

**DOCTORAL (PHD) STUDIES
COURSE DESCRIPTION**

Course title	Field of science	Faculty	Institute
Statistical Analysis and Modeling	Mathematics (N 001)	Faculty of Mathematics and Informatics	Institute of Applied Mathematics
Study method	Number of credits	Study method	Number of credits
Lectures	1	Consultations	0
Individual work	3	Seminars	1

Course summary

The course is designed for learning and application of advanced statistical methods. The main focus is practical application of methods while performing the analysis of data collected during the research: determining the appropriate statistical method, testing assumptions, selecting a model, testing the goodness-of-fit of the model and making conclusions.

Course topics:

1. Generalized linear and generalized additive models (GLM and GAM).
2. Structural equation modelling (SEM).
3. Hierarchical models.
4. Survival analysis.
5. Cluster analysis.
6. Bayesian methods.

Data analysis is performed using R/Python/SPSS software.

The course is aim at PhD students in Natural Sciences (Biology /Geology /Informatics/ Biochemistry/ Biophysics/ Ecology and Environmental Science), Social Sciences (Management /Economics /Sociology /Psychology).

Prerequisites: PhD students should have attended a basic statistics course.

Contact hours: 48 academic hours.

Exam: a case study project with data of your choice and presentation (2 academic hours)

Self-study hours: 75 academic hours

Language of the course: English/Lithuanian.

Main literature

1. Vydas Čekanavičius, Rūta Levulienė. Course notes
2. McCullagh, P, & Nelder, J.A. (2000). Generalized linear models (2nd ed.). Chapman&Hall/CRC.
3. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021) An Introduction to Statistical learning (with applications in R). Springer.
4. Liu. (2012). Survival Analysis (1. Aufl.). Wiley.
5. Kruschke. (2014). Doing Bayesian Data Analysis. Elsevier Science & Technology.
6. B. Tabachnick. (Author), L. Fidell (2021) *Using Multivariate Statistics* (7th edition), Pearson.

Optional literature

1. Vydas Čekanavičius, Gediminas Murauskas (2011). Statistika ir jos taikymai. II, III. TEV.
2. Hahn. (2014). Bayesian methods for management and business. In Bayesian Methods for Management and Business (1st ed.). Wiley.

3. Berk, Richard A. (2008). <i>Statistical Learning from a Regression Perspective</i> , Springer New York.
4. Quiroz Flores. (2022). <i>Survival analysis: a new guide for social scientists</i> . Cambridge University Press.
5. Efron, & Hastie, T. (2016). <i>Computer age statistical inference: algorithms, evidence, and data science</i> . Cambridge University Press.
6. Agresti. (2015). <i>Foundations of linear and generalized linear models</i> . Wiley.
7. J.C. Loehlin A. A. Beaujean (2017) <i>Latent variable models. An Introduction to Factor, Path, and Structural Equation Analysis</i> . (5 th edition) Routledge.
8. Beaujean, A. A. (2014). <i>Latent variable modeling using R: A step-by-step guide</i> . Routledge.

