

Contents

Preface

Acknowledgements

1.	Introduction	1
2.	Longitudinal data and regression models	6
2.1	Longitudinal data	6
2.2	Regression models	7
2.3	Longitudinal growth curves	9
3.	Nonparametric regression methods	15
3.1	Kernel estimates	15
3.2	Weighted local least squares estimates	17
3.3	Smoothing splines	19
3.4	Orthogonal series estimates	21
3.5	Discussion	23
3.6	Heart pacemaker study	24
4.	Kernel and weighted local least squares methods	26
4.1	Mean Squared Error of kernel estimates for curves and derivatives	26
4.2	Asymptotic normality	31
4.3	Boundary effects and Integrated Mean Squared Error...	32
4.4	Muscular activity as a function of force	36
4.5	Finite sample comparisons	38
4.6	Equivalence of weighted local regression and kernel estimators	43
5.	Optimization of kernel and weighted local regression methods	47
5.1	Optimal designs	47
5.2	Choice of kernel functions	49
5.3	Minimum variance kernels	50
5.4	Optimal kernels	52
5.5	Finite evaluation of higher order kernels	58
5.6	Further criteria for kernels	63
5.7	A hierarchy of smooth optimum kernels	65
5.8	Smooth optimum boundary kernels	71
5.9	Choice of the order of kernels for estimating ∞ functions	73
6.	Multivariate kernel estimators	77
6.1	Definiton and MSE/IMSE	77
6.2	Boundary effects and dimension problem	84
6.3	Rectangular designs and product kernels	86

7.	Choice of global and local bandwidths	91
7.1	Overview	91
7.2	Pilot methods	94
7.3	Cross-validation and related methods	98
7.4	Bandwidth choice for derivatives	100
7.5	Confidence intervals for anthropokinetic data	107
7.6	Local versus global bandwidth choice	110
7.7	Weak convergence of a local bandwidth process	114
7.8	Practical local bandwidth choice	117
8.	Longitudinal parameters	122
8.1	Comparison of samples of curves	122
8.2	Definition of longitudinal parameters and consistency	124
8.3	Limit distributions	126
9.	Nonparametric estimation of the human height growth curve ..	131
9.1	Introduction	131
9.2	Choice of kernels and bandwidths	132
9.3	Comparison of parametric and nonparametric regression	135
9.4	Estimation of growth velocity and acceleration	141
9.5	Longitudinal parameters for growth curves	144
9.6	Growth spurts	147
10.	Further applications	151
10.1	Monitoring and prognosis based on longitudinal medical data	151
10.2	Estimation of heteroscedasticity and prediction intervals	153
10.3	Further developments	155
11.	Consistency properties of moving weighted averages	158
11.1	Local weak consistency	158
11.2	Uniform consistency	161
12.	FORTRAN routines for kernel smoothing and differentiation ..	165
12.1	Structure of main routines KESMO and KERN	165
12.2	Listing of programs	169
	References	190