BA in Management Program
Spring 2024
OPIM 407 – Advanced Business Analytics

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Type	Time	Days	Where
Class	11:40-14:30	Mondays	FENS L045

Teaching Assistant: To Be Announced

Course Description:

The main objective of this course is to present advanced business analytics tools in the context of business cases, with an emphasis on implementing analytical approaches within an organization. Throughout this course, students will learn to use tools and ideas from business analytics and R's environment to solve interesting and exciting business problems; learn how to formulate relevant business questions that can be answered using data; understand the various steps of data preparation like data cleaning and feature extraction; develop and test hypotheses to inform managerial decisions and to collaborate meaningfully with multiple stakeholders; evaluate the effectiveness of a solution through statistical learning methods (supervised & unsupervised methods); communicate results to both technical and non-technical audiences.

Course Objectives:

This course builds on the introductory course OPIM 390 Introduction to Business Analytics. It aims to extend the students' background in business analytics by adding new descriptive, and predictive tools. It also aims giving the students to opportunity to explore their core business analytics skills and improve them to have a solid foundation. Specifically, at the end of this course, students should develop knowledge and hands-on skills about:

1. In different business contexts, how to formulate relevant business questions that can be answered using data in order to facilitate improved data-driven decision making.
2. Steps involved in different methodological approaches such as CRISP-DM, KDD and SEMMA.
3. Given a business problem, implement and assess the results of the appropriate descriptive and predictive methods.
4. Understand the basic concepts, assumptions as well as pros and cons of the newly covered business analytics tools such as collaborative filtering, classification using naïve Bayes, black-box predictive data mining approaches such as neural networks and support vector machine as well as ensembles.
5. Effectively communicate the results of a business analytics project, both orally and in writing.

Learning Outcomes:

Upon successful completion of the course, the student should be able to:

1. Select a methodological approach (CRISP-DM, SEMMA or KDD) and give an overview of the steps in a business analytics project,
2. Use descriptive and predictive analytics methods on business data considering the given decision-making contexts,
3. Analyze a business case, select and apply an appropriate method to reach a business decision,
4. Use at least one leading software package in business analytics.

Course Material:

Textbook:

The **e-book** for our textbook can be purchased via Homer bookstore. You are expected to read the chapters mentioned in the course schedule before each session. Hence, we will be closely following the **e-book** of our textbook and its details are given below.

Galit Shmueli. Peter C. Bruce, Peter Gedeck, Inbal Yahav, Nitin R. Patel, *Machine Learning for Business Analytics: Concepts, Techniques and Applications in R*, 2023, 2nd Edition, Wiley.

Software:

We will primarily use R & RStudio for business analytics in this course. Students can download and install them on their laptops and/or can freely sign up to RStudio Cloud provided via Posit Cloud.

Optional Software:

KNIME (a free open source analytics platform – knime.org), SAS Visual Analytics, RapidMiner (a free open source analytics tool – rapidminer.com), Orange (a free open source analytics platform – orange.biolab.si), IBM SPSS Modeler with Text Analytics, Simio, Weka, Arena and Python.

Case Studies:

Cases are used as real-world examples of the topics. There will be three case analysis reports to be prepared as a team. The teams can consist of up to three students (teams comprised of one student will also be allowed). The teams should work to address the issues raised in the case, clearly identify the business analytics problems to be studied, determine, and apply the necessary tools.

The details on the case studies are provided below:

Case 1	**Due:**	**March 08, 2024, Friday 17:00**
	Type:	Harvard Business School Publishing Case – Prepare case report
	Subject:	Chapter 20: Social Network Analytics
	Teamwork?:	Yes
	Grading:	Team
Case 2	**Due:**	**April 19, 2024, Friday 17:00**
	Type:	Harvard Business School Publishing Case – Prepare case report
	Subject:	Chapter 13: Ensemble Methods and Explaining Model Predictions
	Teamwork?:	Yes
	Grading:	Team
Case 3	**Due:**	**May 17, 2024, Friday 17:00**
	Type:	Harvard Business School Publishing Case – Prepare case report
	Subject:	Chapters 17-18-19: Forecasting Time Series
	Teamwork?:	Yes
	Grading:	Team

