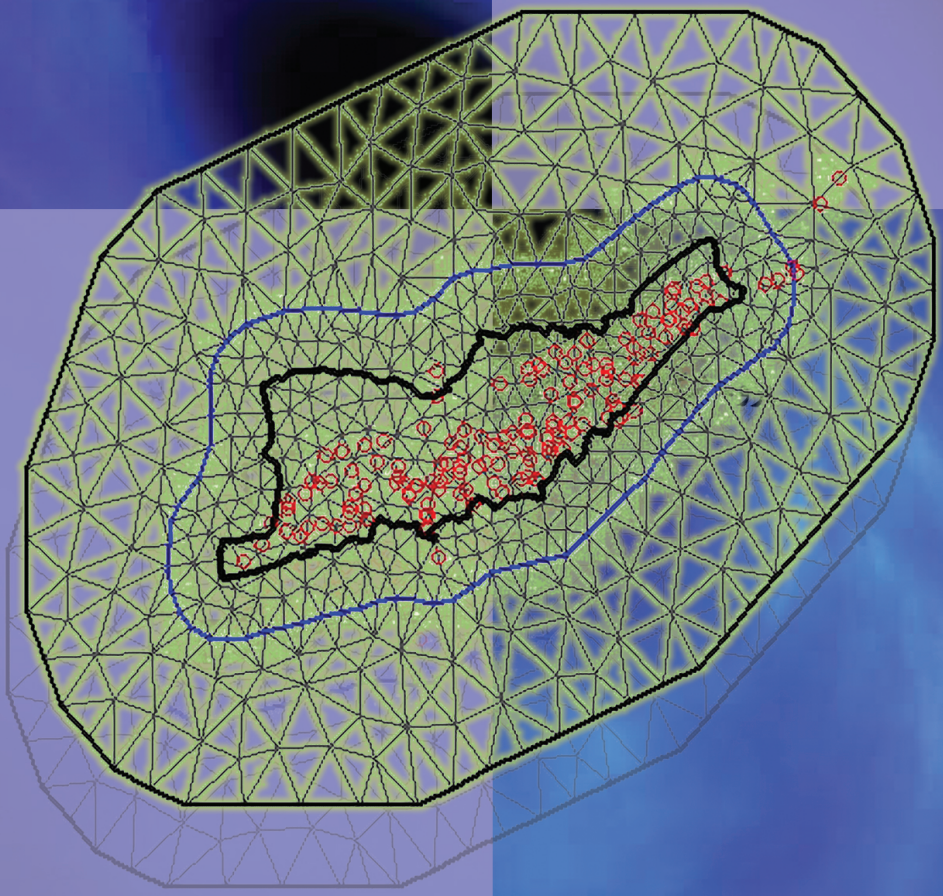
5th Seminar on Spatial Statistics and Its Applications

پنجمین سمینار آمار فضایی و کاربردهای آن

Oct. 2023 25-26
Imam Khomeini International University

۳-۴ آبان ماه ۱۴۰۲
دانشگاه بین‌المللی امام خمینی، قزوین



ABSTRACTS

In the Name of God

Abstarcts of the 5th Seminar on Spatial Statistics and Its Applications

25-26 October 2023

Interenational UIniversity of Imam Khomeini (IUIK)

Qazvin, Iran.

Abstracts of the 5th Seminar on Spatial Statistics and Its Applications

Producer:	Mohsen Mohammadzadeh
Printing:	October 2023
Address:	International University of Imam Khomeini, Qazvin, Iran.
Phone:	028 − 33901379
E-mail:	spatial5@ikiu.ac.ir
Website:	conf.ikiu.ac.ir/spatial5

