UNIVERSITY OF PANNONIA

COURSE DATASHEET

Semester:	2025/26/2
Course:	Subprogam oriented knowledge - quantitative methods
Code:	PEDIECON143
Responsible department:	
Department code:	DIGDI
Responsible instructor:	Dr. Zsolt Tibor Kosztyán

Course objectives:

The aim is for students to acquire the spatial knowledge necessary for the study of economic and social relations.

network and econometric models.

Knowledge:

- Familiar with the concepts of data analysis, ethics, data security, mathematics, statistics, programming principles and contexts, in particular data types, data representations, data transformation and optimisation procedures, multivariate statistics, and machine learning necessary for an innovative, research-level data science activity.

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Course objectives:

- He/she is familiar with the current technologies used for analysis and modelling and can apply them in real-life situations with large amounts of data.

Ability:

- He/she is able to formalize complex classification, modelling and forecasting problems in different disciplines, define the necessary theoretical and practical methods and solve them.

- He/she knows the dependency relations between data elements and the structurability and types of data. He/she is able to make the data analysis strategy independent of the technology when the technology changes.

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Course objectives:

Skills are developed and measured by class and submitted assignments.

attitude:

• Keeps abreast of the latest results in artificial intelligence, data science and related fields, primarily related to mathematics, statistics, IT, and special areas, and strives to put them to the service of their own development.

autonomy and responsibility:

• Pays great attention to the precise completion of their tasks and the exact observance of deadlines, or ensuring their observance.

• Suitable for performing routine recognition, recommendation, generation and support system design tasks both individually and as a member or leader of a group.

Course content:

1. Social and economic networks I - production, organisational networks (random networks, small worlds)

2. Social and economic networks II - economic networks (Mathew effect, scale-free networks, preference attachments)

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Course content:

3. The role of location, geographical networks and models

4. Network properties and their economic meaning (asymmetry, centrality, densification)

5. Identification of communities, modules, null models

6. Modelling the formation of networks

7. Modelling the evolution of networks and shocks

8. Linking network and econometric models I - Geographical, economic models (gravity,

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Course content:

logistic regression, random forests) in modelling the self-organisation of the network

9 Linking network and econometric models II - Application of network-based modelling and data reduction methods

10. Robustness, resilience, maintainability in production systems and supply chains

11-13: Investigating multi-layered economic networks and extending single layer models to mult layers

14: Network-based time series and spatial autocorrelation studies on mobility and migration networks

Requirements, evaluation and grading:

At least 60% of the obtainable points must be achieved to achieve a sufficient grade. The condition of signing is that you write a closed document or complete the assignments by the

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Requirements, evaluation and grading:

deadline. During the semester, it is mandatory to write a closed paper, which can be replaced by submitting 2 assignments by the deadline.

The use of AI must be indicated in every submitted assignment.

Required and recommended readings:

- Aura Reggiani, Daniele Fabbri: Network Developments in Economic Spatial Systems, Taylor & Francis Group, 2020, ISBN 1138333549, 9781138333543

- Aura Reggiani, Laurie A. Schintler, Danny Czamanski · Handbook on Entropy, Complexity and Spatial Dynamics: A Rebirth of Theory? 2021, Edward Elgar Publishing. Copyright. ISBN: 9781839100598

Learning outcome:

During the course, students develop their analytical and problem-solving skills. The course develops critical thinking competence through solving and analyzing class assignments.