Reading Assignments:

Several additional articles and cases will be announced weekly or bi-weekly via SUCourse. They will be used as real-world examples of the topics covered in class or to facilitate the development of core business analytics skills. They will be included in the midterm and final exams

Optional Reading Materials:

Several online resources for reviewing the R software are available. Each student should check these resources and find the one that works best for his/her learning. The references include the following and their links will be posted on SUCourse during the semester.

- Grolemund, G. and H. Wickham (2018) *R for Data Science*, O'Reilly.
- Jeffrey, B. A. (2020) *R for Data Science: Exercise Solutions*.
- Wilke, C. O. (2019) *Fundamentals of Data Visualization*, O'Reilly.
- Wickham, H. and J. Bryan (2015) *R Packages*, O'Reilly.
- Silge, J. and D. Robinson (2017) *Text Mining with R: A Tidy Approach*, O'Reilly.
- Wickham, H. (2021) *Mastering Shiny*, O'Reilly.

Additional list of book references includes the following:

- Davenport, T. H. and J. G. Harris (2007) *Competing on Analytics: The New Science of Winning*, Harvard Business Review Press.
- Baesens, B. (2014) *Analytics in a Big Data World: The Essential Guide to Data Science and its Applications*, John Wiley & Sons.
- Dean, J. (2014) *Big Data, Data Mining, and Machine Learning: Value Creation for Business Leaders and Practitioners*, John Wiley & Sons.
- Mayer-Schönberger, V. and K. Cukier (2014) *Big Data: A Revolution That Will Transform How We Live, Work, and Think*, Eamon Dolan/Mariner Books.
- Stubbs, E. (2014) *Big Data, Big Innovation*, John Wiley & Sons.
- Bozkaya, B. and V.K. Singh (2015) *Geo-Intelligence and Visualization through Big Data Trends*, Hershey, PA: IGI Global.
- Witten, I. H., E. Frank, M. A. Hall and C. J. Pal (2016) *Data Mining: Practical Machine Learning Tools and Techniques* (4th Edition), Morgan Kaufmann.
- Sharda, R., D. Delen and E. Turban (2016) *Business Intelligence, Analytics, and Data Science: A Managerial Perspective* (4th Edition), Pearson.
- Berinato, S. (2016) *Good Charts: The HBR Guide to Making Smarter, More Persuasive Data Visualizations*, Harvard Business Review Press.
- Dinov, I. D. (2018) *Data Science and Predictive Analytics*. Cham, Switzerland.
- Agrawal, A., J, Gans and A. Goldfarb (2018) *Prediction Machines: The Simple Economics of Artificial Intelligence*, Harvard Business Review Press.
- Daugherty, P. R., and H. J. Wilson (2018) *Human + Machine: Reimagining Work in the Age of AI*, Harvard Business Review Press.
- Iansiti, M and K. R. Lakhani (2020) *Competing in the Age of AI: Strategy and Leadership When Algorithms and Networks Run the World*, Harvard Business Review Press.

Course Web:

The course syllabus, announcements, lecture notes and RScripts, details of each case study assignment, each midterm and final exam, and all your grades will be posted on OPIM 407 SUCourse site. Students are expected to visit SUCourse a couple of times each week.

The **OPIM 407 SUCourse main page** will be organized on a session and topic basis so that students can follow the course schedule provided at the end of this syllabus.

The **announcements component of SUCourse** will be actively used for sharing announcements. Each announcement posted on SUCourse will be emailed to the students, thus the students are responsible for regularly checking their emails and appropriately setting the emailing options in their SUCourse account.

The **lecture notes and RScripts** will be posted on SUCourse after they are covered in the class beneath the corresponding class session.

