

DATA SCIENCE, YEAR 2, SEMESTER 3

Course title: Innovative project 3 (Innovative project 3 – Go to market Strategies)

Lecture type: Obligatory

ECTS: 6

Course overview

This is a series of three interconnected modules (Innovative Project 1-2-3)

The aim of the module is for student teams to finalise their innovative products/services. They will make their first attempts, facilitated by their teachers and mentors, at acquiring their first customers. Using the wide university's ecosystem, they will be given guidance at building partnership networks needed for successful product launch.

Students will also learn what are the required steps in the process of intellectual property protection, as well as about the legal framework for regulation of team relations. They will be shown how the financing path of a startup looks like, what are pros and cons of bootstrapping as opposed to the bankrolling or VC investments.

Finally, with the help of professional communication experts, they will work on perfecting their final pitch. They will acquire the skills of an elevator pitch, pitch for investors, and wide-audience sales pitch. In the final step of the module, they will pitch their new products/services before a wide audience of investors, companies and business experts – their potential future partners, customers, but also employers.

<u>MINIMAL LEARNING OUTCOMES</u>	<u>PREFERRED LEARNING OUTCOMES</u>
<ol style="list-style-type: none">1. Implement development plan in order to produce final digital product / service.2. Critically evaluate final solution in respect to initial market research and conceptual model.3. Implement effective intellectual property protection and regulation of team relations contract.4. Implement and design technical documentation for final solution using classical or agile development methodology and relevant standards.5. Successfully present innovative solution to market / investors and public in line with selected financing method.	<ol style="list-style-type: none">1. Implement best practices approaches while implementing development plan and producing final digital product / service.2. Enhance final solution using best practices approaches to fit market research inputs and iterative piloting with users.3. Use best practices while implementing effective intellectual property protection and regulation of team relations contract.4. Use best practices approaches while implementing and design technical documentation for final solution, using classical or agile development methodology and relevant standards.5. Select financing and presentation approach to market / investors and public which would provide best results.

Course title: Analytical techniques based on large data sets

Lecture type: Obligatory

ECTS: 6

Course overview

The aim of the course is to develop students' awareness of the potential of large data sets using analytical tools and techniques to plan business activities. The aim of the course is to enable students to actively use tools and analytical techniques that will help them to extract knowledge from large data sets for business planning purposes.

An introduction to large data sets and their analytics. Python programming language - basics. Data structures in python. Objects in python. Open source libraries for large data sets analysis. Analysis of unstructured data source for the campaign. Understanding the Text. Planning of business activities based on the discovery of quoted samples and meaning. Targeted campaigns and big days. Early warning system development strategy. System development strategies for preventive termination of contractual relations. Strategies for segmentation system development. CRM system development strategies. Integration of technologies. Trends and future.

<u>MINIMAL LEARNING OUTCOMES</u>	<u>PREFERRED LEARNING OUTCOMES</u>
<ol style="list-style-type: none">1. Review potentials of large data sets.2. Review analytical techniques to analyze large data sets.3. Review campaigns using knowledge from large data sets.4. Evaluate product quality using knowledge from large data sets.5. Evaluate tools and techniques for image recognition.	<ol style="list-style-type: none">1. Evaluate the potentials of large data sets for business planning.2. Evaluate analytical techniques to analyze large data sets.3. Recommend methods for discovering knowledge from large data sets for your campaign.4. Recommend methods for discovering knowledge from large data sets for the development of new products.5. Recommend tools and techniques for specific computer vision use-case.

Course title: **Advanced Machine Learning Methods**

Lecture type: Obligatory

ECTS: 6

Course overview

Introduction to deep learning. Perceptron. Logistic Regression. Artificial neural networks. Stochastic gradient descent. Regularization. Convolutional neural networks. Autoencoders. Recurrent neural networks. Neural language models. Trends and future. Deep learning is today the most important machine learning method used in the world's most important production systems for various tasks. Through this course, we will present and implement basic deep learning techniques on examples from natural language processing such as machine translation, sentiment analysis, and recognition of named entities. Also, the course will handle awarded learning.

The course objective is to enable students to deepen their understanding of mathematics and algorithms of deep neural architecture and deep learning, as well as acquire practical knowledge to implement deep learning. Students will acquire the skills of designing deep architecture in TensorFlow, as well as hand-made deep neural networks that can be implemented later in any programming language.

