SYLLABUS

1. Information about the study program

1.1 Higher education institution	Babeș-Bolyai University
1.2 Faculty	Faculty of Psychology and Educational Sciences
1.3 Department	Department of Psychology
1.4 Field of study	Psychology - Cognitive Sciences
1.5 Study cycle	Bachelor level
1.6 Study program / Qualification	Psychologist

2. Information about the course

2.1 Title of the course			Big Data Analysis				
2.2 Teacher in charge of the lecture			Senior assistant professor Ioana-Georgiana Ciuciu, PhD Associate professor Sebastian Pintea, PhD*				
2.3 Teacher in charge of the seminar			Senior assistant professor Ioana-Georgiana Ciuciu, PhD Associate professor Sebastian Pintea, PhD*				
2.4 Study year	2	2.5 Semester	2	2.6. Examination type	E	2.7 Course type	
**Both teachers are in charge with lectures and seminars because both lectures and seminars have a multidisciplinary approach (Data Science and Psychology/Cognitive Sciences)*							

3. Estimated total time (number of hours of teaching activities per semester)

3.1 Number of hours per week	3	out of which: 3.2 lecture	2	3.3 seminar / laboratory	1
3.4 Total number of hours in the curriculum	100	out of which: 3.5 lecture	28	3.6 seminar / laboratory	14
Distribution of the allocated amount of time:					hours
Individual study (textbook, course support, bibliography, and notes)					28
Supplementary documentation at the library using specialized electronic platforms in the field					15
Preparing for seminars / laboratories, homework, papers, portfolios, and essays					10
Tutoring					2
Exams					2
Other activities: research activities					1

3.7 Total number of hours of individual study	58
3.8 Total number of hours per semester	100
3.9 Number of credits (ECTS)	4

4. Prerequisites (if applicable)

4.1 Curriculum	• Quantitative research methods
4.2 Competencies	• Basic knowledge of data analytics, preferably • Basic knowledge of data visualization, preferably • Basic programming skills

5. Requirements (if applicable)

5.1 For the lecture	• Classroom with at least 180 seats, computer and video projector / Online course conducted through the MS Teams platform.
5.2 For the seminar / laboratory	• Room with at least 50 seats, computer and video projector / Online seminar conducted through the MS Teams platform. • Room with computers as needed; • Big Data software installed • High level programming language environment

6. Specific skills acquired

Professional skills	**Knowledge and understanding** • Understanding the specificity of Big Data in the context of psychological research • Knowledge of the main sources of Big Data for psychological research and the main procedures of processing Big Data • Understanding the role of Big Data analysis in cognitive sciences, social psychology, healthcare and other related fields of knowledge **Explanation and interpretation** • Explaining specific behaviors using complex models based on Big Data analysis • Interpreting the results of Big Data analysis by integrating empirical findings with the psychological theoretical context **Instrumental - applicative** • Use of non-traditional databases for storing and processing large amounts of data

	• Advanced querying over distributed information resources • Evaluation, testing and validation with real-world data • Learning to conduct incipient research in the field of Big Data **Attitude** • Manifest openness to the contributions of Big Data in the field of cognitive sciences
Transversal skills	● Methods and algorithms for data processing and analysis applied to Cognitive Science and Big Data ● Multidisciplinary competencies spanning various application sectors (mainly from cognitive sciences) ● Data Science competencies, combining data analyst and basic data engineer competencies (e.g., competencies from the fields of mathematics, statistics, information science, computer science, databases, machine learning, data mining, visualization, etc.)

7. Objectives of the course (based on the grid of acquired competencies)

7.1 General objective	Handling and analyzing large amounts of digital data in the field of cognitive science
7.2 Specific objectives	Understanding and using novel algorithms, software infrastructures and methodologies for the purpose of processing and especially consuming (retrieve, analyze) large amounts of data in the field of cognitive sciences Provide decision support over large volumes of cognitive and social sciences data Enable the creation of applications and services for various applicative domains of cognitive sciences based on the results of big data analysis

8. Content

8.1 Lecture	Teaching strategies	Remarks
1. Challenges of Psychology in Big Science	Lecture, demonstrative example, synthesis of knowledge, guided discovery	From hypothesis testing to inductive research From correlation to causation and back
2. Introduction to Data Science and Big	Lecture, demonstrative	Data Science

