

Contents

1	Introduction	1
1.1	Contributions	2
1.2	Thesis Outline	2
	References	3
2	Preliminaries	5
2.1	Sparse Linear Regression and Compressed Sensing	5
2.2	Nonlinear Inference Problems	7
2.2.1	Generalized Linear Models	7
2.2.2	1-Bit Compressed Sensing	8
2.2.3	Phase Retrieval	9
	References	9
3	Sparsity-Constrained Optimization	11
3.1	Background	11
3.2	Convex Methods and Their Required Conditions	13
3.3	Problem Formulation and the GraSP Algorithm	14
3.3.1	Algorithm Description	15
3.3.2	Sparse Reconstruction Conditions	17
3.3.3	Main Theorems	19
3.4	Example: Sparse Minimization of ℓ_2 -Regularized Logistic Regression	21
3.4.1	Verifying SRH for ℓ_2 -Regularized Logistic Loss	21
3.4.2	Bounding the Approximation Error	25
3.5	Simulations	26
3.5.1	Synthetic Data	27
3.5.2	Real Data	30
3.6	Summary and Discussion	33
	References	34

4	1-Bit Compressed Sensing	37
4.1	Background	37
4.2	Problem Formulation	38
4.3	Algorithm	40
4.4	Accuracy Guarantees	40
4.5	Simulations	41
4.6	Summary	48
	References	48
5	Estimation Under Model-Based Sparsity	51
5.1	Background	51
5.2	Problem Statement and Algorithm	53
5.3	Theoretical Analysis	55
5.3.1	Stable Model-Restricted Hessian	55
5.3.2	Accuracy Guarantee	55
5.4	Example: Generalized Linear Models	57
5.4.1	Verifying SMRH for GLMs	57
5.4.2	Approximation Error for GLMs	58
5.5	Summary	59
	References	60
6	Projected Gradient Descent for ℓ_p-Constrained Least Squares	61
6.1	Background	61
6.2	Projected Gradient Descent for ℓ_p -Constrained Least Squares	63
6.3	Discussion	67
	References	68
7	Conclusion and Future Work	71
A	Proofs of Chap. 3	73
A.1	Iteration Analysis For Smooth Cost Functions	73
A.2	Iteration Analysis For Non-smooth Cost Functions	79
B	Proofs of Chap. 4	87
B.1	On Non-convex Formulation of Plan and Vershynin (2013)	89
	Reference	90
C	Proofs of Chap. 5	91
D	Proofs of Chap. 6	95
D.1	Proof of Theorem 6.1	95
D.2	Lemmas for Characterization of a Projection onto ℓ_p -Balls	103
	References	107

Algorithms for Sparsity-Constrained Optimization

Bahmani, S.

2014, XXI, 107 p. 13 illus., 12 illus. in color., Hardcover

ISBN: 978-3-319-01880-5