
Book

Nonparametric and Semiparametric Models

HÄRDLE, Wolfgang, et al.

Reference

HÄRDLE, Wolfgang, et al. *Nonparametric and Semiparametric Models*. Springer, 2004

Available at:

<http://archive-ouverte.unige.ch/unige:111629>

Disclaimer: layout of this document may differ from the published version.

Contents

Preface	7
Notation	11
1 Introduction	19
1.1 Density Estimation	19
1.2 Regression	20
1.2.1 Parametric Regression	22
1.2.2 Nonparametric Regression	25
1.2.3 Semiparametric Regression	27
Summary	37
I Nonparametric Models	39
2 Histogram	41
2.1 Motivation and Derivation	41
2.1.1 Construction	41
2.1.2 Derivation	43
2.1.3 Varying the Binwidth	44
2.2 Statistical Properties	45
2.2.1 Bias	46
2.2.2 Variance	47
2.2.3 Mean Squared Error	48
2.2.4 Mean Integrated Squared Error	49

2.2.5	Optimal Binwidth	50
2.3	Dependence of the Histogram on the Origin	51
2.4	Averaged Shifted Histogram	52
	Bibliographic Notes	56
	Exercises	57
	Summary	59
3	Nonparametric Density Estimation	61
3.1	Motivation and Derivation	61
3.1.1	Introduction	61
3.1.2	Derivation	62
3.1.3	Varying the Bandwidth	64
3.1.4	Varying the Kernel Function	64
3.1.5	Kernel Density Estimation as a Sum of Bumps	67
3.2	Statistical Properties	69
3.2.1	Bias	69
3.2.2	Variance	71
3.2.3	Mean Squared Error	72
3.2.4	Mean Integrated Squared Error	73
3.3	Smoothing Parameter Selection	74
3.3.1	Silverman's Rule of Thumb	74
3.3.2	Cross-Validation	76
3.3.3	Refined Plug-in Methods	79
3.3.4	An Optimal Bandwidth Selector?!	80
3.4	Choosing the Kernel	81
3.4.1	Canonical Kernels and Bandwidths	81
3.4.2	Adjusting Bandwidths across Kernels	83
3.4.3	Optimizing the Kernel	84
3.5	Confidence Intervals and Confidence Bands	85
3.6	Multivariate Kernel Density Estimation	90
3.6.1	Bias, Variance and Asymptotics	95

3.6.2	Bandwidth selection	97
3.6.3	Computation and Graphical Representation	100
Bibliographic Notes		104
Exercises		105
Summary		107
4 Nonparametric Regression		109
4.1	Univariate Kernel Regression	109
4.1.1	Introduction	109
4.1.2	Kernel Regression	113
4.1.3	Local Polynomial Regression and Derivative Estimation	119
4.2	Other Smoothers	124
4.2.1	Nearest-Neighbor Estimator	124
4.2.2	Median Smoothing	126
4.2.3	Smoothing Splines	126
4.2.4	Orthogonal Series	130
4.3	Smoothing Parameter Selection	133
4.3.1	A Closer Look at the Averaged Squared Error	136
4.3.2	Cross-Validation	140
4.3.3	Penalizing Functions	141
4.4	Confidence Regions and Tests	145
4.4.1	Pointwise Confidence Intervals	145
4.4.2	Confidence Bands	147
4.4.3	Hypothesis Testing	150
4.5	Multivariate Kernel Regression	156
4.5.1	Statistical Properties	157
4.5.2	Practical Aspects	160
Bibliographic Notes		163
Exercises		165
Summary		167

II Semiparametric Models	171
5 Semiparametric and Generalized Regression Models	173
5.1 Dimension Reduction	173
5.1.1 Variable Selection in Nonparametric Regression	176
5.1.2 Nonparametric Link Function	177
5.1.3 Semi- or Nonparametric Index	177
5.2 Generalized Linear Models	180
5.2.1 Exponential Families	180
5.2.2 Link Functions	182
5.2.3 Iteratively Reweighted Least Squares Algorithm	183
Bibliographic Notes	191
Exercises	193
Summary	194
6 Single Index Models	195
6.1 Identification	196
6.2 Estimation	198
6.2.1 Semiparametric Least Squares	200
6.2.2 Pseudo Likelihood Estimation	203
6.2.3 Weighted Average Derivative Estimation	207
6.3 Testing the SIM	212
Bibliographic Notes	215
Exercises	216
Summary	217
7 Generalized Partial Linear Models	219
7.1 Partial Linear Models	219
7.2 Estimation Algorithms for PLM and GPLM	221
7.2.1 Profile Likelihood	222
7.2.2 Generalized Speckman Estimator	225
7.2.3 Backfitting	228

7.2.4	Computational Issues	230
7.3	Testing the GPLM	234
7.3.1	A LR Test with Approximate Degrees of Freedom	234
7.3.2	A Modified LR Test	236
	Bibliographic Notes	239
	Exercises	240
	Summary	241
8	Additive Models and Marginal Effects	243
8.1	Backfitting	244
8.1.1	Classical Backfitting	245
8.1.2	Modified Backfitting	252
8.1.3	Consistent Backfitting	253
8.2	Marginal Integration Estimator	255
8.2.1	Estimation of Marginal Effects	256
8.2.2	Derivative Estimation for the Marginal Effects	258
8.2.3	Interaction Terms	260
8.3	Finite Sample Behavior	267
8.3.1	Bandwidth Choice	269
8.3.2	MASE in Finite Samples	270
8.3.3	Equivalent Kernel Weights	272
	Bibliographic Notes	280
	Exercises	281
	Summary	283
9	Generalized Additive Models	285
9.1	Additive Partial Linear Models	286
9.2	Additive Models with Known Link	292
9.2.1	GAM using Backfitting	293
9.2.2	GAM using Marginal Integration	295
9.3	Generalized Additive Partial Linear Models	297

9.3.1	GAPLM using Backfitting	297
9.3.2	GAPLM using Marginal Integration	297
9.4	Testing in Additive Models, GAM, and GAPLM	301
	Bibliographic Notes	308
	Exercises	309
	Summary	310
	Bibliography	313
	Author Index	327
	Index	331