Chapter 4
Modelling Spatial Medical Data

S. Zimeras
University of the Aegean, Greece

Y. Matsinos
University of the Aegean, Greece

ABSTRACT

Models are sometimes incomplete, especially in scaling data where other information of large regions needs to be predicted by smaller ones. Uncertainty analysis is the process of assessing uncertainty in modelling or scaling to identify major uncertainty sources, quantify their degree and relative importance, examine their effects on model output under different scenarios, and determine prediction accuracy. Especially for large dimensional data where spatial process in regional investigation are difficult to applied due to incompleteness leading us to spatial heterogeneity and non-linearity of our data. Modelling the uncertainty particular in scaling data starts with a general structure (linear most of the time) that explains as accurate as it is the real data and the model is built through adding variables, which are significant or which aid in prediction (hierarchical modelling). Parameter estimation is an important issue for the evaluation of these proposed models. Statistical techniques based on the spatial modelling could be proposed to overcome the problem of dimensionality and the spatial homogeneity between different grains levels based on the neighbourhood structure of the regions with similar characteristics. Investigation of the neighbourhood structure analysis could be applied using kriging or variogram techniques. In this work, we introduce and analyse methodologies for scaling data under uncertainty where incomplete data can be explained by spatial

DOI: 10.4018/978-1-4666-9961-8.ch004

INTRODUCTION

Incompleteness of the data in the models, especially when a prediction is taking place leading us to uncertainty analysis, where variability is the important measure during the investigation process (Katz 2002). Many times uncertainty implies error mostly statistical (due the process or the estimation procedures), unreliability, and incompleteness in our data (Funtowwicz and Ravetz 1990, Petersen 2000, Regan et al. 2002, Katz 2002). Especially for large dimensional data where spatial process in regional investigation are difficult to applied and model estimation is difficult to predict due to incompleteness leading us to spatial heterogeneity and non-linearity of our data (Katz 2002, Regan et al. 2002).

Models sometimes involve incomplete data, especially in grain scaling data where various information of large regions needs to be predicted by smaller ones. Uncertainty analysis is the process of assessing uncertainty in modelling or scaling to identify major uncertainty sources, quantify their degree and relative importance, examine their effects on model output under different scenarios, and determine prediction accuracy (Jansen 1998, Katz 2002).

Modelling the uncertainty particular in grain scaling data starts with a general structure (linear most of the time) that explains as accurate as it is the real data and the model is built through adding variables, which are significant or which aid in prediction (hierarchical modelling) (Zimeras and Aykroyd, 1999; Zimeras, 2007). Parameter estimation is an important issue for the evaluation of these proposed models. For example, the GLUE procedure can be used in estimating likelihoods of all possible outcomes for a specific distribution of inputs as well as to acquire behavioral outcomes (Beven and Binley 1992, Wang et al 2012, Huang et al. 2013) based on likelihood measures in evaluating parameters in model's outcomes. Statistical techniques based on the spatial modelling could be proposed to overcome the problem of dimensionality and the spatial homogeneity between different grains levels based on the neighbourhood structure of the regions with similar character-