TIMG 5301A

Applied Analytics for Technology Innovation Management

[0.5 credit]

Fall 2025

Institute of Technology Entrepreneurship and Commercialization

TIME AND PLACE:

September 3 to December 5, 2025, Tuesdays, 6:05-8:55 pm Eastern time (Ottawa time)

In person: Nicol Building 4030

Online (synchronous portion): Zoom https://carleton-ca.zoom.us/j/92480962788

DELIVERY MODE:

HyFlex: students can attend in-person, online or a combination of in-person and online. All course participants must use CU credentials and CU email accounts for communications and login. Students should engage in class regardless of in-person or online attendance.

INSTRUCTOR:

Mika Westerlund, mika.westerlund@carleton.ca

Office: Nicol Building 5029

Office hours: Email is the preferred mode of communication because there is a record of content exchanged. The instructor will be available after class and by appointment depending on availability. Email the instructor to schedule an on-campus or virtual appointment.

COURSE MATERIALS:

Access to online course sessions, course materials, list of readings and recorded videos will be provided through the CU Brightspace system: https://carleton.ca/brightspace/.

To access Brightspace and course materials you should use your CU credentials and select the TIMG 5301A Applied Analytics for Technology Innovation Management.

Readings (articles) can be accessed and downloaded through the CU Library Online service using student's CU access privilege. A required textbook is not assigned for this course. Please note there can be changes to the material during the course. An up-to-date list of course readings will be available through the course site within Brightspace.

Lecture slides will be available on Brightspace on the day of each lecture.

COURSE DESCRIPTION:

Application of advanced business analytics in the domain of technology innovation management and technology entrepreneurship. Topics include data sourcing and scoping analysis, unsupervised machine learning techniques, text polarity analysis, trends and anomalies detection, visualization and interpretation, information validation, and ethical consideration to inform managerial judgement and support strategic and operating decisions faced by managers and entrepreneurs.

Please note that some topics covered on the course may be different from the calendar description.

OBJECTIVES AND LEARNING OUTCOMES:

To help students acquire collaborative skills and applied analytics expertise needed to co-create solutions for managerial and entrepreneurial problems and generate valuable insights for companies, organizations supporting local companies and the TIM program ecosystem.

The specific objectives are to acquire proficiency in:

- Applying topic modeling, text polarity analysis, and text mining techniques to generate practical insights from online textual data such as social media comments, customer- and product reviews, and websites.
- Combining insights from applied data analytics and scholarly literature into coherent analytics reports to inform managerial judgment and support strategic and operating decisions faced by managers and entrepreneurs.

Upon course completion, participants will be able to:

- Apply machine learning tools to solve relevant managerial and entrepreneurial problems.
- Prepare and present applied analytics outcomes in a way that advances our knowledge.
- Synthesize steps from text data processing, analysis, and interpretation into a coherent report.

CLASS SESSIONS:

Class sessions will include a combination of online lectures and interactive sessions that focus on using various machine learning tools. For each class, read the assigned readings and be prepared to:

- Use machine learning tools to solve real problems in organizations.
- Apply and present key learnings from the assigned course material.
- Generate actionable insights and propose solutions to real problems.

Video recordings of class sessions will be available on the day after lecture within Brightspace.

STUDENT GROUPS

The class will be split into 10-12 groups of 5-6 students each. Each student will work individually and together with the group members to perform tasks in class and outside the class hours, participate in informal group meetings, and contribute to delivering the assignments. Constructive collaboration among group members is part of the group assignments. Leaving and changing groups for any reason will not be tolerated, because the course schedule and grading mechanism does not support such alterations in group structure. Once formed, each group should establish a project management structure that will help collaboration between group members and maximize the value of the deliverables. Group members should meet on a weekly basis.

GROUP WORK AND FREE LOADERS

There will be zero tolerance for free loaders. A freeloader is someone who exploits the efforts of team members without making a proportional contribution in return. Group work is an important component of this course. Group conflicts are to be dealt with by the group in a way that is fair, respectful, and fast. In case a non-contributing student is excluded from a group, that student may not be able to complete the course or will need to deliver the assignment individually if the course schedule allows it. Any exclusions from a group must be reported to the instructor immediately.

ADMINISTRATIVE DETAILS:

Missing classes

If a student misses a class, it is the student's responsibility to find out what was covered, what assignments were made and what handouts were distributed. It is strongly recommended to watch the video recording of each missed class.

