

Title:	Multivariate analysis and its tools - Families of MSA Methods
Lecture hours:	Contact hours: 45 hours with the teacher: usually 9 meetings for 5 hours including assessment projects presentations Self study: 20-30 hours student's self-study The course may be delivered in a blended learning format. Owing to the use of the R statistical software, practical sessions, workshops and project presentations can be conducted either on campus or online, providing flexibility while maintaining the intended learning outcomes.
Study period: (summer/winter)	Summer and winter semester
Number of credits:	3 ECTS
Assessment methods:	– 70% attendance at the course; – active participation during classes; – completion of practical exercises; – towards the end of the course, students will prepare and present a project applying selected MSA methods to a real or simulated dataset (final examination).
Language of instruction:	English
Prerequisites:	Students need to speak English well enough to participate in classes conducted in English (B1+ or higher). Basic knowledge of statistics and spreadsheet software (e.g., MS Excel) is recommended.
Course content:	The Families of MSA Methods course introduces students to the most important groups of Multidimensional Statistical Analysis (MSA) methods used in economics, finance, management, social sciences and business analytics. The course combines theoretical background with practical applications using real datasets. Students will learn how to select appropriate methods, interpret results and draw meaningful conclusions from multidimensional data. Module 1. Introduction to Multidimensional Statistical Analysis (MSA) • Introduction to MSA • Types of multidimensional data • Data preparation and standardization • Selection of appropriate analytical methods Module 2. Dimensionality Reduction Methods • Principal Component Analysis (PCA) • Factor Analysis (FA) • Interpretation of principal components and factors • Practical applications and examples Module 3. Classification and Clustering Methods • Cluster analysis • k-means clustering • Hierarchical clustering • Correspondence analysis

	• Interpretation of classification results Module 4. Ranking and Ordering Methods • Linear ordering methods • Construction of synthetic measures • Borda count method • Introduction to the Shapley value • Applications in decision support Module 5. Composite Indicators Construction • Variable selection • Data normalization and standardization • Weighting methods • Aggregation techniques • Construction and interpretation of composite indices Module 6. Practical Applications of MSA Methods • Case studies from economics, finance and management • Interpretation of software output • Student project presentations • Discussion of results and conclusions
Learning outcomes:	By the end of the Families of MSA Methods course you will have: • developed an understanding of the main families of multidimensional statistical analysis methods; • understood the principles of selecting appropriate MSA methods for different research problems; • learned how to prepare multidimensional datasets for analysis; • applied dimensionality reduction, clustering and ranking methods to real datasets; • interpreted statistical results obtained using selected MSA techniques; • constructed and evaluated composite indicators; • developed analytical and critical thinking skills in multidimensional data analysis; • improved professional statistical and analytical vocabulary used in research and business practice. During the course you will also have several opportunities to work with other international students to build strong international, analytical and social competences.
Name of lecturer:	Dr Dagna Wleklińska
Contact (email address):	dagna@ukw.edu.pl

Literature:	• Hair J.F., Black W.C., Babin B.J., Anderson R.E., <i>Multivariate Data Analysis</i>, Pearson. • Everitt B., Hothorn T., <i>An Introduction to Applied Multivariate Analysis with R</i>, Springer. • Rencher A.C., Christensen W.F., <i>Methods of Multivariate Analysis</i>, Wiley. • Jolliffe I.T., Cadima J., <i>Principal Component Analysis: A Review and Recent Developments</i>, Philosophical Transactions of the Royal Society A. • Additional materials, scientific articles and datasets provided by the Lecturer.
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