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6 Software for social network analysis

As I outlined in Chapter 1, the time was that many of the processes involved in social network analysis had to be undertaken manually. Even when computers came into wide use, the possibilities for rapid data analysis were limited by the need to refine, or even to provide from scratch, software programs that would automate some of the basic tasks. All this has changed. A number of software programs are now both easily and cheaply available, and the newcomer to social network analysis can rapidly begin to produce sophisticated analyses of her or his data. This situation has its dangers, of course. The temptation to generate output is such that a researcher may produce that output first and only then consider whether it is useful or, indeed, valid. However, having got this far in this book, I hope that my readers will be very aware of this problem and will not fall into that trap.

In this chapter I want to provide a general guide to the use of some of the most important packages available. In order to use these effectively you may want to work through some of the more technical readings given in Chapter 3, but this guide

should provide you with enough information to allow you to begin producing some simple, but quite powerful, measures of network structure.

Two programs dominate the field: UCINET and PAJEK. UCINET is a commercial programme distributed by Analytical Technologies (<http://www.analytictech.com/>). PAJEK is a freely distributed programme available from a WIKI site (<http://pajek.imfm.si/doku.php?id=pajek>). A word of warning: this webpage includes a large photograph of a spider and the squeamish may prefer to go directly to (<http://pajek.imfm.si/doku.php?id=download>)! Each program has its particular advantages and limitations, and a choice may be a matter of personal preference. This choice may be quite easy to make as UCINET includes PAJEK as an add-in for its own program code. In addition to these general programs there is a widely used statistical program, R, that includes a specialist add-on for the statistical analysis of social network data. This program is more complex to use, but is extremely powerful and makes it possible to transfer data to other statistical and graphical routines. These are the three principal programs on which I will concentrate, but I will also make some brief reference to a number of specialist visualisation programs that are associated with them and, in some cases, distributed with them as add-ons.

UCINET: The pioneer program

UCINET was developed at the Irvine campus of the University of California (UC, Irvine—hence the acronym). It was designed and

produced by some of the leading social network researchers—most notably, Lin Freeman, Steve Borgatti, and Martin Everett—as a way of helping others to undertake the kinds of analyses that they themselves were using in their empirical studies. It is now available in Version 6 and is established as a tried and tested, and very stable, platform for social network analysis.

UCINET appears on screen with a very simple menu structure, from which data entry and information windows appear. Seven top-level menu headings define the structure of the program:

- FILE
- DATA
- TRANSFORM
- TOOLS
- NETWORK
- VISUALIZE
- OPTIONS

As might be expected, the FILE menu provides access to the basic file management tasks and access to its current add-ins. The core of the program, however, is to be found under the DATA menu, together with the TRANSFORM menu. DATA is the gateway to data entry and the import and export functions. From here it is possible to compile a data file in native UCINET format—typically simply the network as a linked list of data points—or to import the raw data from text files and spread sheets. The DATA menu also provides the routines needed to refine and prepare data sets, using extraction and deletion procedures to determine the inclusion or exclusion of particular points and subgroups. Finally, the DATA menu allows for the sorting, permutation, and

transposing of the basic data and for converting it into different formats. For example, the conversion of 2-mode into 1-mode data is achieved in this way. TRANSFORM provides further options for dichotomising or slicing a network. All these tasks are handled very intuitively, with the option given at each stage to save any newly generated files. There is also a useful provision of error messages that can be supplemented by the comprehensive 'Help' screens.

The TOOLS menu in UCINET leads to procedures for undertaking some basic, auxiliary tasks. This is the way in which it is possible to use cluster analysis—and to construct dendrograms from clustered data—and to undertake metric and non-metric multidimensional scaling, factor analysis, and correspondence analysis. The key network concepts and measures are to be found, unsurprisingly, under the NETWORK menu. Here are to be found measures of distance, density, homophily, and centrality, as well as methods for identifying components, cliques, structurally equivalent blocks, and other subgroups. It is also through the NETWORK menu that a number of egocentric measures can be produced, including analyses of betweenness and brokerage.

