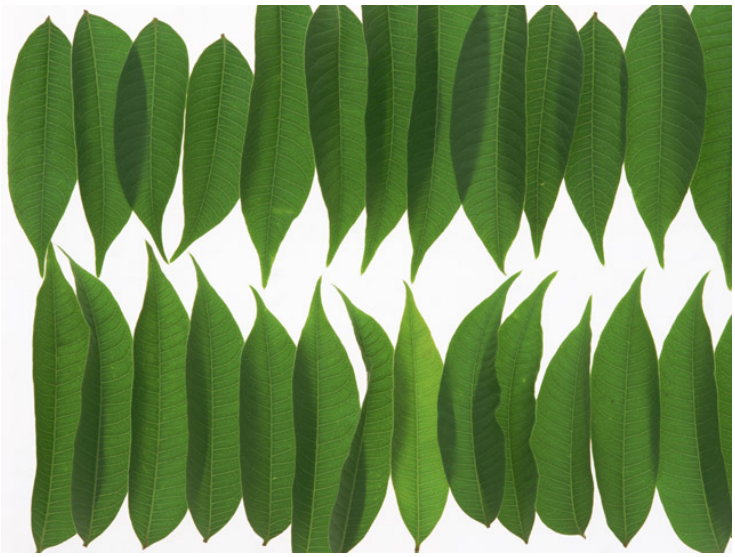
ISM Symposium on Environmental Statistics 2013



Date & Time: Jan. 25(Fri), 2013

Venue: The Institute of Statistical Mathematics,

10-3 Midori-cho Tachikawa, Tokyo 190-8562, Japan

Aim of Symposium:
In order to enhance the understanding of the global environment, statistical science is extremely important. Centered around the topic of directional statistics, we are holding a symposium in order to better develop research on statistical theory which can be applied to solve specific issues in the fields of environmental and ecological data.

Host Organization:
The Institute of Statistical Mathematics

Organizing Committee:
Koji Kanefuji(ISM)
Kunio Shimizu(Keio University, ISM)
Atsushi Yoshimoto(ISM)
Kenichiro Shimatani(ISM)

Program

Opening Address : Junji Nakano(ISM) 13:00-13:05

[1]Alan Welsh(The Australian National University) 13:05-13:50
Is it there? Analysing occupancy surveys

[2]Janice Scealy(The Australian National University) 13:50-14:35
Fitting Kent models to compositional data with small concentration

[3]Toshihiro Abe(Tokyo University of Science) 14:35-15:05
Circular and axial distributions with an application for fallen tree data

Coffee Break 15:05-15:20

[4] Shuangzhe Liu(University of Canberra) , Min-zhen Wang (Keio University), K. Shimizu (Keio University) , and A. SenGupta (Indian Statistical Institute) 15:20-16:05
Influence diagnostics in asymmetric circular-linear multivariate regression models

[5]Kenichiro Shimatani(ISM) 16:05-16:35
Circular statistics for animal movement ecology and movement ecology for circular statistics

[6]Min-zhen Wang and Kunio Shimizu (Keio University) 16-35-17:05
Cylindrical Distributions with Application to Environmental Data

Closing address : Tomoyuki Higuchi(ISM: Director-General) 17:05-17:10

Abstract

[1]Alan Welsh

Is it there? Analysing occupancy surveys

We will discuss some general methods which deal with nondetection and then consider a currently popular method called occupancy modelling in more detail. We will show how we use statistical thinking to understand occupancy modelling and evaluate its properties. It is obviously important to understand when a method will or will not work well and to understand its limitations. We will see that occupancy models are more difficult to fit and interpret than is generally appreciated because the estimating equations often have multiple solutions and the estimates are unstable when the data are sparse. When the abundance of a species varies from site to site the standard analysis runs into difficulties and in this case, occupancy modelling can be just as poor as analyses which ignore nondetection completely. This raises broader philosophical questions about the use of incorrect models and the value of trying to make complicated adjustments in difficult problems.

