# Automatically reading maps

Geographic Information Systems (GIS) are increasingly important in the management and analysis of information that can be spatially referenced. Applications of GIS are varied and wide-ranging in the commercial and administrative sectors, and consequently GIS is rapidly replacing paper-based mapping techniques.

The foundation of any system is the base map through which the attribute data can be referenced, and this is usually derived from topographic mapping, such as that produced by the Ordnance Survey. For simple tasks, the plain geometry depicted by the map suffices, but for more analytical and intelligent applications, the system has to read the map like a human, seeing the objects being depicted (houses, roads, rivers, etc.) rather than a mass of lines and symbols. To accomplish this, the data must be structured into features and objects representing the real-world topography being depicted.

The input of topographical geometry (the lines on the map) into a computer system can largely be automated using image-processing techniques. However, the structuring of this data as features and objects is usually carried out semi-manually by an operator who selects
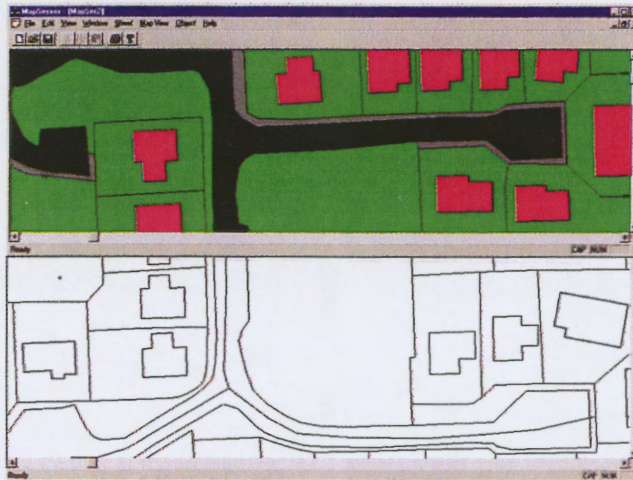
Before and after statistical analysis of map shapes. The upper window has been automatically colour-coded to indicate similar topographic objects.

the geometry depicting each object and adds a code that represents the type of feature. The time-consuming and costly nature of this task often results in a lack of suitably structured data (or at most only partial structuring) for GIS systems.

The Department of Computer Science at Maynooth is developing and evaluating methods of automatically structuring topographic

data. The methods used are largely based on the identification and classification of the individual objects on a map based on their size, shape and context. For example, houses tend to fall within certain ground-area limits, have rectangular outlines and have access to a road. Streams, on the other hand, are long, thin and irregular. Some methods being evaluated are well-known from other fields, such as statistical analysis, artificial intelligence, and machine vision. In addition, novel methods are being investigated, borrowed from natural language processing and semantic context analysis. It is likely that different methods will prove effective depending on the nature and context of the topographical data. The object of the project is to develop software tools that combine the best methods to structure topographical data. These tools will be able to communicate with existing GIS and mapping systems.

Although the project concentrates on topographic structuring, the techniques developed also have applications in other fields, such as technical and architectural drafting, and the classification and searching of image databases.

Marketing geography

Success in the retail industry is due to three factors: "location, location and location". The choice of location can make the difference between being a market leader or an also-ran in an industry that thrives on change and competition. The advent of new retail formats – factory outlet centres or forecourt shops; new players in the market, for example Tesco and Debenhams; and new retail locations – adjoining new motorway routes or in airports and railway stations – combine to make consumer market identification of critical importance. Information on consumers, their location, shopping behaviour and attitudes; on the competition and the local market; and on site characteristics, are essential to retail locational decision-making. And once a location has been developed, on-going monitoring is vital to the strategic management of the business and maintaining the competitive edge.

Research undertaken by the Centre for Retail Studies, located in the Geography Department, University College Dublin, has been at the forefront of monitoring and analysing changes in the Irish retail market. Regular pedestrian counts on the prime shopping streets of Dublin, Cork, Limerick and Galway have been paralleled by company-specific analyses of other key retail locations. The ebbs and flows of pedestrian footfall have a direct relationship upon retail performance and, together with on-going consumer surveys, undertaken since the

Centre for Retail Studies was founded in 1987, reveal the changing nature of the consumer market.

The Centre's research programme includes analyses of existing and future retail locations, identifying drive-time hinterlands and consumer demographics within the trade areas. Demographic profiling can identify good and bad locations for shopping developments and can provide estimates of potential spending power for different types of goods. Considerations of the competitive environment adds to the comprehensive analyses, enabling retailers, developers and investors to make more informed judgements regarding commercial viability. Within-company analyses can clarify the potential trading characteristics of existing store networks, identifying specific stores which are capable of achieving greater profitability, and the reasons for those which have exhausted their potential.

The rapidity of change in Irish retailing is exemplified in the growth of shopping centres, with over nine million square feet being developed since 1966. The Centre regularly publishes detailed statistics on shopping centres, and researches the changing consumer and competitive market of specific centres. This research is paralleled by studies of retailing in urban areas throughout the country, focusing on the key elements of consumer demographics, competition, retail environment, future retail developments,

The ebbs and flows of pedestrian footfall.
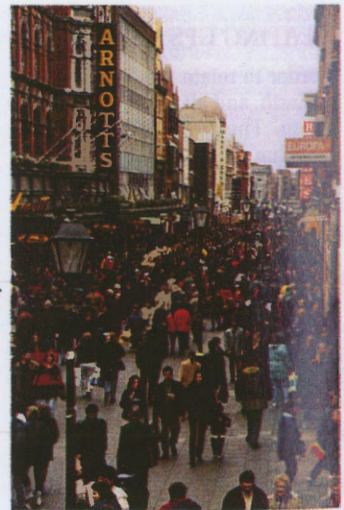
planning policies, and expenditure patterns, that enable the retail industry to achieve success.

The Centre for Retail Studies research is regularly disseminated to organisations who participate as Associate Members, while the Centre also undertakes specific research projects funded by individual retail industry organisations.

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