

## BC2407 Analytics II: Advanced Predictive Techniques

Pre-requisites : AB1202 Statistics & Analysis, or equivalent;  
BC2406 Analytics I: Visual and Predictive Analytics.

Software : R (main), Python (optional).

Reference Texts [Optional]:

[AAD1] Chew C.H. (2021). Artificial Intelligence, Analytics and Data Science, Volume 1: Core Concepts and Models. Cengage<sup>1</sup>.

[ISL] Gareth James et. al. (2021). [An Introduction to Statistical Learning](#). 2<sup>nd</sup> Edition. Springer.

[ESL] Trevor Hastie et. al. (2017). [The Elements of Statistical Learning](#). 2<sup>nd</sup> Edition. Springer.

Avril Coghlan. [A Little Book of R for Time Series](#). Website.

### Course Description

Previously, BC2406 introduced core concepts of Business Analytics and the important models in used by businesses and governments. However, there are more complex situations that require more sophisticated Analytics solutions. BC2407 is the continuation of BC2406. The main objective of BC2407 is to introduce students to advanced Analytics techniques to extract more useful and deeper insights under more complex realistic situations. At the end of the course, students will see the strengths and weaknesses of standard models, and learn advanced techniques to overcome the weaknesses in various scenarios. This course builds upon open source R software (as learnt in AB1202 & BC2406), and Python (as learnt in AB0403).

### Course Learning Objectives

At the end of the module, students will be able to:

1. Identify aspects of business problems that cause standard analytics models to become useless or less effective.
2. Apply advanced techniques to overcome or mitigate the weaknesses of standard analytics models.
3. Evaluate performance of the advanced predictive techniques.
4. Explain the workings and results of the advanced predictive techniques in the context of the business problem to client/employer.
5. Propose business solutions/recommendations based on the advanced predictive techniques.

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<sup>1</sup> Refer to NTULearn Main Site on availability of textbook for borrowing from libraries or purchase from publisher (with discount code for NTU students).

## Learning & Teaching Methods

Duration: Pre-class learning at-home and 3 hrs of seminar (totaling 52 hrs across 13 weeks).

The course will be taught in seminar-style, and requires student to complete the readings/videos and attempt the basic exercises before class. Class discussions and in-class learning activities are an integral part of learning.

## Course Content

There are 12 class sessions and 1 e-learning topic (self-learning at home). The exact week for e-learning will be announced on NTULearn, typically in the CNY week to minimize disruption.

Session	Topic	Content	Remarks
1	Course Overview and Project Brainstorm	- Course Overview & Assessment Policy. - Team Project Brainstorm & Research	Students randomly assigned into Teams in ntulearn class site.
2	Review of Basic Analytics and Software	- Review of Basic Techniques (Linear Reg, Logistic Reg, CART).	
3	Association Rules	- Support, Confidence, Lift. - Transaction data formats.	
4	Quantile Regression	- Overcoming a weakness of Linear Reg. - Quantiles in Regression.	
5	Neural Network	- Neural Network structure. - Backpropagation.	
6	Multivariate Adaptive Regression Splines (MARS)	- Overcoming a weakness of Linear Reg. - Hinge functions. - Automated Interactions search.	
7	Bootstrap for Analytics	- Bootstrap Sampling. - Bootstrap Confidence Interval. - Out-Of-Bag (OOB) Error	
8	Random Forest	- 500 CARTs. - Bagging. - Random Subset Feature Selection.	
	CBA Homework Assignment	No class. Paper release on Monday. Do-at-home individual assignment.	Submit by end of week on Sunday.
9	Time Series Forecasting	- Decomposition Methods. - Exponential Smoothing. - Auto ARIMA.	Project Submission due end of wk on Sunday.
	Project Presentation A	Each team to present project during scheduled timeslot. Attend only your team timeslot.	To inform instructor by week 7 if Team has preferred wk to present project.
	Project Presentation B	Remaining teams to present project.	Revised Project Submission due end of wk Sunday.
eLearning	Visualization & Dashboard	Power BI Desktop.	eLearning week to be announced.

## Course Assessment

	Component	Weightage	Assessment Rubrics	Deadline
C01-1	Class Participation - 2 Reflection Journal Postings (5%) - Q&A / Discussions - Presentation of work (excl. Project)	15% (Indiv)	Critical Thinking	
C01-2	Individual Presentation (Project)	15% (Indiv)	Critical Thinking	During Project Presentation
C02	Assignment (Project Proposal)	10% (Team)	Problem Solving & Decision Making	End of wk 7 Sun 11:30pm
C03	Project	30% (Team)	Written & Oral Communication	End of wk 11 Sun 11:30pm
C04	Computer Based Assessment (CBA) Homework Assignment	30% (Indiv)	Problem Solving & Decision Making	End of wk 10 Sun 11:30pm
	Total	100%		

Refer to Assessment Rubrics and Measures.PDF for details.

### Penalty for late submission after deadline:

You are given 30 minutes grace period (by 12 midnight) for submission before penalty starts. For each 24 hours of late submission beyond the deadline + grace period, 10% of the total marks for the component will be deducted from your score.

### On CBA Homework Assignment:

With the earlier homework paper release and submission, the deadlines are spread out and instructors have time to call selected students for Q&A to clarify work submitted and ascertain understanding.

### Peer Evaluation of Team Mates contribution to Project Proposal and Project:

Peer evaluation to be submitted by end of week 13. Submission link to be announced.

Refer to Sample Peer Evaluation Form.PDF and Peer Evaluation Rubrics.PDF to understand the rules and penalty.

### Coding, Business Focus and Academic Honesty:

This is a business school course that requires a little bit of coding. Your ability to frame the business problem to be solved using Analytics/Machine Learning, select suitable techniques, interpret the software results, and communicate actionable insights to Business Management is critical.

With open source software, you are expected and encouraged to copy and paste code from elsewhere and modify the code to suit your purpose (but quote/cite your source). Thus coding is not the focus. Focus on the business problem, the key concepts in selected techniques and explain how Analytics/Machine Learning solved the business problem/opportunity.

If you suspect any student of academic dishonesty, report to your class instructor and course coordinator within 3 days with your reasons and evidence.