<u>MINIMAL LEARNING OUTCOMES</u>	<u>PREFERRED LEARNING OUTCOMES</u>
<ol style="list-style-type: none">1. Understand how basic deep learning algorithms work.2. Describe the flow of data through an artificial neuron.3. Evaluate the impact of different depth architectures on the speed of calculation.4. Analyze the results of deep learning over the data.	<ol style="list-style-type: none">1. Judge which algorithm is best for a particular problem.2. Critically evaluate changes in information during passage through artificial neuron.3. Evaluate the influence of different components of deep neural architecture.4. Directly apply the selected depth architecture to the problems of natural language processing and computer vision.

Course title: Management of Information Services

Lecture type: Obligatory

ECTS: 3

Course overview

Adoption of terms, concepts, knowledge and skills for information services management in line with ITIL 2011 and ISO/IEC 20000-1:2011.

Basic terms and concepts of information services management, Service strategy - principles and processes, Service design - principles and processes, Service transition - principles and processes, Service operation - principles, processes and functions, Continual service improvement - principles and processes.

<u>MINIMAL LEARNING OUTCOMES</u>	<u>PREFERRED LEARNING OUTCOMES</u>
<ol style="list-style-type: none">1. Define basic terms used in information services management.2. Define purpose, objectives, principles and processes in the service strategy stage.3. Define purpose, objectives, principles and processes in the service design stage.4. Define purpose, objectives, principles and processes in the service transition stage.5. Define purpose, objectives, principles, processes and functions in the service operation stage.6. Define purpose, objectives, principles and process in the continual service improvement stage.	<ol style="list-style-type: none">1. Explain basic terms used in information services management.2. Explain purpose, objectives, principles and processes in the service strategy stage and integration with other stages in the service lifecycle.3. Explain purpose, objectives, principles and processes in the service design stage and integration with other stages in the service lifecycle.4. Explain purpose, objectives, principles and processes in the service transition stage and integration with other stages in the service lifecycle.5. Explain purpose, objectives, principles, processes and functions in the service operation stage and integration with other stages in the service lifecycle.6. Explain purpose, objectives, principles and process in the continual service improvement stage and integration with other stages in the service lifecycle.

Course title: Visualisation and analytical software tools

Lecture type: Obligatory

ECTS: 3

Course overview

The course objective is to introduce students with basic visualization techniques, explorative data analysis and predictive modeling. It is a necessary theoretical and practical knowledge and skills for all business areas that are characterized by a large amount of data. Besides the technique, students are introduced to various visualization tools, exploratory data analysis tools and predictive modeling tools.

Introduction to data visualization. The visual apparatus. The most common errors in data visualization. Types of visualization tools. Analytical interactions: comparison, sorting and grouping, aggregation, change the definition of variables. Analysis of the structure, distribution and time series. Forecasting. Analysis of deviations and correlations. Spatial analysis. Dashboards for visualization and exploratory analysis. Data processing in SPSS Modeler. Feature engineering. Predictive modeling.

<u>MINIMAL LEARNING OUTCOMES</u>	<u>PREFERRED LEARNING OUTCOMES</u>
<ol style="list-style-type: none">1. Select appropriate visualization tool, correct visualization errors and achieve graphical integrity of given example.2. Prepare data from a single data source for visual analysis and create an interactive dashboard based on given dataset and requested granularity levels.3. Join data from multiple sources, aggregate, filter and restructure tabular data, choose and apply appropriate method for handling missing values.4. Apply and interpret the results of simple machine learning algorithms and statistical models.	<ol style="list-style-type: none">1. Select appropriate visualization tool, correct visualization errors, and critically interpret choice of analytical patterns and the techniques of analytical interaction used to achieve graphical integrity of given example.2. Link data from multiple sources for visual analysis, create complex interactive dashboard - argue the choice of granularity and used dashboard elements.3. Apply advanced data preprocessing techniques to create features (variables) for predictive models.4. Apply and interpret the results of complex machine learning algorithms and statistical models, evaluate model performance and choose the best model using standard machine learning metrics.