Preface

In the Name of GOD

The increasing development of human societies in various fields is gaining momentum every day. To overcome and control this increasing growth, the need for advanced methods of modeling different phenomena becomes doubly important. Most experimental phenomena have a series of dependent and independent variables. Discovering and modeling the dependence of these variables has a vital role in a better and fact-based understanding of those phenomena. Statistical sciences and new methods of data science play a key role in this regard and promote interdisciplinary collaboration. Spatial statistics is a powerful tool, which examines their correlations by analyzing spatial and temporal data. With this in mind, spatial statistics methods can be used in a wide range of areas. Including Earthquake Science and Engineering, Risk Engineering, Crisis Management, Atmospheric and Meteorological Sciences, Water Resources, Environment, Geology, Mining, Urban and Regional Planning, Traffic, Transportation, Remote Sensing, Health and Treatment, epidemiology, forensics, social sciences, oil and gas, economics, and insurance have a wide range of applications. To provide opportunities for the exchange of views of experts in various related fields to spatial statistics, the Fifth Seminar on Spatial Statistics and Its Applications, to be held from 25 to 26 October 2023, is hosted by the International University of Imam Khomeini in collaboration the Centre of Excellence in Analysis of Spatio-Temporal Correlated Data Tarbiat Modares University and the Iranian Statistical Society will be held. This seminar provides a unique opportunity for academics, professionals, government agencies, the private sector and other institutions active in related fields to exchange views and present the results of their research by presenting the latest scientific achievements. Thanks to the esteemed experts from inside and outside the country in various fields who contribute to the scientific fruitfulness of this seminar by presenting their valuable articles and the respected referees, scientific committee, and executive committee who took great efforts to hold this seminar. We hope that with your active presence and participation in this seminar, it will be possible to achieve its predicted goals like the previous successful seminars.

Secretary of the Scientific Committee
Professor Mohsen Mohammadzadeh
October 2023

.

Seminar Partners and Sponsors:

This seminar is hosted by the International University of Imam Khomeini in cooperation with the Centre of Excellence in Analysis of Spatio-Temporal Correlated Data at Tarbiat Modares University and the Iranian Statistics Society, as well as the support of organizations and institutions listed below. We would like to express our gratitude to all the individuals and organizations that supported the seminar.

Scientific Committee

1- Mohsen Mohammadzadeh (Secretary)	Tarbiat Modares University
2- Afshin Fallah	Imam Khomeini International University
3- Ali Aghamohammadi	Zanjan University
4- Hossein Baghishani	Shahrood University of Technology
5- Morteza Bastami	International Institute of Earthquake Engineering and Seismology
6- Fatemeh Hosseini	Semnan University
7- Ramin Kazemi	Imam Khomeini International University
8- Omid Karimi	Semnan University
9- Mousa Golalizadeh	Tarbiat Modares University
10- Kiomars Motarjem	Tarbiat Modarres University

Excutive Committee

1- Afshin Fallah (Seminar Secretary)	Imam Khomeini International University
2- Sedigheh Zamani Mehreyan	Imam Khomeini International University
3- Elias Shivanian	Imam Khomeini International University
4- Maryam Dargahi	Imam Khomeini International University
5- Ramin Kazemi	Imam Khomeini International University
6- Arezo Hajrajabi	Imam Khomeini International University
7- Mahsa Nadifar	University of Pretoria

Contents

Maximum Entropy and Bayesian Methods for Image and Spatial Analysis

Zahra Amini Farsani *

Department of Statistics, Ludwig Maximilians University Munich, Germany.

Statistics Department, School of Science, Lorestan University, Khorramabad, Iran.

