



Univerza v Mariboru

Fakulteta za naravoslovje
in matematiko

UČNI NAČRT PREDMETA / COURSE SYLLABUS

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|----------------------|-----------------------------------------|
| Predmet: | Multivariatne statistične metode |
| Course title: | Multivariate Statistics Methods |

| Študijski program in stopnja Study programme and level | Študijska smer Study field | Letnik Academic year | Semester Semester |
|-----------------------------------------------------------|-------------------------------|-------------------------|----------------------|
| Matematika, 2. stopnja | | 1. ali 2. | 1. ali 3. |
| Mathematics, 2 nd cycle | | 1. or 2. | 1. or 3. |

Vrsta predmeta / Course type

Univerzitetna koda predmeta / University course code:

| Predavanja Lectures | Seminar Seminar | Sem. vaje Tutorial | Lab. vaje Laboratory work | Teren. vaje Field work | Samost. delo Individ. work | ECTS |
|------------------------|--------------------|-----------------------|------------------------------|---------------------------|-------------------------------|------|
| 45 | | | 30 | | 135 | 7 |

Nosilec predmeta / Lecturer:

Jeziki / Languages: **Predavanja / Lectures:**
Vaje / Tutorial:

Pogoji za vključitev v delo oz. za opravljanje študijskih obveznosti:

Poznavanje splošne (osnovne) statistike in linearne algebre.

Vsebina:

- Uvod v multivariatno analizo: Osnove statistične analize podatkov. Variančno-kovariančna matrika in korelacijska matrika. Standardiziranje podatkov. Grafična predstavitev multivariatnih podatkov.
- Razvrščanje v skupine: Proces razvrščanja v skupine. Mera podobnosti in različnosti. Optimizacija in kriterijske funkcije. Hierarhične metode (minimalna, maksimalna, Wardova,...) in nehierarhične metode (metoda

Prerequisites:

Knowledge of general (basic) statistics and linear algebra.

Content (Syllabus outline):

- Introduction to multivariate analysis: Basic statistical data analysis. Variance-covariance matrix and correlation matrix. Data standardization. Graphical representation of multivariate data.
- Clustering: Clustering process. Measure of similarity and dissimilarity. Optimization and criteria functions. Hierarchical methods (minimal, maximal, Ward's) and non-hierarchical methods (k-means clustering).

voditelj). Dendrogram. Določanje števila skupin. Grafična predstavitev večrazsežnih podatkov.

- Metoda glavnih komponent: Večrazsežnost podatkov. Korelacijska matrika. Komunalitete in pojasnjena varianca. Določanje števila glavnih komponent.
- Faktorska analiza: Manifestne in latentne spremenljivke. Splošni faktorski model in ocenjevanje. Metode faktorске analize (metoda glavnih osi, metoda največjega verjetja). Pravokotne in poševne rotacije.
- Diskriminantna analiza: Predpostavke. Diskriminantni kriterij. Pravila uvrščanja enot v skupine. Diskriminantna funkcija in klasifikacijska tabela. Pomen napovednih spremenljivk in centroidov.
- Kanonična korelacijska analiza: Kanonične rešitve. Kanonične in strukturne uteži.

Dendrogram. Choosing the number of clusters. Graphical representation of high-dimensional data.).

- Principal component analysis: High-dimensional data space. Correlation matrix. Commonalities and explained variance. Choosing the number of principal components.
- Factor analysis: Manifest and latent variables. Factor model and estimation. General factor model and estimation. Factor analysis methods (principal axis factoring and maximum likelihood). Orthogonal and oblique rotations.
- Discriminant analysis: Assumptions. Discriminant criteria. Classification rules. Discriminant function and classification table. Importance of manifest variables and centroids.
- Canonical correlation analysis: Canonical solutions. Canonical and structure loadings.

Temeljni literatura in viri / Readings:

1. Dillon W.R. in Goldstein M.: Multivariate Analysis, Wiley, New York, 1984.
2. Mardia K.V., Kent J.T. in Biliy J.m.: Multivariate Analysis, Academic Press, London, 1979.
3. Sharman S.: Applied multivariate techniques, Wiley, New York, 1996.
4. Ferligoj A.: Razvrščanje v skupine, Metodološki zvezki, 4, FSPN, Ljubljana, 1989.
5. Omladič V.: Uporaba linearne algebre v statistiki, Metodološki zvezki, 13, FDV, Ljubljana, 1997.