Course title: Cloud Analysis

Lecture type: Elective*; ECTS: 6

Course overview

One of the areas that will experience big changes with increasing computing in the cloud is data analysis and quantitative modeling. The increasing volume and speed of data generation on the one hand and the increasing need for cost efficiency, speed of reaction and flexibility on the other, increasingly direct organizations to using analytic clouds. Analytical cloud services are now the dominant form of large data analysis based on distributed technologies such as Apache Hadoop, Apache Spark, Dremel, etc. HPC infrastructure becomes key to gaining competitive advantage and optimizing data monetization. By further developing analytical cloud services, they will become an inevitable solution to the most problems of most organizations, such as: low utilization of internal and external data, poor understanding of client needs, obscurity in response to external changes, large total cost of ownership of information infrastructure, etc. Objective of this course is to introduce students with cloud analytic concepts and general insights into analytical services in the cloud, including also 3 major market players (IBM, Oracle and Microsoft).

The introduction to the cloud computing and benefit and importance of the cloud. Importance of collecting data, storing and converting data into information with quality analyzes in the cloud. Benefits of cloud processing of large data sets. DWH in the cloud and the difference between the traditional DWH compared to the one on cloud. The difference between cloud modeling and traditional modeling. "Proof of Concept" for DWH implementation in the cloud and ROI on Investment. Preparation and transfer of DWH data in the cloud. Difference between ETL and ELT process. Client tools for cloud analytics. Search and allocate virtual resources (Amazon AWS, IaaS), contextualization, snapshot, volume, network creation, security. Face recognition, age, gender and person emotion estimation in front of camera, using cloud services. IBM Watson and the use of artificial intelligence in the cloud. Microsoft and Oracle Cloud Services and Autonomous Databases. Container basics. Trends and Future.

<u>MINIMAL LEARNING OUTCOMES</u>	<u>PREFERRED LEARNING OUTCOMES</u>
<ol style="list-style-type: none">1. Understanding of basic elements, tools and concepts of cloud computing.2. Understand cloud DWH and basic concepts (benefits and drawbacks).3. Understand BI concept in the cloud and select key BI cloud tools common characteristics.4. Identify which already developed services in the cloud can be used, how we can use them (including those based on artificial intelligence).	<ol style="list-style-type: none">1. Explain cloud computing possibilities using business example.2. Valuate key difference between cloud DWH and "on premise" (traditional) DWH.3. Understand BI in the cloud elements using organization and cloud analysis project.4. Apply cloud services to the concrete data set.

Course title: Structured Analytical Techniques

Lecture type: Elective*

ECTS: 6

Course overview

This course enables students to apply structured analytical techniques to overcome cognitive limitations and instinctive mental traits in decision-making and business decision making. If we want to solve problems, either individual or nation-wide, we need to learn how to identify and break down restrictive mental circuits and give full and serious attention to alternative solutions. In other words, we must learn to be open to new insights. It should be noted that structuring is not a substitute for thinking but a means that allows and empowers thinking.

Introduction lecture. Introduction to structured analytical techniques. Structured Techniques: Decomposition and Visualization. Structured Techniques: Scenarios and Indicators. Structured techniques: Recapitulation of teaching contents through case analysis. Structured Techniques: Generating and Testing Hypotheses. Structured Techniques: Causes and Consequences.

<u>MINIMAL LEARNING OUTCOMES</u>	<u>PREFERRED LEARNING OUTCOMES</u>
<ol style="list-style-type: none">1. Critically evaluate analytical errors and analytical failure.2. Recommend methods for solving business problems by decomposing and visualizing.3. Recommend resolving different business issues with scenarios and indicators.4. Recommend resolving different problems by generating a hypothesis.5. Choose the appropriate application of a specific method of estimating causes and consequences.	<ol style="list-style-type: none">1. Evaluate the reasons for introducing structured techniques.2. Arguing the idea of practical problem solving by decomposing and visualization.3. Arguing an opinion on the practical resolution of different problems using scenarios and indicators.4. Arguing the opinion of practically solving different problems by generating a hypothesis.5. Critically evaluate the practical application of a certain method of estimating causes and consequences.

* **Choose one of the 2 elective courses offered.** Algebra UC cannot guarantee that all elective courses from the list will run in the summer semester 2021/2022.