Plagiarism

Plagiarism is a serious instructional offense that will not be tolerated. A case of plagiarism in assignments or the take-home final exam will be referred to the Chair of the Department and the

Carleton University Ethics Committee. The instructor will not deal with the matter directly. See: http://carleton.ca/registrar/academic-integrity/

Software & IT requirements

This course requires that at least one person in each group installs the open-source software -based Orange machine learning and data mining toolkit, available at https://orangedatamining.com/ with its text widget (Option → Add-ons → Text). However, it is recommended for all students have it. The Documentation section on Orange's website provides some help and tutorials. Installing and dealing with any compatibility issues or problems regarding operationality is each student's own responsibility. The instructor does not have resources to help students with their IT problems.

Also, spreadsheet software (preferably Excel) is necessary to handle and edit data sets. Computer programming skills are not required on this course but may be useful, and any student interested in becoming proficient in data analytics, and especially those in the MABA option, are highly recommended to develop and advance their programming skills..

Course grading

Marks will be assigned as follows:

Course requirement	**Format**	**Mark (max.)**
Assignment 1 (group effort) – Scoping review	Presentation, slides, report	15
Assignment 2 (group effort) – Data analysis & interpretation	Presentation, slides, report	40
Assignment 3 (group effort) – Validation & storytelling	Presentation, slides, report	15
Take-home final exam (individual effort)	Exam report	30
Total (max.)		100

Assignments 1, 2 and 3 have two parts: 1) a presentation in class using slides and 2) a written document. The maximum time allocated for presentation is A1) 5 minutes + 5 minutes for feedback, and A2 & A3) 10 minutes + 10 minutes for feedback. The maximum length for reports: 3,000 words (A1, A2) and 6,000 words (A3). Assignment 3 is a summative report that also includes key points from A1 and A2. All assignments and the final exam should be submitted through Brightspace and are mandatory to pass the course. See below for details and deadlines.

The take-home final exam will be graded on a competitive basis. The best solution(s) in class will receive the maximum available points. All other solutions will be graded, firstly, in comparison with the top solution(s) and, secondly, in comparison with other students' solutions. Assessment of the take-home final exam will emphasize originality, novelty, relevance, and depth of the solution, as

well as quality and compliance with the guidelines provided. The maximum points any one student can receive is 30 points. See below for details.

In accordance with the Carleton University Graduate Grading System, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100 | A = 85-89 | A- = 80-84 | B+ = 77-79 | B = 73-76 | B- = 70-72 | F = Fail

The minimum passing grade for the course is B-.

Grades entered by Registrar: WDN = Withdrawn from the course | DEF = Deferred

ASSIGNMENTS:

The students must successfully complete 3 mandatory assignments (group work only). When put together, these assignments result in a coherent report (A3). The instructor will mark all assignments and exams himself. Late assignments are not acceptable without permission from the instructor. The data required for the assignments is group-specific and will be provided by the instructor.

Assignments 1, 2 and 3 have two parts: 1) a presentation in class using slides and 2) a written document. The maximum time allocated for presentation is A1) 5 minutes + 5 minutes for feedback, and A2 & A3) 10 minutes + 10 minutes for feedback. The maximum length for reports: 3,000 words (A1, A2) and 6,000 words (A3). Assignment 3 is a summative report that also includes key points from A1 and A2. Slides and documents should be submitted in PDF format through the course site within Brightspace by the deadline (details available in Brightspace). At least one person from each group will need to present each assignment in class (in person or online). Any feedback received after the presentation should be considered and applied to improve the written document.

Further details and instructions regarding the assignments will be delivered and discussed in class. This information will also be available on the course site within Brightspace.

Deadlines for assignments: 1) Slides are due on the day before the presentation (see Class schedule); 2) Reports are due A1: Oct 13, A2: Nov 17, A3: Dec 8 (see Class schedule and Summary table which also lists the key points in grading assignments. Slides and reports in PDF format.

Summary table for assignments:

Max. points	**Assignment**	**Deadlines**
15 p.	A1: Scoping review (article corpus 5 p., topic identification 10 p.)	• A1 slides (all groups): Mon Sep 29 • A1 report (all groups): Mon Oct 13
40 p.	A2: Data analysis & interpretation (preprocessing 5 p., analysis 20p., interpretation 10p., problem identification 5 p.)	• A2 slides (groups 1-6): Mon Nov 3 • A2 slides (groups 7-12): Mon Nov 10 • A2 report (all groups): Mon Nov 17

15 p.	A3: Validation & storytelling (validation 5 p., recommendations 5p., summarization 5p.*) *) A3 report includes key points from A1 & A2	• A3 slides (groups 1-6): Mon Nov 24 • A3 slides (groups 7-12): Mon Dec 1 A3 report (all groups): Mon Dec 8

TAKE-HOME FINAL EXAM:

Take-home final exam is an individual effort, and group effort is considered an act of plagiarism. The examination questions along with detailed instructions and guidelines will be introduced and discussed in class and distributed through the course site within Brightspace during Session 13.

