Module Layout
ERM522 / Predictive Analytics in Risk Management

Faculty	FEM	Faculty of Economics and Management		
Programme of Study	ERMII	Enterprise Risk Management		
Module	ERM522	Predictive Analytics in Risk Management		
Level of Study	**Undergraduate**	**Graduate**		
		Master	**Doctoral**	
		X *Joint Program* *OUC & HOU*		
Language of Instruction	English			
Mode of Delivery	Distance			
Module Type	**Required**	**Electives**		
	X			
Number of Group Consulting Meetings	***Total***	***Physical Presence***	***Online***	
	6	-	6	
Number of Assignments	3			
Final Grade Calculation	**Assignments**	**Weekly Activities**	**Final Exam**	
	30%	10%	60%	
Number of European Credit Transfer System (ECTS)	10			

Module Description

This Thematic Unit / Module is designed to to introduce students to a range of applications of advanced analytics that are suitable in risk management context. The module emphasizes more on how predictive analytics can be effective tools in reducing risk rather than the theoretical underpinnings of the models.

In the last decade, the amount of data available to organizations has reached unprecedented levels. Companies and individuals who can use this data together with analytics give themselves an edge over the competition. Predictive analytics is transforming risk management as it helps organizations by informing them what is arriving in the future. The Module covers a wide area of models and techniques from simple visual models and extending to statistical and machine learning techniques as well as some basic financial risk models. The approach is to focus on practical and conceptual issues involved in substantive applications of risk management.

The main objective of the module is to train students in employing methodologies and techniques for extracting information from existing data in order to determine patterns and predict future outcomes and trends, with an acceptable level of reliability, including what-if scenarios and risk assessment.

Students develop in depth understanding of the key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modelling, and statistics.

Through the study of proper case studies, students will be able to identify the inputs and outputs involved in each modelling approach and the suitability of the models to specific instances, gain practical, hands-on experience with statistics programming languages and big data tools through coursework, and practical assignments.

Submodules

1. Visualization Models – Decision Making (2 weeks)
2. Statistical Models – Logistical & Nominal Regression, Classification models (4 weeks)
3. Introduction to Machine Learning Algorithms – (Apriori algorithm for Association rule learning, Bayesian classifiers, K nearest neighbor-KNN). (4 weeks)
4. Financial models – Value at Risk, Portfolio risk assessment, CAPM (3 weeks)

Expected Learning Outcomes

Upon completion of this module, the students will be able to:

Knowledge

- Develop an understanding of the Data Science field with regard to competencies required in areas such as statistics, data analytics, machine learning, data wrangling, data visualization, communication, business foundations.
- Have a thorough understanding of how analytics are applied to critical tasks facing business decision-making in managing risks.
- Understand the proper use as well as advantages and disadvantages of the techniques employed in predictive analytics such as visualization, regression, clustering, and classification.
- Understand the basic principles of machine learning

Comprehension

- Distinguish between training data, validation data and test data in data analytics.
- Recognize that different models fit and perform better than others, depending on the circumstances, and can measure fit and performance appropriately.
- Explain the underpinnings of logistics and nominal regression models and explain their differences from linear regression models.
- Understand the advantages and disadvantages of Bayesian Learning, complete a Bayesian analysis of a basic problem, and discuss the differences between Bayesian and frequentists models
- Distinguish between supervised and unsupervised machine learning approaches and identify areas where those can be applied efficiently to mitigate risks.

Application

- Apply quantitative modelling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques.
- Specify and implement models with the following techniques: k-nearest-neighbor, Naive Bayes, Classification and Regression Trees and apply the models in real-world contexts.
- Use the logistical and nominal regression models, KNN and Bayesian classifiers to classify cases in a given data set.
- Formulate simple models to solve problems, and implement them using software appropriate for data science work.

Analysis

- Apply principles of Data Science to the analysis of business problems.
- Define training and validation data sets to develop a model and measure its validity and identify the optimum model to solve a given problem.
- In addition to performing exploratory and inferential procedures, students can fit complex models using dedicated statistical software (e.g., R, Minitab, SPSS).
- Analyse statistical data properly, in order to identify distribution patterns, possible relationships among data attributes, contingencies, and interaction among various factors.
- Analyse the statistical significance of a logistical regression model, and interpret the contribution of the explanatory variables in prediction and classification.

Synthesis

- Integrate data from disparate sources, can transform data from one format to another, and can program data management in relational databases.

- Integrate results from clustering and classification algorithms with qualitative aspects of the problem under consideration in order to provide business solutions.
- Consolidate and interpret results of statistical analysis of empirical data in context in order to communicate relative information for supporting business decision making.

Evaluation

- Compare the performance of multiple methods and models, recognize the connections between how the data were collected and the scope of conclusions from the resulting analysis, and articulate the limitations and abuses of formal inference and modelling.
- Choose appropriate data management strategies, can carry out relevant analyses, can interpret and apply the results to inform understanding and solve specific problems in context, and can communicate the work to a technical audience.
- Evaluate the "fitness" and the predictive power of logistics and nominal regression model in making predictions and classifications.

Pre-requisite Modules	
512	Advanced Quantitative Methods for Risk Management

Co-requisite Modules	

Grading Scheme

Assessment Method	***Percentage on Final Grade***	***Workload***	
		Hours	***ECTS***
Weekly Study *(13 weeks *~10 hours)(2 weeks *~20 hours)*	0%	≈150 - ≈180	6
Weekly Interactive Activities *(12 weeks *~2-2.5 hours)*	10%	≈25 - ≈30	1
Assignment 1	10%	≈25 - ≈30	1
Assignment 2	10%	≈25 - ≈30	1
Assignment 3	10%	≈25 - ≈30	1
Final/Repeat Examination	60%	0	-
Total	**100%**	**250 - 300**	**10**

Grading Rules and Assessment methods

- Students are evaluated with 9, if they earn 90% of the possible grade, I.e. 90%*10=9, etc.
- Passing rate
  - 50% of the Assignments
  - 50% of the Interactive Activities
  - Students are allowed to participate in the final exam of a Module if they have overall earned the minimum grade (≥ 50 %) in both their Assignments and Interactive Activities
  - 50% of the Final exam

If a student earns a grade with decimal points, then it is rounded to the nearest half unit.