MGT7179 Advanced Analytics and Machine Learning Academic Year 2023-2024 Module Outline

Module Coordinator:	Dr. Mohsen Jafari Songhori
Office:	Academic Hub 02.0010
Telephone:	-
E-mail:	m.jafarisonghori@qub.ac.uk
Consultation:	By appointment

Lectures and Computer Practicals:

Wednesdays 9:00-12:00 and (repetition of morning sessions) 14:00-17:00

Important Dates

17th March 2024	Assignment 1 Due	40%
4th May 2024	Assignment 2 Due	60%

Module Description

Machine learning is the core technology underpinning predictive analytics and artificial intelligence, as well as many other analytical tasks.
This module will build on the skills developed in the statistics module in terms of both programming and more advanced statistical techniques, namely the application of machine learning algorithms.

Topics may include but are not limited to:

- The analytics process
- Analytics tools
- Supervised learning
- Unsupervised learning
- Deep learning
- Evaluating model performance
- Programming machine learning models
- Evaluation of the ethical implications of the use of algorithms e.g. the potential for reinforcing bias, security and privacy.

Learning Outcomes

Upon successful completion of the module students should be able to:

- Critically evaluate a range of analytics tools and algorithms
- Understand and apply key programming concepts as they pertain to machine learning
- Design a predictive analytics solution

Skills
This course provides opportunities for the students to enhance the following skills:

- Application of advanced algorithms for business decision making
- Programming skills
- Problem solving

Course Schedule

Sessions	**Date**
Introduction to statistical learning	24-Jan-24
Regression	31-Jan-24
Classification	07-Feb-24
Resampling methods	14-Feb-24
Linear models	21-Feb-24
Non-linear models	28-Feb-24
Tree-based methods	06-Mar-24
Support vector machines	13-Mar-24
Neural Networks & Deep learning	10-Apr-24
Unsupervised learning	17-Apr-24
Explainable/interpretable machine learning and If Needed extra discussions on the previously taught topics**	24-Apr-24

Learning Resources

Books

James, G., Witten, D., Hastie, T., and Tibshirani, R. 2021, An Introduction to Statistical Learning with Applications in R, https://www.statlearning.com/

Further reading

Hastie, T., Tibshirani, R. and Friedman, J. 2009, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, https://web.stanford.edu/~hastie/ElemStatLearn/

Last lecture some materials from

Interpretable Machine Learning A Guide for Making Black Box Models Explainable Christoph Molnar, https://christophm.github.io/

Leading Journals

Several journals publish research in the area of business analytics. These vary in terms of their technical, operational, and strategic focus, and some are listed below. Also, some relevant papers from the these journals are provided below.

- Expert Systems with Applications
- Journal of Business Research
- Applied Marketing Analytics
- Big Data & Society
- Decision Support Systems
- European Journal of Operational Research
- Harvard Business Review
- Journal of Marketing Analytics
- MIT Sloan Management Review

- Kraus, Mathias, Stefan Feuerriegel, and Asil Oztekin. "Deep learning in business analytics and operations research: Models, applications and managerial implications." *European Journal of Operational Research* 281.3 (2020): 628-641.
- Dutta, Aniruddha, et al. "An efficient convolutional neural network for coronary heart disease prediction." *Expert Systems with Applications* 159 (2020): 113408.
- Huang, Zan, et al. "Credit rating analysis with support vector machines and neural networks: a market comparative study." *Decision support systems* 37.4 (2004): 543-558.

- Urban, Glen et al. "Is Deep Learning a Game Changer for Marketing Analytics?" MIT Sloan Management Review 61, 2 (November 2019): 71-76.

Selected E-resources and Websites

- R Bloggers
- Analytics Training
- Data Science Central
- IBM Analytics
- KDnuggets
- MIT Sloan Management Review Data & Analytics
- Eric Siegel's Homepage

Canvas

Canvas will be used to post summary lecture notes. The module coordinator/ lecturer(s) will also use canvas to communicate with the class so it is important that students check canvas and their University email account on a regular basis.

Assessment & submission deadlines

The assessment for the module consists of two individual assignments:

1. Business analysis and report 1, due by 17th March 2024, worth 40% of the final grade
2. Business analysis and report 2, due by 4th May 2024, worth 60% of the final grade

All assignments must be submitted through Canvas. Students will be penalised for late submission in line with policies outlined in the PGT handbook.