Abstract

The maximum entropy framework is a cornerstone of statistical inference, and it has a privileged position as the only consistent method for combining different data into a single image. It allows us to incorporate extra, prior knowledge about the object being imaged and leads to the selection of a probability density function that is consistent with our knowledge and introduces no unwarranted information. Any probability density function satisfying the constraints that have smaller entropy will contain more information and, hence, less uncertainty. In a Bayesian view, probabilities are seen as degrees of belief that are modified by information, which is refined as more information becomes available. In the presence of limited information, Bayesian probabilities are often easily assigned where conventional probabilities cannot. Due to these properties, both maximum entropy and Bayesian approaches have been used massively in image analysis and processing as well as in spatial statistics. For instance, the crucial steps in spatial analysis and spatial data pattern recognition are modeling the spatial data and estimating the consequential error of the distribution function. The main problem of the quantitative assessment of spatial data - measuring spatial or spatio-temporal variables and therefore, making any decisions based on such observations and predictions- is the existence of considerable uncertainty. Accordingly, in practice, it is often impossible to test the assumptions of the proposed distribution. Then we face the difficulties to use the traditional probability statistical approach for dealing and analyzing spatial data information, too. Here, the combination of Bayesian approaches with the maximum entropy method provides a great inference method to describe the spatial data distribution and gives the actual error estimation..

Keywords: Entropy, Image analysis, Spatial statistics.

Mathematics Subject Classification (2010): 62H11, 62H35.

*Speaker: Zahra.Farsani@stat.uni-muenchen.de

پنجمین سمینار
آمار فضایی و کاربردهای آن
5th Seminar on Spatial Statistics and Its Applications
۳ و ۴ آبان‌ماه ۱۴۰۲ Oct. 2023 25-26
conf.ikiu.ac.ir/spatial5

Determining the Anisotropic Spatial Correlation of V_{s30} Values in Tehran

Morteza Abbasnejad Fard*, Morteza Bastami
International Institute of Earthquake Engineering and Seismology, Tehran, Iran.

Abstract

Spatial correlation and cross-correlation of earthquake intensity measures (IMs) are essential for seismic hazard and risk assessment of spatially distributed assets, such as portfolios of buildings or infrastructure networks. Recent studies have shown that the spatial correlation characteristics of local soil conditions, represented by the average shear-wave velocity in the upper 30 m of soil (Vs30), significantly impact the spatial correlations of earthquake IMs. This study aims to analyze the spatial correlation characteristics of the soil profile in the Tehran region by collecting accurate Vs30 measurements and obtaining the parameters of a multivariate anisotropic spatial correlation model of earthquake IMs for seismic hazard and risk assessment applications in Tehran.

Keywords: Spatial correlations, Earthquake, Latent dimensions, Anisotropy.
Mathematics Subject Classification (2010): 62P30, 62N01, 62H11.

*Speaker: m.abbasnejad@iiees.ac.ir

Statistical Analysis of Object Data: Breathing Bogs and Protein Shapes

Ian Dryden*
Department of Mathematics and Statistics, Florida International University, USA.

Abstract

Object-oriented data analysis (OODA) is a framework for analyzing datasets with much richer structure than the usual numbers or vectors. Examples of object data include shapes, functions, images, and networks. At the start of any OODA application, we need to answer the following questions: What are the data objects? What is the object representation space? What is the feature space for carrying out practical statistical analysis? What statistical methods will be used? This talk will focus on two topics: spatial analysis of satellite data and shape analysis of protein molecules. An important aspect of OODA is to reduce the dimension to a small number of key features while respecting the geometry of the manifold in which objects lie. Two case studies are given with objects at big and little scales: i) Bayesian clustering of the condition of peatland bogs in Scotland using satellite images collected over several years, where peatland levels oscillate throughout the annual cycle (bog breathing) and ii) estimating non-linear dynamic sequences of protein shapes from a small number of individual molecules using principal nested shape spaces.

Keywords: Bayesian, cluster analysis, Markov chain Monte Carlo, object-oriented data analysis, Principal nested spheres, proteins, Satellite image, Shapes, smoothing, Spatial, Time series.
Mathematics Subject Classification (2010): 57N25, 62J05, 55P55.

*Speaker: j.t.kent@leeds.ac.uk

Enhancing Suicide Mortality Prediction Using Spatially Informed Random Forest Models: A Comparative Study with Spatial Econometrics

Mohadeseh Alsadat Farzammehr*
Judiciary Research Institute, Tehran, Iran.

