439	0.050975	0.273360
8	"Chessplayers	1.187328	1.495402	2.009105	1.563945

Table S8: Root Mean Square Error (RMSE) values of different teams in Sub-competition 2-b (RST: 2b-4, 2b-5, and 2b-6).

Rank	Team Name	(2b-4)	(2b-5)	(2b-6)	MCRMSE
1	RESSTE	0.264053	0.071254	0.013380	0.116229
2	GpGp	0.274177	0.070873	0.014260	0.119770
3	GeoModels	0.276957	0.070880	0.014269	0.120702
4	UOW	0.308589	0.075349	0.025829	0.136589
5	AppStatUZH	0.351894	0.152453	0.054196	0.186181
6	Envstat.ai	0.538314	0.232796	0.050681	0.273930
7	JPTIKKS	1.700258	0.072034	0.013824	0.595372
8	Chessplayers	1.054821	1.067591	0.858559	0.993657

Table S9: Root Mean Square Error (RMSE) values of different teams in Sub-competition 2-b (T10: 2b-7, 2b-8, and 2b-9).

Rank	Team Name	(2b-7)	(2b-8)	(2b-9)	MCRMSE
1	Envstat.ai	0.522757	0.206519	0.047245	0.258840
2	RESSTE	0.903714	0.964134	0.688624	0.852157
3	GpGp	0.904975	0.949491	0.651425	0.835297
4	GeoModels	0.888390	0.948918	0.728364	0.855224
5	JPTIKKS	0.927430	0.934707	0.708131	0.856756
6	UOW	1.176349	1.169883	0.741038	1.029090
7	Chessplayers	1.279538	1.386951	1.597437	1.421309

Table S10: Root Mean Square Error (RMSE) values of different teams in Sub-competition 3-a (3a-1, 3a-2, and 3a-3). ExaGeoStat (with estimated parameters using true underlying model) and ExaGeoStat-true (with true parameters using true underlying model) are listed for reference purpose.

Rank	Team Name	(3a-1)		(3a-2)		(3a-3)		MCRMSE
		$Z_1$	$Z_2$	$Z_1$	$Z_2$	$Z_1$	$Z_2$	
-	<b>ExaGeoStat</b>	<b>0.184518</b>	<b>0.016386</b>	<b>0.320748</b>	<b>0.663963</b>	<b>0.551254</b>	<b>0.732293</b>	<b>0.411527</b>
-	<b>ExaGeoStat-true</b>	<b>0.184510</b>	<b>0.016385</b>	<b>0.320763</b>	<b>0.663966</b>	<b>0.551365</b>	<b>0.732319</b>	<b>0.411551</b>
1	GpGp	0.196135	0.017299	0.320739	0.664316	0.551069	0.731762	0.413553
2	Spatial Special	0.196224	0.017302	0.320789	0.663739	0.553120	0.731824	0.413833
3	GeoModels	0.202789	0.025286	0.320728	0.666056	0.551300	0.732574	0.416456
4	AppStatUZH	0.210191	0.041420	0.320773	0.667213	0.551572	0.735952	0.421187
5	Envstat.ai	0.230040	0.055544	0.323833	0.669034	0.543802	0.726903	0.424859
6	TripleU	0.345256	0.162181	0.323262	0.666511	0.551401	0.732695	0.463551

Table S11: Root Mean Square Error (RMSE) values of different teams in Sub-competition 3-b (3b-1, 3b-2, and 3b-3).

Rank	Team Name	(3b-1)		(3b-2)		(3b-3)		MCRMSE
		$Z_1$	$Z_2$	$Z_1$	$Z_2$	$Z_1$	$Z_2$	
1	Spatial Special	0.120548	0.005592	0.320749	0.657893	0.237513	0.522222	0.310753
2	JPTIKKS	0.117552	0.005573	0.320923	0.661571	0.238348	0.522699	0.311111
3	GpGp	0.176316	0.014349	0.322395	0.659632	0.238240	0.521536	0.322078
4	Envstat.ai	0.141734	0.020365	0.321192	0.658702	0.237959	0.520832	0.316797
5	AppStatUZH	0.164823	0.013804	0.320575	0.660687	0.239276	0.524558	0.320620
6	GeoModels	0.152050	0.091849	0.323591	0.659231	0.237636	0.521805	0.331027