Konsultuojančiųjų dėstytojų vardas, pavardė	Mokslo laipsnis	Pedag. vardas	Svarbiausieji darbai mokslo paskelbti per pastaruosius 5 metus
Vydas Čekanavičius	Habil.dr.	Prof.	<ol style="list-style-type: none"> V.Čekanavičius, S. Novak (2022). Compound Poisson approximations// <i>Probability Surveys</i>, ISSN: 1549-5787, 19, 271–350. https://doi.org/10.1214/22-PS8 V.Čekanavičius, P. Vellaisamy (2021). Compound Poisson approximations in ℓ_p-norm for sums of weakly dependent vectors.// <i>Journal of Theoretical Probability</i>, ISSN:0894-9840, 34(4), 2241–2264. https://doi.org/10.1007/s10959-020-01042-9 (Straipsnis DB Clarivate Analytics Web of Science) G. Liaudanskaitė, V.Čekanavičius (2020). Approximations for sums of three-valued 1-dependent symmetric random variables//<i>Nonlinear Analysis: Modelling and Control</i>, 25(4), 675–691. https://doi.org/10.15388/namc.2020.25.16843 (Straipsnis DB Clarivate Analytics Web of Science) V. Čekanavičius, P. Vellaisamy (2020). Lower bounds for discrete approximations to sums of m-dependent random variables.// <i>Probab. Math. Stat.</i>, 40(1), 23–35. https://doi.org/10.37190/0208-4147.40.1.2 (Straipsnis DB Clarivate Analytics Web of Science) V. Čekanavičius, P. Vellaisamy (2019). On large deviations for sums of discrete m-$\tilde{\nu}$-dependent random variables.// <i>Stochastics</i>, 91(8), 1092-1108. https://doi.org/10.1080/17442508.2019.1568438 (Straipsnis DB Clarivate Analytics Web of Science) P. Vellaisamy, V. Čekanavičius (2018). Infinitely divisible approximations for sums of \tilde{m}-dependent random variables.// <i>Journal of Theoretical Probability</i>, ISSN: 0894-9840, 31(4), 2432–2445. (Straipsnis DB Clarivate Analytics Web of Science) V. Čekanavičius, P. Vellaisamy (2018). Approximating by convolution of the normal $\tilde{\nu}$ and compound Poisson laws via Stein's method.// <i>Lithuanian Mathematical Journal</i>, ISSN: 0363-1672, 58(2), 127–140. (Straipsnis DB Clarivate Analytics Web of Science)
Rūta Levulienė	Dr.	Doc.	<ol style="list-style-type: none"> Markevičiūtė, Jurgita; Bernatavičienė, Jolita; Levulienė, Rūta; Medvedev, Viktor; Treigys, Povilas; Venskus, Julius. Impact of COVID-19-related lockdown measures on economic and social outcomes in Lithuania // <i>Mathematics</i>. Basel : MPDI. eISSN 2227-7390. 2022, vol. 10, no. 15, art. no. 2734, p. [1-20] (Straipsnis DB Clarivate Analytics Web of Science) Markevičiūtė, Jurgita; Bernatavičienė, Jolita;

			<p>Levulienė, Rūta; Medvedev, Viktor; Treigys, Povilas; Venskus, Julius. Attention-based and time series models for short-term forecasting of COVID-19 spread // <i>CMC-Computers, materials & continua</i>. Henderson, NV : TECH Science Press. ISSN 1546-2218. eISSN 1546-2226. 2022, vol. 70, no. 1, p. 695-714. (Straipsnis DB Clarivate Analytics Web of Science)</p> <p>3. Bagdonavičius, Vilijandas; Hafdi, Mohamed Ali; Levulienė, Rūta. Modeling and analysis of data with confounding covariates and crossing of the hazard functions // <i>Communications in statistics - theory and methods</i>. Philadelphia : Taylor & Francis. ISSN 0361-0926. eISSN 1532-415X. 2021, vol. 50, no. 20, p. [5262-5284]. (Straipsnis DB Clarivate Analytics Web of Science)</p> <p>4. Bagdonavičius, Vilijandas; Levulienė, Rūta. On accelerated life testing when the AFT model fails // <i>IEEE transactions on reliability</i>. Piscataway : IEEE. ISSN 0018-9529. eISSN 1558-1721. 2019, vol. 68, iss. 4, p. 1311-1319. (Straipsnis DB Clarivate Analytics Web of Science)</p> <p>5. Bagdonavičius, Vilijandas; Levulienė, Rūta. Testing proportional hazards for specified covariates // <i>Modern stochastics: theory and applications</i>. Vilnius; Kiev : VTeX. ISSN 2351-6046. eISSN 2351-6054. 2019, vol. 6, no. 2, p. 209-225. (Straipsnis DB Clarivate Analytics Web of Science).</p>
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Approved by Mathematics and Informatics Faculty board 05/12/2022. Resolution No. (1.5 E) 110000-TPN-40

Board Chairman – assoc. prof. dr. Kristina Lapin