Abstract

Amidst the growing adoption of novel machine learning techniques like random forest, grasping the significance of spatial factors within these models is pivotal. This study introduces an innovative approach, crafting spatially informed classification random forest models by integrating spatially lagged variables, mirroring diverse spatial panel data econometric frameworks. Our investigation rigorously compares these models to traditional spatial and non-spatial regression methods in predicting suicide mortality rates across Iran's provinces from 2011 to 2022. Outcomes reveal a nuanced edge of spatial econometric models over random forest counterparts. Remarkably, the optimal spatial random forest model, infused with spatial lag parameters, attains an impressive 89.19% predictive accuracy for suicide mortality levels, surpassing both spatial econometric (46.51%) and non-spatial random forest (27.03%) models. Despite these variances, our conclusion underscores that random forest methods don't surpass traditional spatial econometric models in predicting suicide mortality rates. These findings offer vital insights into spatial considerations within predictive modeling, guiding researchers towards apt choices for spatial data analysis models.

Keywords: Spatial Econometrics, Random Forest, Suicide Mortality, Iran Provinces.
Mathematics Subject Classification (2010): 6207, 62H30, 62H11.

*Speaker: m-farzammehr@jri.ac.ir

Spatio-Temporal Functional Data Analysis of Traffic Offenses in Iran from 2016 to 2023

Mohammad Fayaz*
Allameh Tabataba'i University, Tehran, Iran.

Abstract

Traffic accident in Iran is one of the most important causes of losing years of life and studying risky traffic behavior helps to control and manage it in a proactive way. We estimate the spatio-temporal functional structure of traffic behavior and risky driving patterns of four indices 1) total traffic, 2) speeding, 3) unsafe distance and 4) illegal overtaking in Iran from 2016 to 2023. In this regard, we collect data from more than 2500 count stations near roads. The sandwich smoother for spatio-temporal functional data with hero R package are used in 5 steps 1) Initial smoothing preparation, 2) Assembling spline information, 3) Prepare the data, 4) Enhance the fit and 5) Estimate and Smooth. The results are presented in various maps with quarterly data and summary statistics such as mean squared error (MSE) and correlation (COR) are presented in tables for three resolution scenarios. The best scenario according to them consists of five resolutions 30,60,90,120 and 150 knots.

Keywords: Traffic Offenses, Spatio-Temporal, Functional Data, Iran .
Mathematics Subject Classification (2010): 62H11, 62M30, 91D25

*Speaker: Mohammad.Fayaz.89@gmail.com

Application of Adaptive Lasso Sparisity Identification in Mixed Effects Quantile Regression Models

Forouzan Jafari Maryaki*, Mousa Golalizadeh
Department of Statistics, Tarbiat Modares University, Tehran, Iran.

Abstract

With the development of experimental techniques, one can collect complex structure data in many fields and informations provided by these data are becoming more complicated. A common property of these data sets is that they come from a population with inter-class correlation, which refers to the mixed effects data; the other one is in which the number of variables greatly exceeds the number of samples, then we have high dimensional data. This paper proposes an adaptive lasso approach for the simultaneous selection of mixed effects and also regression coefficients. It is a new approach in variable selection in the mixed effects quantile regression model context by considering the sparsity. Therefore, the present paper proposes a new optimization problem process in this field to shrink the mixed effects and regression coefficients simultaneously. Our simulation experiments show the superiority of the presented method in comparison with lasso penalty in mixed effects quantile regression models.

Keywords: Quantile Regression, Adaptive Lasso, Regularization, Variable Selection.
Mathematics Subject Classification (2010): 62G08, 62J05, 62J07.

*Speaker: f.jafari@modares.ac.ir

Spatial Modelling, Shapes and Smiles

John T. Kent*
Department of Statistics, University of Leeds, UK.

