The University of Melbourne

Melbourne Business School

Predictive Analytics

A core subject to the Master of Analytics Management

An elective subject to the Master of Business Administration

Term 4, 2020

Subject Outline

Instructor:

Associate Professor Ole Maneesoonthorn

About the instructor:

Associate Professor Ole Maneesoonthorn

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Ole Maneesoonthorn is an Associate Professor of Statistics and Econometrics at the Melbourne Business School, the University of Melbourne, Australia. Her research is in the fields of time series forecasting, Bayesian computations and financial econometrics. Ole has published in top field journals in econometrics, such as the *Journal of Econometrics*, the *Journal of Applied Econometrics* and the *Journal of Computational and Graphical Statistics*.

Ole received a PhD in Econometrics from Monash University. The work on her thesis earned her the prestigious International Savage Award, bestowed by the International Society of Bayesian Analysis (ISBA) for the most outstanding doctoral dissertations in Bayesian econometrics or statistics, as well as the Mollie Holman Doctoral Medal 2013 from Monash University. She has been recognized on many occasions for her research and presentation skills. These include winning the prize for best PhD paper at both the inaugural Peter C.B. Phillip PhD Camp in 2012 (held at the National University of Singapore) and the 2010 Financial Integrated Research Network (FIRN) Doctoral Tutorial; and an honourable mention at the 2013 New Zealand Econometrics Study Group.

Subject Description

Predicting key business variables has become increasingly important, as it drives both objective decision-making and improved profitability within organisations. This subject covers the main methods used to predict business variables, based on historical data. These include traditional regression, time series analysis, and machine learning methods. Throughout the subject, the focus will be on understanding how these methods are applied in various business problems, and identifying which predictive approach is the most appropriate to use, given a specific context. The importance of benchmarking different methodologies, as well as the use of prediction in decision-making frameworks, will also be emphasised.

On completion of this subject, students should be able to:

1. Understand a wide range of models and methodologies relevant to predicting business outcomes.
2. Apply appropriate modelling skills to business context.
3. Develop forecasting techniques to identify potentially attractive markets and investment opportunities.
4. Translate forecasting outputs into insights from the basis that form the basis of recommendations addressing relevant business problems.
5. Determine which metrics to use in critiquing and comparing competitive predictive methodologies.
6. Identify what additional data would be required to create more robust predictive models, given a certain business context.

Resources

1. Miller J. D., & Forte, R.M. (2017) *Mastering Predictive Analytics with R - Second Edition: Machine learning techniques for advanced models*. Packt Publishing. (E-book available via the University of Melbourne Library)
2. Hyndman, R. J., & Athanasopoulos, G. (2020). *Forecasting: principles and practice*, 3rd edition, OTexts: Melbourne, Australia. (Available online at https://www.otexts.org/fpp3)

A more technical read (both books available at the authors' homepage):

3. James, G., Witten, D., Hastie, T., & Tibshirani, R. (2013). *An introduction to statistical learning*. New York: springer.
4. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The elements of statistical learning: data mining, inference, and prediction*. Springer Science & Business Media.

Software

R can be downloaded from https://cran.r-project.org/. Only 'base' R is needed. Make sure you have version 4.0.2 or later.

RStudio can be downloaded from https://rstudio.com/products/rstudio/download/. The free Desktop version is sufficient.

Please download and install both software prior to the R Workshop.

Note to Mac users: the Windows virtual machine is recommended for your R software. Some packages are written in Microsoft and may have issues on MacOS. If you decide to install R on Mac OS, there is no guarantee that the instructor can assist with technical issues related to R packages and codes.

Assessments

4 x Individual quizzes	20%
Syndicate assignment	30%
Final Examination (hurdle requirement)	50%

Note (from the Course and Subject Guide) "Students are reminded that only in exceptional circumstances will the School grant permission for assignments to be handed in after the due date or for examination and tests to be taken at times different from those set out."

Assignment submissions:

The School requires that all written assignment submissions are accompanied by a pro forma front cover sheet. This sheet is included in the reading pack and copies are available for collection from Student Services. The assignment will not be marked until the required front cover is supplied by the submitting student(s).

Late submissions:

The MBS teaching code states that

* If (assignments) are not submitted on time, they are regarded as not submitted.
* Late assignments will only be graded if (i) the student has applied for special consideration; and (ii) that application is considered acceptable.

Applications for extensions must be made before submission date, and will only be granted in exceptional circumstances.

Expectation of students

Students should come to class having completed the exercises or problems that were suggested in the previous week. Students are also expected to have read the suggested reading before class each week that are given in the "Topics by week" table below. After each class, students should read through the associated reading material, making sure that everything is understood. If there are difficulties, please contact the instructor or the teaching assistant.

Student Honour Code

Students enrolling in this subject are expected to subscribe to the Student Honour Code. This code is available on the MBS Student Community page here.

Class Schedule

Date	Topic and Readings	Assessment item
Day 1: 26th September	**The Predictive Mindset, Predictive Evaluations and Predicting with Regression** • The predictive mindset • Evaluating predictive outcomes • Predicting with Regression Case: Predicting real estate prices with regression Background readings: HA Sect 5.8, MF Chp. 3	Syndicate Task 1
Day 2: 27th September	**Time Series Prediction – Considerations and Methods** • Considerations for time series prediction • Regression for time series • Smoothing techniques • ARIMA models Case: Predicting retail sales Readings: HA Chp 7, Sect 9.10	Quiz #1 Syndicate Task 2
Day 3: 17th October	**Machine Learning & Unsupervised Learning Methods** • Intro to machine learning • Predicting with regression trees • Neural network • Intro to unsupervised learning • Basic clustering method : k-means Case: Predicting real estate prices Background readings: MF Chp. 5,7	Quiz #2 Syndicate Task 3
Day 4: 24th October	**Unsupervised Learning (cont.) and Ensemble Methods** • More advanced unsupervised learning: k-NN and support vector machine • Why ensembles? • Ensembles techniques – Bagging & Boosting, random forests Case: Predicting real estate prices Background readings: MF Chp. 6,9	Quiz #3 Syndicate Task 4
Day 5: 31st October	**Predicting classifications** • Methods for classification - naïve Bayes, logistic regression, clustering • Evaluating categorical predictions – incorporating user specific losses • Revision Case: Energy Survey Background readings: MF Chp. 4,10	Quiz #4 Syndicate Task 5