University of Gdańsk

Subject card

Subject name and code	Introduction to Generalized Linear Models, PG_00174272						
Field of study	Mathematical Modeling and Data Analysis						
Date of commencement of studies	October 2023		Academic year of realisation of subject	2025/2026			
Education level	Bachelor's studies		Subject group				
Mode of study	full-time studies		Mode of delivery	at the university			
Year of study	3		Language of instruction	Polish			
Semester of study	6		ECTS credits	6.0			
Learning profile	academic		Assessment form	credit			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Janusz Przewocki				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	60		0.0		0.0	60
Subject objectives	The goal is to introduce the basics of generalized linear models.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[MMiADL3_W09] knows and understands the basics of computational and programming techniques supporting mathematician's work and understands their limitations	1. The student knows the method of maximum likelihood estimation of model parameters, 2. The student knows the logistic regression method for models with binary and multi-point explained variables, 3. The student knows Poisson regression for count-type explained variables, the family of exponential probability distributions, 4. The student knows the construction of generalized nonlinear models, 5. The student knows the basic methods of diagnosing parameter estimation in generalized linear models.	[SW4] test/exam - oral or written
	[MMiADL3_U10] is able to recognise problems, including practical issues, that can be solved algorithmically; can make a specification of such a problem	1. The student can perform parameter estimation of a nonlinear model using the nonlinear regression method. 2. The student can perform parameter estimation of the logistic regression function for a model with a binary and multiple explanatory variable. 3. The student can perform parameter estimation of the Poisson regression function for a count-type explanatory variable, as well as estimate parameters of the generalized linear model. 4. The student can conduct diagnostics of the parameter estimation of the generalized linear model.	[SU2] presentation/project/paper/ report
	[MMiADL3_U11] knows how to arrange and analyse an algorithm in accordance with the specification and save it in the selected programming language	1. The student is able to present the results of statistical analyses conducted using generalized linear models implemented in a chosen programming language.	[SU2] presentation/project/paper/ report
	[MMiADL3_K02] is ready to precisely formulate questions to deepen his/her own understanding of a given topic or to find missing elements of reasoning	1. The student is ready to take a critical look at the results of statistical analyses conducted using generalized linear models.	[SK8] observation of student's independent or team work

<table>
<tr><td>Subject contents</td><td>1. Nonlinear regression: nonlinear models and the possibility of their linearization; estimation of nonlinear models using the least squares method.

2. The maximum likelihood method - generalization of the topic to probability distributions other than normal.

3. Numerical solution of the problem of maximizing the likelihood function.

4. Logistic regression for a model with a two-point dependent variable.

5. Logistic regression for a model with a multi-point dependent variable.

6. Poisson regression for a counting dependent variable.

7. Discussion of the exponential family of probability distributions.

8.Generalized linear models.

9. Model diagnostics.

10. The phenomenon of overdispersion.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basics of statistical inference</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>project</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>written or oral exam</td><td>51.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>1. Aneta Ptak-Chmielewska, Uogólnione modele liniowe, Oficyna Wydawnicza SGH
2. Raymond H. Myers Douglas C. Montgomery G. Geoffrey Vining Timothy J. Robinson, Generalized Linear Models: With Applications in Engineering and the Sciences, 2010 John Wiley & Sons, Inc.</td></tr>
<tr><td>Supplementary literature</td><td>1. R. Dennis Cook Sanford Weisberg, Applied Regression Including Computing and Graphics, 1999 John Wiley & Sons, Inc.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Interpretation of logistic/poisson model coefficients

2. Testing the fit of generalized linear models

3. Please determine if a given distribution belongs to the exponential family of distributions.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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