The questions (sometimes also data files) of each **case study assignment** are to be downloaded via SCourse and the case study reports are to be uploaded via the SUCourse **assignment component**.

For the case reports, **the Turnitin tool** will be used. Sabanci University uses a very powerful web-based tool called Turnitin. Turnitin is the worldwide standard in online plagiarism prevention. It allows instructors to compare student papers against a database composed of millions of articles. Every report you submit will be scanned by Turnitin, and results will be reflected in your grades.

Instructional Design:

The course will be taught using a blend of **lectures**, **in-class exercises**, **reading assignments, and case analysis reports** prepared by the students in teams.

The course is designed to facilitate active learning of the topics and hands-on learning of the software (mainly R) through in-class exercises, case studies, and exams. The lectures are also made interactive via the in-class exercises that are carried out by the students either individually or in groups and the RScripts provided to run examples of the topics covered in the class.

The lecture notes will be posted on SUCourse (after each topic is completely covered in the lectures) in the main page which will be organized according to the session number and topic name to match the schedule posted at the end of this syllabus.

There will be three case analysis that aim to facilitate development of essential skills demanded in the field of business analytics using real-world examples from Harvard Business School Publishing's case studies. The students are asked to submit the case analysis reports in teams consisting of 1-3 students. The case teams can be different in each case, and this decision is at the discretion of each team.

Grading:

Attendance and Participation:	10%
In-Class Exercises:	20%
Case Analysis Reports:	15%
Midterm Exams:	35%
Final Exam:	20%

Peer Evaluation in Teamwork

Students will be asked to provide an evaluation of the members of their team in the cases analysis. Each student will divide 100 points between the members of her team, including him/herself. This division should reflect that person's judgment of the contribution of the members of her team. The scores should not be merely functions of time spent by each member, but they should be measures of the "contribution;" their relative contribution to the idea generation, research, analysis, writing, oral presentation, report writing, etc. If the team was highly functional, and each member did what they committed themselves to, then the student can assign the same mark to each member of the team. If, on the other hand, some members of the team did not fulfill their commitments and did not contribute as much as the others, then points can be distributed unevenly.

The points submitted by all members of the team will be aggregated by the instructor. Every student will be given his/her aggregate peer evaluation, without disclosing the individual peer evaluations to the students.

In case there is no consensus among the team, for example, if three students divide the marks evenly and the fourth one divides them unevenly, then the instructor will use his/her judgment to assign peer evaluation marks--possibly after meeting with the members of the team. In cases where there are conflicting marks, it is most likely that the instructor will meet with the team members and provide a mark based on an interview. For example, in a group of four, if Students A and B believe they did most of the work, and Students C and D believe otherwise, the team may be called in for an interview in order to be fair to everyone.

Past experience indicates that in most groups points will be distributed evenly. There will be a few groups where peer evaluations will play a role in the marks. The primary goal of this exercise is to avoid giving undeserved credit to individuals who did not help their teams. However, it is possible to have upwards adjustments of marks in case of students who have done more than what the group expected of them. The peer evaluation will have a direct impact on your case analysis grades. To give a simple example, if the group mark is 20 out of 25, and if your peer evaluation indicates that your contribution was less than what was expected, then your case analysis grade mark will be less than 20 out of 25. There are no simple rules for adjustment.

Requirements:

Attendance & Participation

Class participation includes regular class attendance and getting involved in the learning process during class hours. **The non-verbal participation** requires being promptly in class and engagement via complying with classroom policies and conduct summarized on page 7 of this syllabus. Points can be taken off for not complying with the classroom policies and conduct. **The verbal participation** involves contributing to class discussions positively and regularly, and asking questions which cannot be possible without due preparation (hence quality, relevance, frequency and timing will be accounted for).

In-Class Exercises

In-class exercises will be assigned during class hours. They may be group or individual exercises. These will be completed during class and submitted at the end of the class hour. Still, very few of them might be started in-class and submitted afterward at times to be announced by your instructor. You are expected to work on the assigned exercises by communicating with your classmates and the instructor. Although these in-class exercises will be graded, they are not quizzes but means to learn the topics actively during class hours.