Abstract

In general, statistical modelling involves a balance between smoothing out noise and highlighting features of interest. In the field of spatial statistics, smoothing is often carried out parametrically using kriging (based on e.g. a stationary or intrinsic random field) or nonparametrically using splines. A feature of interest in a spatial process might be a region of high local change. It has been recognized since the work of Bookstein that spatial methods can be used to study the shapes of 3d objects (such as the human head). The locations of a set of landmarks for a particular object can be viewed as a deformation (or 3d spatial process) of the corresponding landmarks (or spatial sites) of a template object. An important application of shape analysis is to the symmetry of the smile for human subjects, especially for cleft palate subjects. A cleft palate is a congenital deformity, and its treatment requires surgery. One measure of the success of the surgery is for the resulting smile to be symmetric. Ideas from spatial statistics can be used to measure departures from symmetry. The act of smiling involves moving the muscles of the face over a few seconds in time. The smile can be studied either statically at a fixed time (a spatial process) or dynamically through time (a spatial-temporal process).

Keywords: spatial statistics, Shape analysis, Spatial-temporal process.
Mathematics Subject Classification (2010): 62H11, 62J05, 55P55.

*Speaker: j.t.kent@leeds.ac.uk

Regularized Multivariate Functional Principal Component Analysis

Mehdi Maadooliat *
Department of Mathematical and Statistical Sciences, Marquette University, WI, USA

Abstract

Multivariate Functional Principal Component Analysis (MFPCA) is a valuable tool for exploring relationships and identifying shared patterns of variation in multivariate functional data. However, controlling the roughness of the extracted Principal Components (PCs) can be challenging. This talk introduces a novel approach called regularized MFPCA (ReMFPCA) to address this issue and enhance the smoothness and interpretability of multivariate functional PCs. ReMFPCA incorporates a roughness penalty within a penalized framework, using a parameter vector to regulate the smoothness of each functional variable. The proposed method generates smoothed multivariate functional PCs, providing a concise and interpretable representation of the data. Extensive simulations and real data examples demonstrate the effectiveness of ReMFPCA and its superiority over alternative methods. The proposed approach opens new avenues for analyzing and uncovering relationships in complex multivariate functional datasets.

Keywords: Multivariate functional data, Rroughness penalty.
Mathematics Subject Classification (2010): 62H25, 62J05, 40H05.

*Speaker: mehdi.maadooliat@marquette.edu

Space-time Point Pattern Models for the Analysis of Infectious Diseases

Jorge Mateu *
Department of Mathematics, Universitat Jaume I, Castellon, Spain

Abstract

We present several statistical approaches to understand the underlying temporal and spatial dynamics of events evolving in space and time that can result in informed and timely public policies. Most studies commonly report figures of the overall phenomenon of interest at a state- or county-level, reporting the aggregated number of cases in a particular region at one time. However, we focus on analysing high-resolution data in form of spatio-temporal point patterns, offering vital insights for the spatio-temporal evolution of events linking it with their spread in a region. We develop a battery of models and approaches, ranging from non-stationary spatio-temporal point processes, mechanistic models giving particular data-driven forms to the spatio-temporal intensity function, cluster spatio-temporal models to identify unknown sources, and methods of spatial growth functions able to develop velocities of the spread of the events.

Keywords: Spatio-temporal point patterns, mechanistic models.
Mathematics Subject Classification (2010): 62H25, 62J05.

*Speaker: mateu@mat.uji.es

Predicting the Performance of Trial Court Administration Using Machine Learning

Meisam Moghimbeygi[1] *, Mohadeseh Alsadat Farzammehr[2]

[1]Department of Mathematics, Faculty of Mathematics and Computer Science, Kharazmi University, Tehran, Iran.

[2]Iranian Judiciary Research Institute, Tehran, Iran.