Particularly useful features of UCINET are the routines found under its VISUALIZE menu. It is here that the NETDRAW network-drawing package, the MAGE modelling program, and the drawing facilities provided in PAJEK can be accessed. These are all discussed below.

PAJEK

PAJEK—Slovenian for ‘spider’—was developed at the University of Ljubljana by Vladimir Batagelj and his colleagues. It had its origins as a specialist program for handling very large data sets and includes a number of advanced measures. The program has a more extensive menu structure than UCINET and does not cover quite the same wide range of measures, but a number of key measures are provided in addition to its ability to analyse large data sets very rapidly. A manual for the program has been published as an accessible guide to social network analysis (De Nooy *et al.* 2005).

The basic elements in the program are to be found under the FILE and NET menus. Here can be found the routines for inputting and editing network data and for exporting data in various formats, such as that of UCINET. The NET menu provides various routines for transforming networks, much as are provided in UCINET’s DATA and TRANSFORM menus, though sorting is accessed under the OPERATIONS menu. NET is also the means through which components can be identified, while the OPERATIONS menu allows the undertaking of blockmodelling.

The heart of the PAJEK program for many of its users is its DRAW menu, which leads to a screen from which sub-menus allow the drawing and displaying of networks and their subgroups. Simple circle diagrams can be drawn, but the most interesting option is, perhaps, the ability to generate two-dimensional and three-dimensional visualisations based on forms of multidimensional scaling. Visual representations can be produced easily, and three-dimensional representations can be

rotated in various ways to display and inspect a network. Simple but powerful techniques are available to include or exclude labels for data points and to indicate the value or intensity of a line. The representations produced can be exported in various graphics formats for printing or for display independently of the PAJEK program.

R and other programs

R (available at <http://www.r-project.org/>) is a program produced as part of a general project for statistical computing. It comprises a basic framework that serves as a platform for a number of supplied modules and add-ons that all operate within its basic environment. The two most important add-ons for social network analysis are STATNET and SIENA. STATNET covers the important techniques for hypothesis testing associated with ERGM methods. SIENA was originally developed by Tom Snijders as part of his StOCNET program, now supplanted by R. SIENA is especially geared to the statistical analysis of longitudinal and cross-sectional data, so allowing the assessment of the significance of change over time.

Other, free-standing, programs that readers may wish to investigate are NETDRAW, MAGE, and SONIA. NETDRAW, also provided as a module within UCINET, is a powerful program for drawing and editing basic network sociograms. It interfaces rapidly with UCINET and works rapidly on its files. MAGE was devised by chemists as a way of using stick and ball methods to represent chemical bonding formulae (see <http://kinemage>.

biochem.duke.edu/kinemage/magepage.php). Because of its data structure it is adapted easily for use in social network analysis and provides both two-dimensional and three-dimensional representations of data generated from UCINET or PAJEK and allows the 'sticks' and 'balls' of a network (the lines and points) to be coloured and labelled in various ways. SONIA, devised by Snijders and supported by Dan McFarland and Skye Bender de Moll, is a visualisation package for longitudinal data (see <http://www.stanford.edu/group/sonia/>). Unlike the programs discussed so far, SONIA works under JAVA and requires the installation of at least the basic JAVA package. The environment gives the program the ability to produce striking and easily transportable visual representations of social network data as moving images.

As all the best marketing presentations say: other network programs are available. A guide to these can be found in Huisman and van Duijn (2011). The programs discussed in this chapter, however, are the most easily accessible and useable programs for the beginner and for more advanced users. If I can be permitted a recommendation, I will suggest using UCINET, which gives direct and integrated access to PAJEK, NETDRAW, and MAGE. Used as an adjunct to your reading of more advanced texts on social network analysis, the program and its add-ons will allow you to do almost anything you can imagine—and many things that you are unlikely to have imagined. As your knowledge improves, you will find that you need to use R and SONIA, and you should, by then, have the technical ability to handle them and to use them sensibly.

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