DOCTORAL (PHD) STUDIES
COURSE DESCRIPTION

Course title	Field of science	Faculty	Institute
Spatial Statistics	Mathematics (N 001)	Faculty of Mathematics and Informatics	Institute of Data Science and Digital Technologies, Institute of Applied Mathematics
Study method	Number of credits	Study method	Number of credits
Lectures	0	Consultations	1
Individual work	4	Seminars	0

Course summary

Main aim

This is a special education course, which aims to provide knowledge about the basic principles and concepts of spatial statistics and is adapted for graduate students in mathematics, computer and environmental sciences. The course covers frquentist and Bayesions approaches to analysis of spatial data, provide knowledge for the understanding of theoretical / conceptual algorithms for spatial big data mining.

Learning outcomes

Ability to combine theory and practical elements.
Ability to interpret spatial data, identify and explore new challenges in science and develop strategies of using spatial statistics methods for analysis of the points and area units data.
Ability to implement the R packages GeoR, georob, INLA and others for the solving of real environmental, biomedical and technical problems,

Main topics

1. Statistical models of spatial data
   - 1.1 Structure of spatial data
   - 1.2 Spatial dependence forms.
2. Spatial trend and variation
   - 2.1 Trend models
   - 2.2 Covariances and semivariograms
   - 2.3 Spatial autoregressive models.
3. Estimators of the data model parameters
   - 3.1 Estimators of trend parameters
   - 3.2 Estimators of variation function parameters
4. Spatial prediction methods
   - 4.1 Linear prediction(kriging)
   - 4.2 Bayesian prediction methods
5. Statistical models for spatio-temporal data
   - 5.1 Spatio-temporal trend models
   - 5.2 Separable and nonseparable models for variation functions
   - 5.3 Estimators of the model parameters and predictions

Main literature

1. N. Cressie, C. K. Wikle. Statistics for Spatio-Temporal Data Wiley, Hoboken, N. Y., 2011, 624 pp.
2. R. Bivand, E. Pebesma, V. Gomez-Rubio. Applied Spatial Data Analysis with R Springer, 2013, xviii, 405 p.
3. K. Dučinskas, J. Šaltytė – Benth. Erdvinė statistika, Klaipėda: KU leidykla, 2003, 116 p.
4. M. Blangiardo, M. Cameletti. Spatial and spatio-temporal Bayesian models with R-INLA. Wiley, 2015. x, 308 p.

Consulting teacher	Scientific degree	Pedagogical name	Main publications in the field of science of the last 5 year period
Kęstutis Dučinskas	Dr.	Prof.	1. Dučinskas K., Dreižienė L. (2021). Actual error rates in linear discrimination of spatial Gaussian data in terms of semivariograms. *Communications in Statistics-Theory and Methods*, 1-9.

			2. Karaliutė M., & Dučinskas K. (2021). Classification of Gaussian spatio-temporal data with stationary separable covariances. *Nonlinear analysis: modelling and control*, *26*(2), 363-374. *3.* Dreižienė L., Dučinskas K. (2020). Comparison of spatial linear mixed models for ecological data based on the correct classification rates, *Spatial statistics.V.35.* 4. Dučinskas K., Dreižienė L. (2018). Risks of classification of the Gaussian Markov random field observations. *Journal of Classification*, 35:422-436 DOI: 10.1007/s00357-018-9269-7 5. Dreižienė L., Dučinskas K., Šaltytė-Vaisiauskė L. (2018). Statistical classification of multivariate conditionally autoregressive Gaussian random field observations. *Spatial Statistics*, 28:216-225.
Marijus Radavičius	Dr.	Assoc. Prof.	1. Radavičius M., Rekašius T., Židanavičiūtė J. (2019). Local symmetry of non-coding genetic sequences. *Informatica*, **30** (3): 553-571. 2. Radavičius M. (2020). A Consistent Estimator of Structural Distribution. *Austrian Journal of Statistics*, 49: 99–105. 3. Radavičius M. (2016). Hoeffding Type Inequalities for Likelihood Ratio Test Statistic.// Computer Data Analysis and Modeling: Theoretical and Applied Stochastics: Proc. of the Eleventh Intern. Conf., Minsk, September 6-10, Minsk Publishing center BSU, 2016ISBN 978-985-553-366-6, p.182-184. 4. Radavičius M. (2019). Structural Distribution Estimation. Computer Data Analysis and Modeling: Stochastics and Data Science, Proceedings of the 12th International Conference, Minsk, September 18-221, 2019, pp. 280–284. Publishing Center BSU, Minsk.

Approved by the Board of Faculty of Mathematics and Informatics 10/12/2021. Resolution No. (1.5 E) 110000-TPN-42
Board Chairman – assoc. prof. dr. Kristina Lapin