Your examination report with the solutions is **due on Saturday December 20, 2025,** and it must be submitted in PDF format through the course site within Brightspace by the deadline. Late submission is not acceptable without permission from the instructor.

There are 2 questions in the final take-home exam. The maximum length of the exam report is 6 pages (3 pages per question). Use 1.5 line spacing. Font type: Times New Roman or Arial. Font size: 10 pts or 12 pts. Use margins of one inch (minimum) all around. PDF. The take-home final exam will be marked based on a comparison with other students' exam reports. See above for criteria.

Summary table for the take-home final exam:

Max. points	**Take-home final exam**	**Deadline**
30 p.	2 questions, max. a'15 pts, totaling max. 30 points	Saturday, December 20

CHATGPT:

Students are encouraged to use ChatGPT (https://chat.openai.com/chat) or other GPT tools to:

- Improve the language, flow and content of your assignments and reports.
- Align parts of an assignment to make a whole.
- Acquire and synthetize information.
- Complement machine learning analyses.
- Perform alternative analyses
- Create notes and learning diaries of the course content.
- Eliminate errors in grammar, spelling, and capitalization as well as citations and references.
- Provide a skeletal structure for assignments.
- Generate ideas, make recommendations, and extract what is most important.

Students are discouraged from using ChatGPT to:

- Provide unedited AI-generated output as a solution to assignments and exam questions.
- Produce content for assignments/exams without double-checking citations and references.

CLASS SCHEDULE:

This calendar is tentative; it may be modified as the course proceeds. Please consult the course site within Brightspace for up-to-date information on the course schedule and readings.

Session	Date	Readings	Details / Other
Introduction to text analytics			
#01	Sep 9	• N/A	• Course outline
Foundations of text processing			
#02	Sep 16	The following article: • Chai (2023)	• Data analysis in class • AirBnB data available on the course site
Introduction to topic models: LSA & Scoping review			
#03	Sep 23	Two of the following articles: • Guan et al. (2018) • Wagire et al. (2020) • Bignell et al. (2022) • Ahmad & Laroche (2023)	• Data analysis in class • AirBnB data available on the course site
Presentation of A1 – Scoping review presentations			
#04	Sep 30	• Presentations (all groups 1-12)	Deadline for all groups: • A1 slides: Mon Sep 29 • A1 report: Mon Oct 13
Sentiment analysis & Product reviews			
#05	Oct 7	Three of the following articles: • Fang & Zhan (2015) • Ghatora et al. (2024) • Ireland & Liu (2018) • Mao et al. (2024) • Shaik et al. (2023) • Li et al. (2025)	• Data analysis in class • Monzo data available on the course site
Topic modeling: LDA & User comments			
#06	Oct 14	Three of the following articles: • Blei (2003) • Bastani et al. (2019) • Toussaint et al. (2022) • Chen et al. (2024) • Ying et al. (2024) • Muhetaer & Hao (2025)	• Data analysis in class • Monzo data available on the course site
Fall break – No classes			
	Oct 21	• *No classes*	• *No classes*
Information visualization & interpretation			

#07	Oct 28	Three of the following: • Liu et al. (2021) • Wong et al. (2021) • Palese & Piccoli (2020) • Gillings & Hardie (2023) • Maskat et al. (2023) • Liu & Wang (2025)	• Monzo data available on the course site
Presentation of A2 – Day 1			
#08	Nov 4	• Presentations (groups 1-6)	Deadlines for groups 1-6: • A2 slides: Mon Nov 3 • A2 report: Mon Nov 17
Presentation of A2 – Day 2			
#09	Nov 11	• Presentations (groups 8-12)	Deadlines for groups 7-12: • A2 slides: Mon Nov 10 • A2 report: Mon Nov 17
Validation & storytelling			
#10	Nov 18	Three of the following articles: • Hagen et al. (2019) • Barravecchia et al. (2022) • Tsao et al. (2022) • Romero et al. (2024) • Zhang et al. (2024) • Herhausen et al. (2025)	• Monzo data available on the course site
Presentation of A3 – Day 1			
#11	Nov 25	• Presentations (groups 1-6)	Deadlines for groups 1-6: • A3 slides: Mon Nov 24 • A3 report: Mon Dec 8
Presentation of A3 – Day 2			
#12	Dec 2	• Presentations (groups 7-12) • Delivery of the take-home final exam	Deadlines for groups 7-12: • A3 slides: Mon Dec 1 • A3 report: Mon Dec 8 Other deadlines: • Take-home final exam deadline: December 20, 2025