Exams

There will be three exams, two midterm exams and one final exam. Note that early final exams are not given in this course. All exams are in class and might be comprehensive. Each exam will be composed of two or three parts. The first parts include multiple choice and true or false type of questions. The second part of the exam consists of short essay questions. The third part of the exam contains questions involving business analytics tasks such as writing R code parts or interpreting obtained results from the corresponding R codes. Additional details on these exams will be posted as an announcement on SUCourse one week before each exam. Students are expected to follow these announcements on SUCourse. Topics included in each exam and the anticipated dates of the exams are provided on the schedule (see the last page).

There will be a single makeup exam for the all the midterm and final exams, which may only be given in the case of excused absences (for health reasons, etc.) that are documented by health reports. The makeup will be scheduled to the end of the final exams' week. This makeup exam will be comprehensive and cover all the topics of all exams. Moreover, the parts of the makeup exam can be organized differently.

Case Analysis

There will be three case assignments to be prepared as a team consisting of up to three students (see page 2). Students are free to form/change their teams in each case. Each case must show the names of all team members.

The teams should address the issues raised in the case questions, and apply the necessary business analytics tools. A case report will be prepared for each case explaining the business analytics problem at hand and the approach taken by the team to address the situation, presenting their analysis and recommendations. Each team should submit their report on SUCourse only once as a PDF file. The RSCripts should be added as an Appendix to the end of the case report. For the sake of completeness, teams can additionally email their processed data files to the instructor.

Late Submission Policy

Late submissions will not be allowed for the in-class exercises. However, for the case analysis reports only one-day lateness might be allowed with a lateness penalty of 15-20% (i.e. 15-20 points out of 100 points), which is at the full discretion of the instructor.

Interviews

As part of the assessment of all course requirements, the faculty member may invite a student or a team for an online interview to go through the solutions and underlying the case report, R script files and/or processed data files.

Considering the guidelines provided to the faculty members by Sabanci University, it is at the full discretion of the faculty member to make these interviews or not.

It is worthwhile to note that students should not feel stressed due to the possibility of the conduct of the interviews as they will be done only on a need basis. Students are expected to check their emails regularly and positively respond to the interview email invitation in a timely manner (within one-two business days is acceptable).

Academic Honesty:

Learning is enhanced through cooperation, and as such, you are encouraged to work in groups, ask for and give help freely in all appropriate settings. At the same time, as a matter of personal integrity, you should only represent your own work as yours. Any work that is submitted to be evaluated in this class should be an original piece of writing, presenting your ideas in your own words. Everything you borrow from books, articles, or web sites (including those in the syllabus) should be properly cited. Although you are encouraged to discuss your ideas with others (including your friends in the class), it is important that you do not share your writing (slides, MS Excel or R script files, reports, etc.) with anyone. Using ideas, text, and other intellectual property developed by someone else while claiming it is your original work is *plagiarism*. Copying from others or providing answers or information, written or oral, to others is *cheating*. Unauthorized help from another person or having someone else write one's paper or assignment is *collusion*. Cheating, plagiarism, and collusion are serious offenses that could result in an F grade and disciplinary action.

Specific to this course, it is important to know that submitting a computer file (e.g. Excel workbook or R script file) prepared by someone else, *even partially*, is cheating. You may talk to others about assignments, but in the end, you should be doing all the work. It is important that you do not share your solutions as Excel files with anyone until it has been graded. Sharing your file with others could easily tempt them to submit part or all of it as their own. This would be cheating and, in most cases, easy to detect. Once you share your file with someone, it could easily be forwarded to a lot of students and some of whom could cheat or plagiarize. Plagiarism is a very serious misdeed that can result in a reduced grade or an F (for the assignment and/or the course). *Please pay utmost attention to avoid such accusation.*

Classroom Policies and Conduct:

Sabancı BA in Management Program and Business Analytics Minor Program **value participatory learning**. Establishing the necessary social order for **a participatory learning environment requires that we all**:

- Start each fifty-minute class session on time. This involves coming to each class on time.
- Turn off all cell phones, tablets, laptops or other electronic devices unless they are used as part of the lecture.
- Do not leave and re-enter the class during each fifty-minute long lecture (of course glitch related exceptions are granted for online students and students in class can silently get the consent of the instructor by showing their eyes for a folded lens emergency and the like).
- Come prepared to make helpful comments and ask questions that facilitate your own understanding and that of your classmates. This requires that you complete the assigned readings for each session before the class starts.

Office Hours:

Office hours arranged by your instructor and teaching assistant can **be face-to-face or online via zoom or google meet**. Designated office hours will be announced on SUCourse. If they do not work for you, please send an email (at least one day before) to arrange an office hour in a different time.

Tentative Course Schedule:

Session 1	**Date:**	**February 19, 2024, Monday**
	Topic:	Introduction to the Course Overview of Business Analytics
	Requirements:	Read Chapter 02 Install first R and then RStudio; or freely sign up to RStudio Cloud via Posit Cloud
Session 2	**Date:**	**February 26, 2024, Monday**
	Topic:	Social Network Analytics
	Requirements:	Read Chapter 20
Session 3	**Date:**	**March 04, 2024, Monday**
	Topic:	Text Mining
	Requirements:	Read Chapter 21
	Case 1 Due:	**Submission of the case analysis report on SUCourse**
Session 4	**Date:**	**March 11, 2024, Monday**
	Topic:	Collaborative Filtering
	Requirements:	Read Chapter 15 excluding section 15.1
Session 5	**Date:**	**March 18, 2024, Monday**
	Exam:	**Midterm Exam 1**
	Requirements:	Read the instructions that will be posted on SUCourse on March 11-12, 2024
Session 6	**Date:**	**March 25, 2024, Monday**
	Topic:	Feature Selection
	Requirements:	Read Chapter 04 excluding section 4.8 Review Linear Regression and Classification & Regression Trees (Chapters 06 & 09)
Session 7	**Date:**	**April 01, 2024, Monday**
	Topic:	Ensemble Methods and Explaining Model Predictions
	Requirements:	Read Chapter 13 excluding section 13.2
	Date:	**April 08, 2024, Monday – Spring Break [No Class] ☺**
Session 8	**Date:**	**April 15, 2024, Monday**
	Topics:	Evaluating Predictive Performance
	Requirements:	Read Chapter 05
	Case 2 Due:	**Submission of the case analysis report on SUCourse**
Session 9	**Date:**	**April 22, 2024, Monday**
	Topic:	K-Nearest Neighbor and Support Vector Machines (not available in your textbook)
	Requirements:	Read Chapter 07
Session 10	**Date:**	**April 29, 2024, Monday**
	Exam	**Midterm Exam 2**
	Requirements:	Read the instructions that will be posted on SUCourse on April 22-24, 2024
Session 11	**Date:**	**May 06, 2024, Monday**
	Topic:	Forecasting Time Series
	Requirements:	Read Chapters 17, 18 and 19 excluding section 19.5
Session 12	**Date:**	**May 13, 2024, Monday**
	Topic:	Neural Nets
	Requirements:	Read Chapter 11 excluding section 11.6
	Case 3 Due:	**Submission of the case analysis report on SUCourse**
Session 13	**Date:**	**May 20, 2024, Monday**
	Topic:	The Naïve Bayes Classifier and Interpretability Methods in Responsible Business Analytics (if time permits)
	Requirements:	Read Chapter 08 and Chapter 22
Session 14	**Date:**	**May 27, 2024, Monday**
	Topic:	A/B Testing, Uplift (Persuasion) Modeling and Reinforcement Learning
	Requirements:	Read Chapter 14
	Final Exam:	**Date and place to be announced by Student Resources**
	Requirements	Read the instructions that will be posted on SUCourse on May 27-28, 2024