

Contents

1	Introduction	1
1.1	Astrometry	1
1.2	Hypothesis testing	3
1.3	Contribution	4
1.4	Main Hypothesis	5
1.5	Structure of the thesis	5
2	Estimation in astrometry	6
2.1	Preliminaries and background	6
2.1.1	Astrometry as a parameter estimation problem	6
2.1.2	The Cramér-Rao bound	7
2.1.3	Achievability and performance of the LS estimator	8
2.2	Bounding the performance of an implicit estimator	9
2.3	Application to astrometry	11
2.3.1	Bounding the variance of the WLS estimator	12
2.3.2	Bounding the variance of the ML estimator	13
2.4	Numerical analysis	14
2.4.1	Experimental setting	15
2.4.2	Bias analysis	16
2.4.3	Performance analysis of the WLS estimator	16
2.4.4	Performance analysis of the ML estimator	20
2.4.5	Comments on an adaptive WLS estimator for astrometry	23
2.5	Conclusions and Final Remarks	26
2.6	Appendix	26
2.6.1	Proof of Theorem 2.2	26
2.6.2	Proof of Theorem 2.3	28
2.6.3	Proof of Theorem 2.4	31
3	Detection in Hypothesis Testing	35
3.1	Preliminaries	35
3.2	Inference Problem	36
3.3	Non asymptotic analysis for the Error Exponent: no-rate constraint case	38
3.3.1	Achievability (Upper bound) and Converse (lower bound) for the discrepancy	39
3.4	Discrepancy analysis: Rate constraint case	39
3.5	Conclusions and Final Remarks	43

3.6	Appendix	43
3.6.1	Proof of Theorem 3.9	43
3.6.2	Proof of Theorem 3.10	45
3.6.3	Berry-Esséen theorem	47
3.6.4	Bounded difference inequality	47
3.6.5	Proof of Lemma 3.4.1	48
4	Conclusion	50
4.1	Astrometry	50
4.2	Hypothesis testing	51
	Bibliography	52