COURSE SHARING WEBSITES:

Materials created for this course (including presentations, slides, case studies, data sets, assignments, and exams) remain the intellectual property of the author(s). They are intended for personal use for the purpose of meeting the course requirements and may not be reproduced or redistributed without prior written consent of the author(s).

REQUESTS FOR ACADEMIC ACCOMMODATION:

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Academic accommodations for students with disabilities

Students with disabilities requiring academic accommodations in this course are encouraged to contact a coordinator at the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or a Letter of Accommodation at the beginning of the term. You must also contact the PMC (carleton.ca/pmc/) no later than two weeks before the assignment or exam requiring accommodation. After requesting accommodation from PMC, meet with your instructor to ensure accommodation arrangements are made.

Pregnancy obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Religious obligation

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Survivors of Sexual Violence

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Other accommodation

For information on other academic accommodation please contact the departmental administrator timprogram@CUNET.Carleton.ca or visit: https://students.carleton.ca/course-outline/

READINGS:

The following is a preliminary list of course articles and may change as the course progresses. An up-to-date list of readings with hyperlinks is available on Brightspace. To access the articles, click the DOI or PERMALINK hyperlinks for each article listed on the course site or go to CU Library's website (https://library.carleton.ca/). Log in using your CU credentials and use the library's search engine to access the material(s). Please note that students are not required to read all the articles; for each lecture with assigned readings, they may choose a minimum number of articles from the list.

Lecture # 02. Foundations of text processing

- Chai, C.P. (2023). Comparison of Text Preprocessing Methods. Natural Language Engineering, 29(3): 509–553

Lecture # 03. Introduction to topic models: LSA & Landscaping

Two of the following:

- Guan, J., Levitan, A.S., & Goyal, S. (2018). Text Mining Using Latent Semantic Analysis: An Illustration through Examination of 30 Years of Research at JIS. The Journal of Information Systems, 32(1): 67–86.
- Wagire, A.A., Rathore, A.P.S., & Jain, R. (2020). Analysis and Synthesis of Industry 4.0 Research Landscape: Using Latent Semantic Analysis Approach. Journal of Manufacturing Technology Management, 31(1): 31–51.
- Bignell, J.T., Chantziplakis, G., Daneshkhah, A. (2022). Comparing the Behaviour of Two Topic-Modelling Algorithms in COVID-19 Vaccination Tweets: LDA vs. LSA. International Journal of Strategic Engineering, 5(1): 1–20.
- Ahmad, S.N., & Laroche, M. (2023). Extracting Marketing Information from Product Reviews: A Comparative Study of Latent Semantic Analysis and Probabilistic Latent Semantic Analysis. Journal of Marketing Analytics, 11(4): 662–676.

Lecture # 05. Sentiment Analysis & Product Reviews

Three of the following:

- Fang, X., Zhan, J. (2015). Sentiment analysis using product review data. Journal of Big Data 2, 5.
- Ghatora, P. S., Hosseini, S. E., Pervez, S., Iqbal, M. J., & Shaukat, N. (2024). Sentiment Analysis of Product Reviews Using Machine Learning and Pre-Trained LLM. Big Data and Cognitive Computing, 8(12), 199.

- Ireland, R., & Liu, A. (2018). Application of data analytics for product design: Sentiment analysis of online product reviews. CIRP Journal of Manufacturing Science and Technology, 23, 128-144.
- Mao, Y., Liu, Q., Zhang, Y. (2024). Sentiment analysis methods, applications, and challenges: A systematic literature review. Journal of King Saud University - Computer and Information Sciences, 36(4), 102048.
- Shaik, T., Tao, X., Dann, C., Xie, H., Li, Y., & Galligan, L. (2023). Sentiment analysis and opinion mining on educational data: A survey. Natural Language Processing Journal, 2, 100003.
- Li, Z., Chan, F.Y., Gao, C., Tong, C., & Ye, Q. (2025). Sentiment analysis and summarization with ChatGPT: implications for sales prediction. Journal of Digital Management, 1, 10.