Abstract

Traditionally, empirical indicators have been generated through methods like expert surveys, document reviews, administrative data analysis, and public surveys. However, this paper utilizes machine learning techniques to predict trial court performance using key indicators for trial case processing. The study uses a dataset collected from 18 civil branches within a trial court in Tehran, Iran, with a sample size of 119 case management data. Logistic Regression was found to be the most effective data mining model, achieving an area under the curve of 98.5% and classification accuracy of 95.0%. The logistic regression analysis revealed that the probability of positive performance evaluation was influenced by factors such as the number of resolved cases. In contrast, the number of pending cases at the beginning of a period had minimal impact. Evaluating trial court administration is crucial for identifying and addressing negative performance issues early on, which helps build public trust and confidence in the justice system. Regular performance evaluations can also contribute to developing a decision support system that enhances overall court performance.

Keywords: Court performance prediction; Data mining; Judicial data; Machine learning techniques; Artificial intelligence.

Mathematics Subject Classification (2020): 62P99, 62H30.

*Speaker: m.moghimbeygi@khu.ac.ir

Penalized Pairwise Likelihood Estimation for Spatial GLM Models

Mohsen Mohammadzadeh*, Leyla Salehi
Department of Statistics, Tarbiat Modares University, Tehran, Iran

Abstract

In this article, we utilized pairwise and weighted pairwise likelihood functions to estimate the parameters of Spatial Generalized Linear Mixed (SGLM) models. Subsequently, we applied the penalized pairwise likelihood function to enhance the accuracy of parameter estimation for the model. In a comprehensive simulation study, we assessed and compared the accuracy of parameter estimations achieved through the pairwise, weighted, and penalized pairwise likelihood, using the mean squared error as the evaluation criterion. Next, we employed the penalized pairwise likelihood method to analyze a real dataset. Finally, the discussion and results are presented.

Keywords: Spatial GLM model, Pairwise likelihood , Penalized pairwise likelihood.
Mathematics Subject Classification (2020): 62H11, 62M30, 62J12.

*Speaker: mohsen_m@modares.ac.ir

Analysis of Survival Data with Spatial Survival Tree

Kiomars Motarjem*
Department of Statistics, Tarbiat Modares University, Tehran, Iran.

Abstract

Spatial Survival Tree is a modeling approach used to analyze time-to-event data in the presence of spatial dependency and predictive covariates. This method is capable of dividing the data into subgroups, each associated with a relevant survival curve, and calculating the probability of survival for individuals in each group over time, taking into spatial-temporal survival correlations. Additionally, it utilizes criteria such as spatial location and event timing to further partition the data into smaller groups. The structure of the tree enables the identification of subgroups of individuals or spatial locations that possess unique survival characteristics while facilitating the selection of influential predictive variables on survival time. Simulation results conducted in this study demonstrate that the Spatial Survival Tree exhibits a higher efficacy in analyzing survival data with spatial structure, contributing significantly to improved accuracy and efficiency in the analysis of spatial survival data.

Keywords: Survival Data, Tree-based Algorithm, Spatial Survival Tree.
Mathematics Subject Classification (2010): 62M30, 62H30, 62N05.

*Speaker: k.motarjem@modares.ac.ir

A Bayesian Semi-parametric Spatial Count Model for Analysing Lung Cancer Mortality

Mahsa Nadifar[1]*, Andritte Bekker[1], Mohammad Arashi[2]
[1]Department of Statistics, University of Pretoria, South Africa.
[2]Department of Statistics, Ferdowsi University of Mashhad, Iran.

Abstract

The issue of treating unbalanced count data distributions in spatial count analysis prompts inquiries over the appropriateness of the Poisson model. Furthermore, more than traditional methods are required when straightforward parametric models do not capture the associations between variables because of the inclusion of covariates with unclear functional forms and complex or unspecified spatial patterns. To tackle these issues, we propose the implementation of an innovative Bayesian hierarchical modeling approach. This methodology combines non-parametric methods with a modified dispersed count model based on renewal theory, enabling us to effectively address challenges associated with count data exhibiting non-equivalent dispersion, nonlinear connections between variables, and intricate spatial patterns. In order to showcase the adaptability and efficacy of our proposed approach, we employ it to examine empirical lung cancer data obtained from Pennsylvania, United States.

