

## Appendix I Software

The following is a short listing of software that is available for implementing some of the methods described in this book. A good source of information on specialist spatial analysis software is provided by the website of the Centre for Spatially Integrated Social Science: [www.csiss.org](http://www.csiss.org): There is a spatial tools menu which includes a search engine.

Spatial statistical capability has been added to some geographic information systems. ESRI's ArcGIS (version 8.1) provides *Geostatistical Analyst*. This undertakes kriging, including modelling the semi-variogram, exploratory spatial data analysis (including identifying global and local outliers, trends and spatial autocorrelation) and interpolation (inverse distance weighting, local and global polynomial surface fitting and kriging). The module *Spatial Analyst* enables raster and vector data to be integrated. The website for information is: [www.esri.com/software](http://www.esri.com/software)

Semi-variogram and kriging software are available in GENSTAT and SAS and in MLP from the Numerical Algorithms Group at Oxford.

S+SpatialStats is an add-on to S-PLUS from Mathsoft ([www.mathsoft.com](http://www.mathsoft.com)). It has geostatistical capability (variogram modelling, ordinary and universal kriging). Spatial regression modelling (with conditional autoregressive, simultaneous autoregressive or moving average errors) is included. There are autocorrelation tests and point process methods.

The package Stat! from Biomedware ([www.biomedware.com](http://www.biomedware.com)) has a number of tests including clustering tests and Moran's spatial autocorrelation test as well as Oden's modification. The Biomedware site provides access to Luc Anselin's SpaceStat, a package that has many exploratory spatial data analysis tools and also has advanced spatial regression modelling (spatial econometric) tools including modelling with spatially lagged response variables as predictors. Other models include the regression model with spatial errors, the trend surface model and the spatial expansion method model. It includes an excellent tutorial workbook. A number of spatial clustering and cluster detection tests (including the Besag-Newell test and Ripley's K test) are available at [www.terraseer.com/csr/clusterseer\\_methods.html](http://www.terraseer.com/csr/clusterseer_methods.html)

This site is currently linked to the Biomedware site. It also has software with boundary detection and analysis methods. James LeSage has developed a spatial econometrics library that can be viewed at [www.spatial-econometrics.com](http://www.spatial-econometrics.com) (see also [www.spatial-statistics.com](http://www.spatial-statistics.com) by Kelly Pace).

Generalized linear modelling of logistic, binomial and Poisson models (but not the 'auto' versions except on coding schemes or by pseudo-likelihood) can be implemented in packages that include BMDP, GENSTAT, GLIM, MINITAB, SAS, SPSS, STATA and SYSTAT. Multi-level modelling can be performed in MLwiN (<http://multilevel.ioe.ac.uk>), HLM (<http://www.ssicentral.com>) and VARCL (<http://www.assess.com>).

There are increasing amounts of software available from the web that are currently free of charge or relatively inexpensive. WinBUGS for Bayesian modelling using Gibbs sampling is available from the MRC Unit of Biostatistics at Cambridge University ([www.mrc-bsu.cam.ac.uk](http://www.mrc-bsu.cam.ac.uk)). GeoBUGS is being developed to model spatial data. In the current (beta) version (1.4) GeoBUGS is subsumed within WinBUGS. It contains an extended range of spatial priors including a CAR model with a spatial parameter.

SPLANCS is available from the Department of Mathematics website ([www.maths.lancs.ac.uk/~rowlings/Splanacs](http://www.maths.lancs.ac.uk/~rowlings/Splanacs)) at the University of Lancaster and includes kernel density estimation and K-function clustering tests.

MANET for exploring data with missing values is available from the website [www1.math.uni.augsburg.de/Manet/](http://www1.math.uni.augsburg.de/Manet/)

Kulldorff's scan test is available from the US National Cancer Institute, Division of Cancer prevention: [dcp.nci.nih.gov/BB/SaTScan.html](http://dcp.nci.nih.gov/BB/SaTScan.html)

The crime pattern analysis package, CrimeStat, is available from the US National Institute of Justice Crime Mapping Research Centre. The web address for this package is: [www.ojp.usdoj.gov/cmrc/tools/welcome.html](http://www.ojp.usdoj.gov/cmrc/tools/welcome.html). Version 2.0 is available from [www.icpsr.umich.edu/NACJD/crimestat.html](http://www.icpsr.umich.edu/NACJD/crimestat.html)

Geographically weighted regression analysis software is available from the geography department website at the University of Newcastle on Tyne. Openshaw's geographical analysis (cluster detection) machine (GAM) is available along with other software via the Geography department website at Leeds University. SAGE (Spatial Analysis in a GIS environment) developed at Sheffield University can be accessed via the GIS research centre of the Departments of Geography and Town and Regional Planning (SCGISA).

The spatial visualization package CommonGIS developed from DESCARTES can be downloaded from [www.commongis.de](http://www.commongis.de). This is understood to be the visualization tool for the 2001 UK Census, downloadable from the MIMAS website ([www.mimas.ac.uk](http://www.mimas.ac.uk)). See also [www.mimas.ac.uk/argus/ICA/J.Dykes/](http://www.mimas.ac.uk/argus/ICA/J.Dykes/) by Jason Dykes.

A useful source for data sets, some of which are spatial, can be found at: <http://lib.stat.cmu.edu/datasets/>. See also the UK data archive at [www.data-archive.ac.uk](http://www.data-archive.ac.uk).