

**Western University
Faculty of Engineering
Department of Electrical and Computer Engineering**

SE 9603/9063B: Data Analytics

Course Outline 2017-18

Description:

In recent years, developments in the Web, social media, IoT, sensors, and mobile devices have resulted in the ability to collect more data than ever. This course focuses on approaches and techniques for extracting value from such massive data through data analytics. Various forecasting approaches (such as moving averages, support vector regression, neural networks) and recommender systems will be covered. The emphasis will be on solving real world problems using those techniques. Deep learning will be explored because it can learn complex non-linear relationships commonly present in Big Data, capture various levels of abstraction, and learn good features from data. Challenges of data analytics with large data sets will be explored and emerging techniques for addressing those challenges will be discussed. Students are required to develop a project which provides an opportunity to explore in more details an area of data analytics and experience some of the challenges that they may face in their future work/research activities.

Instructor: Dr. Katarina Grolinger.
TEB 371, 519-661-2111 ext. 81407, kgroling@uwo.ca
Consultation hours: by appointment

Contact Hours: 3 hours/week

Prerequisites: At least one undergraduate programming course and at least one statistics course.

Recommended References:

- [1] Course notes
- [2] Papers and supplementary reading list of recent research publications
- [3] Sadalage, Pramod J., and Martin Fowler. NoSQL Distilled: A brief guide to the emerging world of polyglot persistence. Pearson Education, 2012.
- [4] Runkler, Thomas A., Data Analytics: Models and Algorithms for Intelligent Data Analysis, Second Edition, Springer, 2016.
- [5] Friedman, Jerome, Trevor Hastie, and Robert Tibshirani. The elements of statistical learning: The elements of statistical learning data mining, inference, and prediction. Second Edition. New York: Springer, 2009.

Topics and Specific Learning Objectives

1. Introduction

At the end of this section, students will be able to:

- a. Define data analytics and its relation to statistics, machine learning, and data mining
- b. Describe stages of the data analytics process

- c. Identify tools for data analytics
- d. Define Big Data and the role of data analytics in Big Data

2. Forecasting

At the end of this section, students will be able to:

- a. Describe principles behind forecasting models such as moving averages, support vector regression, and neural networks
- b. Apply forecasting approaches on different problems

3. Recommender Systems

At the end of this section, students will be able to:

- a. Explain differences among different types of recommender systems and identify their strengths and weaknesses
- b. Design, implement, and evaluate various recommender systems such as collaborative filtering, content-based filtering, context-aware, and hybrid systems

4. Deep Learning

At the end of this section, students will be able to:

- c. Describe the group of learning methods belonging to deep learning
- d. Explain principles behind the deep learning approaches such as convolutional neural networks and recurrent neural networks

5. Big Data Analytics

At the end of this section, students will be able to:

- a. Identify and explain difficulties caused by large data sets
- b. Categorize approaches for dealing with large data sets
- c. Identify advantages and disadvantages of different approaches
- d. Describe machine learning paradigms for large data sets such as online learning, local learning, and ensemble learning

Course Evaluation

The final course grades will be determined based on the performances in four components:

Course Component	Weight
Assignments	20%
Reports on other students' presentations	10%
Project	40%
Final Examination	30%

In order to pass the course, a student must obtain a mark of 50% or more in each component. A mark less than 50% in any component will result in a final course grade of 48% or less.

Project: The project provides the students with an opportunity to experience some of the challenges that they may face in their future work/research activities. The project topic and scope will be selected in consultation with the instructor. The deliverables will consist of a project proposal, a written report, and an oral presentation.

Late Submission Policy: There will be strict deadlines for the project and assignments. Marks will be deducted for a late assignment. 10% per day will be subtracted for a late assignment, to a maximum of 4 days late.

Final Examination: The final examination will cover all course content and will be closed book.

Use of English: In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests, and examinations for improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

Attendance: Any student who, in the opinion of the instructor, is absent too frequently from class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the department, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.

Absence Due to Illness or Other Circumstances: Students should immediately consult with the instructor or department Chair if they have any problems that could affect their performance in the course. Where appropriate, the problems should be documented (see the attached “Instructions for Students Unable to Write Tests or Examinations or Submit Assignments as Scheduled”). The student should seek advice from the instructor or department Chair regarding how best to deal with the problem. Failure to notify the instructor or department Chair immediately (or as soon as possible thereafter) will have a negative effect on any appeal.

For more information concerning medical accommodations, see the relevant section of the Academic Handbook:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

For more information concerning accommodations for religious holidays, see the relevant section of the Academic Handbook:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

Cheating and Plagiarism: Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic

offence. The commission of a scholastic offence is attended by academic penalties, which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism-detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>).

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, in the relevant section of the Academic Handbook:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

Policy on Repeating All Components of a Course: Students who are required to repeat an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment, or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted by the student for grading in subsequent years.

Internet and Electronic Mail: Students are responsible for regularly checking their Western e-mail and the course web site (<https://owl.uwo.ca/portal/>) and making themselves aware of any information that is posted about the course.

Accessibility: Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 519-661-2111 ext. 82147 for any specific question regarding an accommodation.

Support Services: Office of the Registrar, <http://www.registrar.uwo.ca/>
Student Development Centre, <http://www.sdc.uwo.ca/>
Engineering Undergraduate Services, <http://www.eng.uwo.ca/undergraduate/>
USC Student Support Services, <http://westernusc.ca/services/>

Students who are in emotional/mental distress should refer to Mental Health @ Western, http://www.health.uwo.ca/mental_health/, for a complete list of options about how to obtain help.