Keywords: Bayesian spatial model, Count data, Semi-parametric, Over-dispersion, Under-dispersion, INLA.
Mathematics Subject Classification (2010): 62J12, 62F15, 62H11.

*Speaker: u23027917@tuks.co.za

پنجمین سمینار
آمار فضایی و کاربردهای آن
5th Seminar on Spatial Statistics and Its Applications
۳ و ۴ آبان‌ماه ۱۴۰۲ Oct. 2023 25-26
conf.ikiu.ac.ir/spatial5

Introducing a New Method in Determining the Fault Plane Using the Spatial Position of Aftershocks

Shahrokh Pourbeyranvand*
International Institute of Earthquake Engineering and Seismology, Tehran, Iran.

Abstract

In this study, a new method for determining the fault plane using the spatial position of the hypocenter of aftershocks has been introduced. A conventional method that is usually used in seismological studies of aftershock sequences is to draw earthquakes on a map and design several cross-sections in such a way that the spatial distribution of events can be inferred. In this way, the fault plane can be visualized. In the proposed method however, the role of human observation and inference is almost eliminated. By using automatic fitting methods in the 3D environment, the spatial position of seismic events is used directly to create a surface and then a planar surface which is recognized and fault plane is fit to it. The geometrical characterization of the fault plane can be achieved by computer modeling hence.

Keywords: hypocenter, earthquake, focal mechanism, fault, seismicity, location.
Mathematics Subject Classification (2010): 62P30, 62N01, 62H11.

*Speaker: beyranvand@iiees.ac.ir

Bayesian Kriging Regression for Post-Earthquake Damage Prediction

Mahdi Rahmani-Qeranqayeh[1]*, Morteza Bastami[1], Afshin Fallah[2]
[1]International Institute of Earthquake Engineering and Seismology, Tehran, Iran.
[2]Department of Statistics, Imam Khomeini International University, Qazvin, Iran.

Abstract

This study utilizes Bayesian kriging regression to predict damage in earthquake-affected areas. This approach accounts for the spatial correlation between building damage and ensures that the predicted values remain within an acceptable range. It is also well-suited for handling damage data with measurement errors. These are aspects that are often overlooked in earthquake studies. The performance of the Bayesian kriging regression was compared with that of regression kriging and probit regression using both simulated and actual datasets from the Sarpol-e Zahab earthquake. The results showed that the Bayesian kriging regression model provided superior predictions of the damage ratio compared to the other models, exhibiting lower bias.

Keywords: Earthquake damage, Bayesian approach, Spatial correlation, Probit model.
Mathematics Subject Classification (2010): 62M30, 62H30, 62N05.

*Speaker: omid.karimi@semnan.ac.ir

Machine-Learning Models for Predicting the Class of Divorce Cases in Iranian Judiciary Courts

Elham Tabrizi[1*], Mohadeseh Alsadat Farzammehr[2]

[1]Department of Mathematics, Faculty of Mathematics and Computer Science, Kharazmi University, Tehran, Iran.

[2]Judiciary Research Institute, Tehran, Iran.

Abstract

This paper introduces a machine-learning model for predicting divorce case outcomes in Iranian Judiciary Courts, leveraging various classification algorithms, including Naïve Bayes, Multinomial Logistic Regression, kNN, Decision Tree, Random Forest, GraBoost, AdaBoost, Neural Network, SGD, and SVM. It utilizes historical divorce case data and socioeconomic indicators like literacy rate, urbanization rate, and employment status. Comparative analysis reveals that the Random Forest classifier achieves the highest accuracy. Additionally, the study highlights key factors linked to divorce cases in Iran, including the population aged 15 and over, unemployment rate, urbanization rate, and participation rate. These findings offer valuable insights for crafting more effective policies and interventions to address the social and economic challenges associated with divorce in Iran.

Keywords: Divorce Cases, Data Mining, Machine Learning Techniques, Iran, Judiciary.
Mathematics Subject Classification (2010): 62M30, 62H30, 62N05.

