

12th CI²MA Focus Seminar
“Recent Advances in Statistical Modeling and Computational Methods”
Supported by Departamento de Estadística, CI²MA
and Fondecyt 1130233.

January 17, 2016
Room FM 101, 1st floor
Facultad de Ciencias Físicas y Matemáticas, Universidad de Concepción

Organizer: Mauricio Castro

Programme

- 15.10** **Opening**

- 15.15** **Guillermo Ferreira** (Departamento de Estadística, UdeC, Chile):
Kalman filtering for spatio-temporal statistics

- 15.50** **Jorge González** (Departamento de Estadística, PUC, Chile):
Statistical modeling for the comparison of test scores

- 16.25** **Gabriel Arriagada** (INCAR, UdeC, Chile):
Application of statistical methods in epidemiology

- 16.55** **COFFEE BREAK**

- 17.15** **Garritt Page** (Department of Statistics, BYU, USA):
Spatial product partition models

- 17.50** **Mauricio Castro** (Departamento de Estadística and CI²MA, UdeC, Chile):
Bayesian semiparametric modeling for HIV longitudinal data

- 18.25** **Conclusions and floor discussion**

- 20.30** **Seminar Dinner**

Practical information

Seminar participants who would like to join dinner should register with CI²MA secretary:

Ms Angelina Fritz, CI²MA
E-mail: afritz@ci2ma.udec.cl, Phone: (041) 2661324

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KALMAN FILTERING FOR SPATIO-TEMPORAL STATISTICS

GUILLERMO P. FERREIRA

ABSTRACT. This work provides an overview of Kalman filter algorithm in spatio-temporal processes, a powerful methodology for handling observations coupled both in time and space. These techniques allow us to capture the temporal dependence as well as the spatial correlation structure through the well-known state-space equations. This work also reviews estimation and predictions techniques, illustrating the application of these methods using real-life data examples. The examples show that the Kalman filter methods provide a useful theoretical and practical framework for the statistical analysis of spatio-temporal data.

DEPARTAMENTO DE ESTADÍSTICA, UNIVERSIDAD DE CONCEPCIÓN, CHILE
E-mail address: `gferreir@udec.cl`

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**STATISTICAL MODELING FOR THE COMPARISON OF TEST
SCORES**

JORGE GONZÁLEZ

ABSTRACT. A particular statistical problem in the field of educational measurement relates to the comparability of scores arising from different test forms. Such problem is called *equating*. Equating is a family of statistical models and methods that are used to make test scores comparable among two or more versions of a test which are intended to measure the same attribute. In this talk, I will discuss about the role of random variables, probability distributions and parameters as involved in equating, and on the possibility of going towards a formal statistical modeling framework for equating.

DEPARTAMENTO DE ESTADÍSTICA, PONTIFICIA UNIVERSIDAD CATÓLICA DE CHILE, CHILE
E-mail address: `jorge.gonzalez@mat.uc.cl`

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APPLICATION OF STATISTICAL METHODS IN EPIDEMIOLOGY

GABRIEL ARRIAGADA

ABSTRACT. In this talk I will present my experience on how statistics may help to answer epidemiological questions in the context of diseases of aquatic animals. Epidemiology studies patterns, causes and effects of conditions of health and disease in populations. It identifies exposures and assesses associations with various outcomes such as health, welfare, productivity, etc., so one can take advantage of that knowledge to improve these population parameters. Exposures and outcomes are part of complex causal webs. Epidemiologists (with the help of statistics) are constantly improving their study designs and data analyses in order to describe these causal webs in a more realistic way. In this presentation I will show some applications of linear mixed models, GLMM, and spatial statistics to the problem of sea lice, which is a parasite that causes important economic losses to the salmon industry in Chile and other countries. Projects involving Bayesian hierarchical models and data mining will be presented as well.

INTERDISCIPLINARY CENTER FOR AQUACULTURE RESEARCH (INCAR), UNIVERSIDAD DE CONCEPCIÓN,
CHILE

E-mail address: `garriagada@oceanografia.udec.cl`

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SPATIAL PRODUCT PARTITION MODELS

GARRITT PAGE

ABSTRACT. When modeling geostatistical or areal data, spatial structure is commonly accommodated via a covariance function for the former and a neighborhood structure for the latter. In both cases the resulting spatial structure is a consequence of implicit spatial grouping in that observations near in space are assumed to behave similarly. It would be desirable to develop spatial methods that explicitly model the partitioning of spatial locations providing more control over resulting spatial structures and be able to better balance local and global spatial dependence. To this end, we extend product partition models to a spatial setting so that the partitioning of locations into spatially dependent clusters is explicitly modeled. We explore the resulting spatial structure and demonstrate its flexibility in accommodating many types of spatial dependencies. We illustrate the method's utility through an education application.

DEPARTMENT OF STATISTICS, BRIGHAM YOUNG UNIVERSITY, USA
E-mail address: page@stat.byu.edu

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**BAYESIAN SEMIPARAMETRIC MODELING FOR HIV
LONGITUDINAL DATA WITH CENSORING AND SKEWNESS**

LUIS M. CASTRO

ABSTRACT. In biomedical studies, the analysis of longitudinal data based on Gaussian assumptions is common practice. Nevertheless, more often than not, the observed responses are naturally skewed, rendering the use of symmetric mixed effects models inadequate. In addition, it is also common in clinical assays that the patient's responses are subject to some upper and/or lower quantification limit, depending on the diagnostic assays used for their detection. Furthermore, the responses may also often present a nonlinear relation with some covariates such as time. To address the aforementioned three situations, we consider a Bayesian semiparametric model based on splines and wavelets for longitudinal censored data using the multivariate skew-normal distribution. The proposed semiparametric approach is focused on the use of splines to approximate the nonlinear general mean and wavelets for modelling the individual trajectories per subject. Lastly, the use of the skew normal distribution allows us to capture the skewness presented in the data. The newly developed method is illustrated through the analysis of a motivating data set of AIDS/HIV infected patients.

DEPARTAMENTO DE ESTADÍSTICA AND CI²MA, UNIVERSIDAD DE CONCEPCIÓN, CHILE
E-mail address: `luiscastroc@udec.cl`