folder/uio-fp-navn-eng.pdf

teleskopgutt2.jpeg

Master's thesis

A novel application of machine learning to develop pointing models for current and future radio/sub-millimeter telescopes

Bendik Nyheim

Computational Science: Physics
60 ECTS study points

Department of Physics
Faculty of Mathematics and Natural Sciences

folder/uio-fp

Spring 2023

Bendik Nyheim

A novel application of machine learning to develop pointing models for current and future radio/sub-millimeter telescopes

Supervisors:
Signe Riemer Sørensen (Sintef)
Rodrigo Parrar (ESO)
Claudia Cicone (UiO)

Contents

Chapter 1

Introduction

Chapter 2

Atronomical Background

Chapter 3

Machine Learning Background

Chapter 4

Method

Chapter 5

Results

Chapter 6

Discussion

Chapter 7

Conclusion

Appendices

Appendix A

Table 1: RMS values for different terms in the analytical model

	Case 1		Case 2	
k	Azimuth	Elevation	Azimuth	Elevation

Table 2: tmp2022$_{c}lean_{c}lf_{n}flash230_{r}esults_{t}able, randomlysplit$

k	Az RMS 1	Az STD 1	El RMS 1	Az RMS 2	El RMS 2
2	0.983957	1.018378	0.926561	0.991728	
5	1.297720	1.137682	0.938401	0.987364	
10	1.428557	1.153950	0.966462	1.002820	
20	1.229440	1.103770	0.943179	0.984103	
30	1.387079	1.064364	0.958910	0.995761	
40	1.224572	1.054826	0.962620	1.004978	
50	1.179139	1.073336	0.974661	0.968089	

Table 3: tmp2022$_{c}lean_{c}lf_{n}flash230_{t}ransformed_{r}esults_{t}able, randomlysplit$

k	Az RMS 1	Az STD 1	El RMS 1	Az RMS 2	El RMS 2
2	1.063771	1.097368	0.982346	1.023116	
5	1.158891	1.135054	0.974600	1.005169	
10	1.110609	1.074162	0.989497	1.005604	
20	1.125938	1.001437	0.970074	1.013085	
30	1.126540	1.023054	0.994982	0.971606	
40	1.134314	1.065193	1.013492	1.041213	
50	1.112269	1.028447	0.980788	0.998984	

Table 4: tmp2022$_clean_clf_results_table, randomlysplit$

k	Az RMS 1	Az STD 1	El RMS 1	Az RMS 2	El RMS 2
2	1.005252	1.232152	0.963643	0.966159	
5	1.002968	1.228990	0.962584	0.952695	
10	1.289085	1.212770	0.969236	0.983188	
20	1.474769	1.223286	0.973215	0.957379	
30	1.420438	1.217082	0.977044	0.957553	
40	1.359452	1.250011	0.981884	0.939400	
50	1.447718	1.239426	0.960710	0.950992	

Table 5: tmp2022$_clean_clf_transformed_results_table, randomlysplit$

k	Az RMS 1	Az STD 1	El RMS 1	Az RMS 2	El RMS 2
2	1.411340	1.072811	0.958876	0.944501	
5	1.658062	1.095572	0.959785	0.959705	
10	1.656576	1.144753	0.977446	0.943979	
20	1.744980	1.020705	0.974366	0.946778	
30	1.891196	1.006098	0.998285	0.940884	
40	2.040398	0.993940	0.972515	0.952763	
50	2.226176	0.997667	0.976921	0.942357	

Table 6: tmp2022$_clean_clf_nflash230_results_table, splitondays$

k	Az RMS 1	Az STD 1	El RMS 1	Az RMS 2	El RMS 2
2	0.982285	1.019755	0.929712	0.956510	
5	1.365704	1.198440	0.917298	0.937182	
10	1.383077	1.155258	0.951214	0.943254	
20	1.251918	1.126138	0.939914	0.942015	
30	1.334676	1.093938	0.928257	0.939238	
40	1.145716	1.057689	0.936151	0.955285	
50	1.201661	1.061612	0.937422	0.941564	

Table 7: tmp2022$_clean_clf_nflash230_transformed_results_table, splitondays$

k	Az RMS 1	Az STD 1	El RMS 1	Az RMS 2	El RMS 2
2	1.030842	1.005132	0.982900	1.057857	
5	1.036558	1.000412	0.983725	1.031629	
10	1.136567	1.008504	0.987074	1.012463	
20	1.042592	1.008786	0.977380	0.994046	
30	1.242498	1.004090	0.977887	1.008825	
40	1.214723	1.006611	1.006974	0.996165	
50	1.180379	0.992092	0.983166	0.976880	

Table 8: tmp2022$_clean_clf_results_table, splitondays$

k	Az RMS 1	Az STD 1	El RMS 1	Az RMS 2	El RMS 2
2	1.007153	1.232004	0.959771	0.957618	
5	1.002580	1.169598	0.955311	0.967055	
10	1.287770	1.115745	0.957866	0.962132	
20	1.579776	1.120837	0.969443	0.957544	
30	1.606464	1.107195	0.967436	0.971148	
40	1.528256	1.068496	0.979982	0.951577	
50	1.757519	1.061275	0.993239	0.947433	

Table 9: tmp2022$_clean_clf_transformed_results_table, splitondays$

k	Az RMS 1	Az STD 1	El RMS 1	Az RMS 2	El RMS 2
2	1.362174	1.049563	0.958867	0.949895	
5	1.519794	1.073077	0.968773	0.951299	
10	1.515574	1.043983	0.974003	0.948826	
20	1.698061	1.017496	0.981890	0.939138	
30	1.716675	1.014389	0.979207	0.957982	
40	2.476614	1.034294	0.990171	0.947986	
50	2.493252	1.031271	0.968949	0.943721	

Bibliography