V70: 70-study hour course (Cost: £600)

Course Title: Investigation of Spatial Patterns of Animal Disease

This course consists of four units:

1. Introduction to Geographic Data
2. Using a Geographic Information System
3. Exploring Spatial Data
4. Explaining of Spatial Data

Aims of each unit and your learning outcomes are outlined in the following section.

Unit 1: Introduction to Geographic Data

Aims of the unit

- To familiarise you with the different types of spatial information and how that information is stored and then used by a GIS.
- To outline the different methods of projecting geographic information and how data can be converted from one projection to another.
- To give you a first 'hands-on' experience of using a GIS.

What you will learn

By the end of this unit you should be able to:

- list and describe attributes of geographic data and the types of spatial objects
- explain how spatial objects can be stored within a GIS using raster and vector data formats
- define georeferencing and describe different types of georeferencing systems
- describe why and how georeferences are converted from one system into another
- explain the importance of spatial autocorrelation in spatial data analysis
- outline the limitations of spatial interpolation
- briefly discuss uncertainty in geographic data.

Unit 2: Using a Geographic Information System

Aims of the unit

- To familiarize you with the use of a GIS.
- To familiarize you with basic spatial operations that be performed using a GIS.
- To familiarize you with the concept of 'loose coupling' – the process of moving information between a data management, GIS and statistics package.
- To familiarize you with a method for organizing a small-to-medium-scale GIS projects.[1]

What you will learn

By the end of this unit you should be able to:

- display a map within the GIS package ArcView
- import tabular data into a GIS project, link it to a map projection and visualize the spatial features of the data
- perform basic query operations, using a GIS
- describe the advantages and disadvantages of choropleth mapping
- perform basic GIS calculations – determine the length of boundaries, areas of polygons, create buffer zones around defined areas.

Unit 3: Exploring Spatial Data

Aims of the unit

- To introduce methods for describing point data – particularly methods for describing the density of point data.
- To describe methods for describing spatial autocorrelation in point data.
- To familiarize you with the methods for describing disease count data, recorded on an area basis.
- To familiarize you with methods for describing spatial autocorrelation in area data.

What you will learn

By the end of this unit you should be able to:

- plot point data using the GIS package ArcView for Windows
- create a kernel density surface, based on plotted point data
- explain the term 'extraction mapping'
- describe the situations in veterinary epidemiology where K-function plots of a spatial process would be useful
- explain the term 'standardized mortality ratio'
- describe the use of Bayesian smoothing of disease count data collected on an area basis.

Unit 4: Modelling of Spatial Data

Aims of the unit

- To familiarize you with fixed-effect Poisson regression models, as used in classical (frequentist) statistics.
- To introduce you to full Bayesian methods fixed-effect Poisson regression modelling – an alternative the frequentist approach.
- To enable you to use methods for detecting clusters of disease.

What you will learn

By the end of this unit you should be able to:

- describe the structure of a fixed-effects Poisson model of disease count data
- interpret the regression coefficients from a fixed-effects Poisson model of disease count data
- explain a Bayesian approach to analysis
- describe the situations where a Poisson model of disease count data that accounted for spatial autocorrelation would be preferred over a model that ignored spatial autocorrelation entirely
- interpret the regression coefficients from a mixed-effects Poisson model of disease count data.

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