[2]Janice Scealy
Fitting Kent models to compositional data with small concentration

Compositional data can be transformed to directional data by the square root transformation and then modelled by using the Kent distribution. The current approach for estimating the parameters in the Kent model for compositional data relies on a large concentration assumption which assumes that the majority of the transformed data is not distributed too close to the boundaries of the positive orthant. When the data is distributed close to the boundaries with large variance significant folding may result. To treat this case we propose new estimators of the parameters derived based on the actual folded Kent distribution which are obtained via the EM algorithm. We show that these new estimators significantly reduce the bias in the current estimators when both the sample size and amount of folding is moderately large. We also propose using a saddlepoint density approximation for the Kent distribution normalising constant in order to more accurately estimate the shape paramet ers when the concentration is small or only moderately large.

[3]Toshihiro Abe
Circular and axial distributions with an application for fallen tree data

We present a retrospective method for studying forest disturbance regimes, and especially the role of windthrows, based on circular and axial statistical models of directions of fallen logs. This approach was applied to fallen log data from three areas of pristine Picea abies-dominated boreal forests in northern Europe. The data consisted of 5 plots from each of the three areas, totaling 15 plots and covering an area of 24 ha.The disturbance history of the plots, which varied from area to area, was known from previous detailed studies. Our results suggested the utility of circular and axial distributions of fallen logs and their statistical models for retrospective assessments of forest disturbance regimes.

[4] Shuangzhe Liu(University of Canberra) , Min-zhen Wang (Keio University), K. Shimizu (Keio University), and A. SenGupta (Indian Statistical Institute)

Influence diagnostics in asymmetric circular-linear multivariate regression models

Distributional studies and regression models have played important roles in statistical analysis of circular data. Asymmetric circular-linear multivariate regression models (SenGupta and Ugwuowo, 2006) are motivated by and applied to predict some environmental characteristics based on both circular and linear predictors. In this paper, we consider a likelihood approach (Cook, 1986) to study influence diagnostic analysis for these models, using the maximum likelihood estimation and influence diagnostics methods. The observed information matrices and normal curvatures are derived. Simulated and real data examples are then provided to illustrate our approach and establish the utility of our results.

[5] Kenichiro Shimatani

Circular statistics for animal movement ecology and movement ecology for circular statistics

Animal movement ecology will advance in parallel to developments in circular statistics, and the development of circular statistics will be promoted by the practical demands made from movement ecology. Here I will present an example of such studies. Movement trajectories of an animal are often more oriented or tortuous than expected from simple (correlated) random models. On the basis of the recently developed circular auto-regressive model, a new movement model was introduced and applied to GPS trajectories of a seabird. The proposed model enables us to evaluate the effects of external factors on movements separately from the animal's internal state. For example, maximum likelihood estimates and model selection by AIC suggested that in one homing flight section, the seabird intended to fly toward the home island, but misjudged its navigation and was driven off-course by winds, while in the subsequent flight section, the seabird reset the focal direction, navigated the flight under strong wind conditions, and succeeded in approaching the nest.

[6]Min-zhen Wang and Kunio Shimizu
Cylindrical Distributions with Application to Environmental Data

A cylindrical distribution means the joint distribution of a linear random variable and a circular random variable such as wind speed and direction and the concentration of a pollutant and wind direction. A pair of realization may be identified with a point on the cylinder. Johnson and Wehrly (1978) and Mardia and Sutton (1978) give fundamental models on the cylinder, and Kato and Shimizu (2008) extend some of the Mardia-Sutton and Johnson-Wehrly models. In this talk we introduce some cylindrical distributions and fit them to the periwinkle dataset in Fisher (1993).

References

1. Fisher, N. I. (1993). Statistical Analysis of Circular Data, Cambridge University Press, Cambridge.
2. Johnson, R. A. and Wehrly, T. E. (1978). Some angular-linear distributions and related regression models, Journal of the American Statistical Association, 73, 602-606.
3. Kato, S. and Shimizu, K. (2008). Dependent models for observations which include angular ones, Journal of Statistical Planning and Inference, 138, 3538-3549.
4. Mardia, K. V. and Sutton, T. W. (1978). A model for cylindrical variables with applications, Journal of the Royal Statistical Society, B40, 229-233.

ISM Symposium on Environmental Statistics 2013

Jan. 25, 2013

The Institute of Statistical Mathematics, Japan