Cilji in kompetence:

Glavni cilj predmeta je proučiti najpomembnejše koncepte, metode in rezultate multivariatne analize.

Objectives and competences:

The main goal of the course is to study the fundamental concepts, methods and results of multivariate analysis.

Predvideni študijski rezultati:

Znanje in razumevanje:

- Razumevanje in poznavanje osnovnih pojmov multivariatne analize.
- Razumevanje, izvajanje in interpretacija različnih metod multivariatne analize.
- Obvladanje ustrezne programske opreme za namene statističnega raziskovanja.

Prenosljive/ključne spretnosti in drugi atributi:

Intended learning outcomes:

Knowledge and Understanding:

- Understanding and knowledge of the basic concepts of multivariate analysis.
- Understanding, correct application and interpretation of different methods of multivariate analysis.
- Knowledge of using an appropriate software for statistical research.

Transferable/Key Skills and other attributes:

| | | | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <ul style="list-style-type: none"> • Prenos znanja iz statistike na različna strokovna in znanstvena področja, kjer se uporabljajo metode multivariatne analize. | | <ul style="list-style-type: none"> • Knowledge transfer of statistical methods into different areas dealing with multivariate analysis methods. | |
| Metode poučevanja in učenja: | | Learning and teaching methods: | |
| <ul style="list-style-type: none"> • Predavanja • Laboratorijske vaje • Projekt | | <ul style="list-style-type: none"> • Lectures • Laboratory exercises • Project | |
| Načini ocenjevanja: | | Assessment: | |
| Način (pisni izpit, ustno izpraševanje, naloge, projekt): | Delež (v %) / Weight (in %) | Type (examination, oral, coursework, project): | |
| <ul style="list-style-type: none"> - Pisni test – praktični del - Izpit (ustni) – teoretični del - Projekt | 50% 30% 20% | <ul style="list-style-type: none"> - Written test – practical part - Exam (oral) – theoretical part - Project | |
| <ul style="list-style-type: none"> - Vsaka izmed naštetih obveznosti mora biti opravljena s pozitivno oceno. | | <ul style="list-style-type: none"> - Each of the mentioned commitments must be assessed with a passing grade. | |
| <ul style="list-style-type: none"> - Pozitivna ocena pri pisnem testu je pogoj za pristop k izpitu. | | <ul style="list-style-type: none"> - Passing grade of the written test is required for taking the exam. | |

Reference nosilca / Lecturer's references:

1. ČELOFIGA, Andreja, KORES-PLESNIČAR, Blanka, KOPRIVŠEK, Jure, MOŠKON, Miha, BENKOVIČ, Dominik, GREGORIČ KUMPERŠČAK, Hojka. Effectiveness of de-escalation in reducing aggression and coercion in acute psychiatric units : a cluster randomized study. *Frontiers in psychiatry*. Apr. 2022, vol. 13, str. 1-14, ilustr. ISSN 1664-0640.
<https://www.frontiersin.org/articles/10.3389/fpsy.2022.856153/full#fun1>, <https://doi.org/10.3389/fpsy.2022.856153>, DOI: [10.3389/fpsy.2022.856153](https://doi.org/10.3389/fpsy.2022.856153). [COBISS.SI-ID [104051971](https://www.cobiss.si/id/104051971)]
2. BENKOVIČ, Dominik. Lie σ -derivations of triangular algebras. *Linear and Multilinear Algebra*. 2022, vol. 70, iss. 15, str. 2966-2983. ISSN 0308-1087.
<https://www.tandfonline.com/doi/full/10.1080/03081087.2020.1820431>, DOI: [10.1080/03081087.2020.1820431](https://doi.org/10.1080/03081087.2020.1820431). [COBISS.SI-ID [127110659](https://www.cobiss.si/id/127110659)]
3. BENKOVIČ, Dominik, GRAŠIČ, Mateja. Jordan $\{g,h\}$ -derivations of unital algebras. *Operators and matrices*. 2022, vol. 16, no. 2, str. 415-428. ISSN 1846-3886.
<http://oam.ele-math.com/16-32/Jordan-g,h-derivations-of-unital-algebras>, DOI: [10.7153/oam-2022-16-32](https://doi.org/10.7153/oam-2022-16-32). [COBISS.SI-ID [114972163](https://www.cobiss.si/id/114972163)]