Data – part 1	example, synthesis of knowledge, guided discovery	main concepts, the Data Science Process
3. Introduction to Data Science and Big Data – part 2	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Challenges, data availability, data types, tools
4. PsychometricAspects in Big Data Analysis	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Validity and reliability in Big Data
5. Big Data Pipeline	Lecture, demonstrative example, synthesis of knowledge, guided discovery	The building blocks of a Big Data pipeline Addressing both the data processing and the data analysis
6. Big Data Architecture	Lecture, demonstrative example, synthesis of knowledge, guided discovery	The Lambda Architecture, a model for building a Big Data system, case studies and examples
7. Big Data Storage and Processing – part 1	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Big Data storage models, with focus on the NoSQL solutions Tutorial provided
8. Big Data Storage and Processing – part 2	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Big Data processing models, examples, case studies Tutorial provided
9. Data Visualization	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Scientific data visualization principles, Batch view, Real-time view Tutorial provided
10. Statistic Analysis of Big Data	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Regression, classi fication, and clustering

11. Big Data Applications in Cognitive Psychology	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Studies upon memory, attention, psycholinguistics
12. Big Data Applications in Social Psychology	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Studies upon intentions, social networks, persuasion
13. Big Data Applications in Healthcare	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Analysis of health care policies, identifying risks, designing prevention programs
14. Ethical Aspects of Big Data in Psychological Research	Lecture, demonstrative example, synthesis of knowledge, guided discovery	Privacy, confidentiality, cyber security

Mandatory references:

Marz, N., & Warren, J.(2015). *Big Data. Principles and Best Practices of scalable real-time systems*. Manning Publications

Cielen, D., Meysman, A.D.B., & Ali, M. (2016). *Introducing Data Science. Big Data, machine learning, and more, using Python tools*. Manning Publications

Optional references:

Grus, J. (2019). *Data Science from Scratch: First Principles with Python*.O'Reilly Media, Inc.

Damji, J.S., Wenig, B., Das, T., & Lee, D. (2020). *Learning Spark*. O'Reilly Media, Inc.

Sadalage, P., Fowler, M. (2013). *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*. Pearson Education, Inc.

Agneeswaran, V. (2014). *Big Data Analytics Beyond Hadoop*. Pearson Education

White, T. (2009). *Hadoop: The Definitive Guide*. O'Reilly

McCallum, Q. E. (2012). *Bad Data Handbook: Cleaning Up The Data So You Can Get Back To Work*. O'Reilly

Mandatory references:

Jones, M. N. (Ed.). (2017). *Big data in cognitive science*. Routledge, New-York

Woo, S.E., Tay, L. E., & Proctor, R. W. (2020). *Big Data in psychological research*. American Psychological Association

Optional references:

Adjerid, I., & Kelley, K. (2018). Big data in psychology: A framework for research advancement. *American Psychologist*, *73*, 899–917. http://dx.doi.org/10.1037/amp0000190

Akhtar, R., Winsborough, D., Ort, U., Johnson, A., & Chamorro-Premuzic, T. (2018). Detecting the dark side of personality using social media status updates. *Personality and Individual Differences*, *132*, 90–97. http://dx.doi.org/10.1016/j.paid.2018.05.026

Albritton, B. H., & Tonidandel, S. (2020). How Can Big Data Science Transform the Psychological Sciences?. *The Spanish journal of psychology*, *23*, e44. https://doi.org/10.1017/SJP.2020.45

Birkhead, G. S., Klompas, M., & Shah, N. R. (2015). Uses of electronic health records for public health surveillance to advance public health. *Annual Review of Public Health*, *36*, 345–359. http://dx.doi.org/10.1146/annurev-publhealth-031914-122747

Cheung, M. W., & Jak, S. (2016). Analyzing Big Data in Psychology: A Split/Analyze/Meta-Analyze Approach. *Frontiers in psychology*, *7*, 738. https://doi.org/10.3389/fpsyg.2016.00738

Coviello, L., Sohn, Y., Kramer, A. D. I., Marlow, C., Franceschetti, M., Christakis, N. A., & Fowler, J. H. (2014). Detecting emotional contagion in massive social networks. *PLoS One*, *9*(3), e90315. http://dx.doi.org/10.1371/journal.pone.0090315

Lin Qiu & Sarah Hian May Chan & David Chan, 2018. "Big data in social and psychological science: theoretical and methodological issues," Journal of Computational Social Science, Springer, vol. 1(1), pages 59-66, January.