*Speaker: elham.tabrizi@khu.ac.ir

Spatial Survival Analysis with an Application to Lung Cancer Data

Mahmoud Torabi *
Department of Community Health Sciences, University of Manitoba, Canada

Abstract

Survival data are often collected in clusters such as geographic regions. Incorporating the cluster effect in the survival model not only improves the accuracy and efficiency of parameter estimation but also investigates spatial pattern and identify high-risk areas. The commonly used spatial-survival models are mostly restricted to single-event or competing risks settings, with a few extensions of semi-competing risks setting which only incorporate between cluster variation. This work proposes a spatial semi-competing risk model that allows for spatial correlation while estimating risks of terminal (e.g., death) and non-terminal (e.g., lung cancer) events. The performance of the proposed model is evaluated in a simulation study and also by a real data application on Manitoba lung cancer registry data to investigate the pattern of events over Manitoba regions and evaluate the effect of demographic and socioeconomic factors on the risk of events.

Keywords: Spatial survival model, Semi-competing risk model.
Mathematics Subject Classification (2020): 62H11, 62M30, 62J12.

*Speaker: Mahmoud.Torabi@umanitoba.ca

Spatio-Temporal Prediction of Traffic Using Deep Learning

Shahin Vaezi*[1], Mohsen Mohammadzadeh[2]
[1]Department of Data Sciences, Tarbiat Modares University, Tehran, Iran.
[2]Department of Statistics, Tarbiat Modares University, Tehran, Iran.

Abstract

Traffic prediction in the following years has gained an essential role in research related to the field of artificial intelligence due to the increase in the data produced in this field and the fact that this issue has become more prominent. By predicting the amount of taxi requests in certain areas and times, taxi companies can more efficiently pre-deploy their taxis throughout the city and at critical points. The main challenge in the subject of study is to model the complex spatial and temporal dependencies of the data. Previous works on traffic prediction include time series, regression, traditional spatio-temporal, and new spatio-temporal deep learning methods. Each of them has taken more data into account and gained more attention over time. The assumptions considered in previous studies are that the spatial dependencies between different regions are constant at other times and the temporal dependencies. At the same time, they can differ from one period to another and are strictly periodic. But in this article, these two essential assumptions are considered as follows: spatial dependencies between various regions change at different times, and Temporal dependencies have daily and weekly patterns. Still, their departures are fixed and strictly periodic due to shifting. To solve these two issues, a spatio-temporal dynamic network has been presented, which uses a flow gate mechanism to handle the spatial dependencies over time and a periodically shifted attention mechanism to take long-term periodic shifts. Another challenge of this issue is considering and applying these two mechanisms simultaneously.

Keywords: Spatio-Temporal Data, Prediction, Machin learning, Deep learning.
Mathematics Subject Classification (2010): 62M30, 62H30, 62N05.

*Speaker: shahinvaezi00@gmail.com

Variable Selection in Spatial Regression Models Using Boosting Algorithm

Sedigheh Zamani Mehreyan*
Department of Statistics, Imam Khomeini International University, Qazvin, Iran.

Abstract

Boosting algorithm is a learning method that overcomes the weaknesses of machine learners. This method is used for classification and regression. This method reduces the error by combining it in parallel or sequentially and correcting the classification. In this paper, we proposed a boosting algorithm based on the maximum likelihood function for variable selection in spatial regression models. We studied the performance of this algorithm and compared it with usual variable selection methods using simulation studies.

Keywords: Akaike information criterion, Boosting algorithm, Spatial regression model, Variable selection.
Mathematics Subject Classification (2010): 62J05, 62F07, 62R07, 62M30.

*Speaker: zamani@sci.ikiu.ac.ir

Imam Khomeini International University,
Faculty of Science, Statistics, Qazvin, Iran
Postal Code: 34148-96818
Phone: +98 (28) 3390 1547
Fax: +98 (28) 3378 6579
email: spatial5@ikiu.ac.ir