06. Topic Modeling: LDA & User Comments

Three of the following:

- Blei, D.M., Ng, A.Y., & Jordan, M.I. (2003). Latent Dirichlet Allocation. Journal of Machine Learning Research, 3: 993-1022.
- Bastani, K., Namavari, H., & Shaffer, J. (2019). Latent Dirichlet allocation (LDA) for topic modeling of the CFPB consumer complaints. Expert Systems with Applications, 127, 256-271.
- Toussaint, P.A., Renner, M., Lins, S., Thiebes, S., & Sunyaev, A. (2022). Direct-to-Consumer Genetic Testing on Social Media: Topic Modeling and Sentiment Analysis of YouTube Users' Comments. JMIR Infodemiology, 2(2): e38749.
- Chen, Y., Xie, Z., & Chiu, D.K.W. (2024). Analytics of Motivational Factors of Educational Video Games: LDA Topic Modeling and the 6 C's Learning Motivation Model. Education and Information Technologies, 29(16): 22023–22056.
- Ying, S. (2024). Guests' Aesthetic experience with lifestyle hotels: An application of LDA topic modelling analysis. Heliyon, 10(16), e35894.
- Muhetaer, M. & Hao, G. (2025). Exploring the Application of ChatGPT in Scientific Topic Analysis: A Novel Paradigm for Enhanced Analysis and Efficiency. Applied Intelligence, 55(7), 625.

Lecture # 07. Information Visualization & Interpretation

Three of the following:

- Liu, H., Tao, Y., Qiu, Y., Huang, W., & Lin, H. (2021). Visual Exploration of Software Evolution via Topic Modeling. Journal of Visualization, 24(4): 827–844.
- Wong, G.K.W., Li, Y.K., & Lai, X. (2021). Visualizing the Learning Patterns of Topic-Based Social Interaction in Online Discussion Forums: An Exploratory Study. Educational Technology Research and Development, 69(5): 2813–2843.
- Palese, B., & Piccoli. G. (2020). Evaluating Topic Modeling Interpretability Using Topic Labeled Gold Standard Sets. Communications of the Association for Information Systems, 47: 433–451.
- Gillings, M., & Hardie, A. (2023). The Interpretation of Topic Models for Scholarly Analysis: An Evaluation and Critique of Current Practice. Digital Scholarship in the Humanities, 38(2): 530–543.
- Maskat, R., Shaharudin, S.M., Witarsyah, D., & Mahdin, H. (2023). A Survey on Forms of Visualization and Tools Used in Topic Modelling. JOIV: International Journal on Informatics Visualization Online, 7(2): 517-526.
- Liu, Y., & Wang, F. (2025). Investigating the interpretability of ChatGPT in mental health counseling: An analysis of artificial intelligence generated content differentiation. Computer Methods and Programs in Biomedicine, 268, 108864.

Lecture # 10. Validation & Storytelling

Three of the following:

- Hagen, L., Keller, T.E., Yerden, X., Luna-Reyes, F.P. (2019). Open data visualizations and analytics as tools for policy-making. Government Information Quarterly, 36(4), 101387.
- Barravecchia, F., Mastrogiacomo, L., & Franceschini, F. (2022). Digital Voice-of-Customer Processing by Topic Modelling Algorithms: Insights to Validate Empirical Results. The International Journal of Quality & Reliability Management, 39(6): 1453–1470.
- Tsao, H.-Y., Campbell, C., Sands, S., Mavrommatis, A. (2022). From Mining to Meaning: How B2B Marketers Can Leverage Text to Inform Strategy. Industrial Marketing Management, 106: 90–98.
- Romero, J. D., Feijoo-Garcia, M. A., Nanda, G., Newell, B., & Magana, A. J. (2024). Evaluating the Performance of Topic Modeling Techniques with Human Validation to Support Qualitative Analysis. Big Data and Cognitive Computing, 8(10), 132.
- Zhang, B., Zhou, Y., & Li, D. (2024). Can Human Reading Validate a Topic Model? Sociological Methodology, *55*(1), 59-90
- Herhausen, D., Ludwig, S., Abedin, E., Ul Haque, N., & de Jong, D. (2025). From words to insights: Text analysis in business research. Journal of Business Research, 198, 115491.