8.2 Seminar / laboratory	Teaching strategies	Remarks
1. Challenges of Psychology in Big Science	Group activities, guided discovery, practical activities	Exercises of hypothesis testing vs. exploratory/inductive research Illustrations of correlation vs. causal research
2. Introduction to Data Science and Big Data – part 1	Knowledge synthesis, conceptual clarification, practical activities	Illustrating and working with the Data Science main concepts Examples and exercises around the Data Science Process applied to Cognitive Sciences
3. Introduction to Data Science and Big Data – part 2	Knowledge synthesis, conceptual clarification, group activities, practical activities	Approaching Big Data Challenges in Cognitive Sciences Exercises around the various data types

4. Psychometric Aspects in Big Data Analysis	Knowledge synthesis, conceptual clarification, practical activities	Analysis of validity and reliability of measurements in classical context of research vs. Big Data
5. Big Data Pipeline	Group activities, guided discovery, practical activities	Approaching the building blocks of a Big Data pipeline with real-world examples/ problems
6. Big Data Architecture	Group activities, guided discovery, practical activities	Modeling a Big Data system based on the Lambda Architecture
7. Big Data Storage and Processing – part 1	Practical activities, group activities	NoSQL Tutorial
8. Big Data Storage and Processing – part 2	Practical activities, group activities	NoSQL Tutorial
9. Data Visualization	Practical activities, group activities	Performing basic data visualization assignments Tutorial provided
10. Statistic Analysis of Big Data	Group activities, guided discovery, practical activities	Regression, classification and clustering exercises using JASP applications
11. Big Data Applications in Cognitive Psychology	Presentation, conceptual clarification, group activities	Critical analysis of several empirical studies based on Big Data in Cognitive psychology
12. Big Data Applications in Social Psychology	Presentation, conceptual clarification, group activities	Critical analysis of several empirical studies based on Big Data in Social psychology
13. Big Data Applications in Healthcare	Presentation, conceptual clarification, group activities	Critical analysis of several empirical studies based on Big Data in Health care
14. Ethical Aspects of Big Data in Psychological Research	Guided discovery, practical activities	Case studies illustrating the issues of privacy, confidentiality and cyber security

Mandatory references:

Optional references:

Same as for the course

9. Correlations between the content of the course and the expectations of the representatives of the epistemic community, professional associations and representative employers in the field related to the program

The proposed lecture and seminar offer central topics in fundamental and applied research in the fields of cognitive sciences, and their approach is based on the most recent results found in the literature. The course also offers state of the art research skills that are transferable to any scientific and applied field of knowledge.

Synergies with various local and EU initiatives: local industry, European Data Science Academy (EDSA, https://edsa-project.eu/),EU projects such as LETHE (https://cordis.europa.eu/project/id/101017405), FARE (https://cordis.europa.eu/project/id/853566), the Human Brain Project (https://www.humanbrainproject.eu/en/), SoBigData (http://project.sobigdata.eu/), etc.

Synergies with the Big Data course from the Faculty of Mathematics and Computer Science (possible collaboration between the Computer Science students and the Psychology students, where the former could play the role of data engineers and the latter could play the role of data consumers or even data analysts).

10. Evaluation

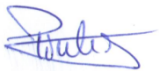
Activity type	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final grade
10.4 Lecture	- to be familiar with the main concepts from Cognitive Science and Data Science -to be able to model a Cognitive Science problem problem as a Big Data problem - to be able to apply these principles in use	Written exam	50%

	cases from Cognitive Science		
10.5 Seminar / laboratory	- to be able to approach big data challenges from the domain of Cognitive Science - to be able to consume (query, analyze)Big Data in order to derive information relevant to Cognitive Science use cases - to demonstrate critical thinking - to successfully perform individual and team-based tasks	Semester project	50%
10.6 Minimum passing score			
The final grade consists of: a. score obtained in the written exam/research essay in proportion of 50%. b. semester project 50%.			

Date 22.11.2021

Signatures of the teachers in charge of the lecture and seminar

Senior assistant professor Ioana-Georgiana Ciuciu 

Associate professor Sebastian Pintea 

Approval date in the department

Signature of the Head of the department /director