# IS 603 Decision Making Support Systems (Spring 2022)

**Information Systems Department**
**University of Maryland Baltimore**
**CountyBaltimore, Maryland 21250**
**Departmental Office: Room ITE 404, ph. 410-455-3206**

## Course Description

This course will provide an overview of data-driven decision-making via artificial intelligence (AI) and data science (DS) technologies. The emphasis is on how to use these technologies to solve real-world problems, rather than on the algorithmic or mathematical details of the methods. Students will obtain an understanding of both fundamental concepts and practical insights in data-analytic thinking, as well as a foundation for further study in AI and DS.

**Student learning outcomes:** By the end of this course, you will be able to:

- Explain how artificial intelligence (AI) and data science (DS) technologies can help businesses and other organizations to leverage data to understand customersand make better decisions,
- describe the data science process and the fundamental concepts underlying data-analytic methods,
- formulate business problems as AI/DS problems, outline several AI/DS techniques at a conceptual level,
- discuss and address ethical issues that arise when performing data-driven decisionmaking, and
- make sensible choices regarding practical issues in the application and deploymentof AI/DS technologies.

**Lecture time and venue:** Tuesdays 4:30 PM - 7:00 PM Online (Blackboard Collaborate)

**Instructor:** Dr. Faisal Quader
**Instructor email:** fquader1 [at] umbc [dot] edu. Please use Blackboard for course-related questions, instead of email, so that everyone can benefit from the answers.
**Instructor office hours:** Thursdays 5:00 - 6:00 pm, online (Blackboard Collaborate) or at Room ITE 402 or other times by appointment

## Prerequisites

None. This is a core course and does not require any background knowledge indata-driven decision-making.

## Required Textbook

Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, 1st Edition, by Foster Provost and Tom Fawcett is the course textbook. You will need this book for mandatory weekly readings.

## Course Requirements and Grading

- Homework 25% (5 of them, 6.25% each for your best 4 homework; the lowest score will be dropped)
- Group projects 25%
    - Proposal 5% (due 3/1/2022)
    - Mid-term report 5% (due 4/19/2022)
    - Group project poster 5% (presented in class 5/10/2022, digital copy due)
    - Final report 10% (due Tuesday 5/17/2022)
- Midterm Exam 20% (4/5/2022)
- Final 25% (5/20/2022)
- Participation 5%
    - Poll questions 3%
    - At least two Blackboard posts 2% (can be either questions or answers)

The project will be done in groups of 3-5. Project proposals are to be sent to me by email and approved by the deadline.

In this course, participation means more than just showing up. It also refers to contributing to everyone's learning, through active engagement in peer instruction exercises, in-class discussions, and Blackboard questions/answers. Participation grades will be assessed as a percentage of peer instruction questions answered (correctly or not), with a 90% response rate being sufficient for full points, and by Blackboard contributions. Two or more contributions (either questions or answers) on Blackboard will earn you 2% of the final grade.

With respect to final letter grades, UMBC's Catalog states that an A indicates "superior"achievement; B, "good" performance; C, "not satisfactory"; D, "unacceptable"; F, "failure." There is specifically no mention of any numerical scores associated with these letter grades. Below are how grades may be assigned based on your final points, accumulated over the semester. Grades will be assigned using a plus/minus system. It isuniversity policy that A+, D+, and D- are not assigned. I do not grade on a curve, so that everyone in the class has the opportunity to succeed.

| Final Grade | Letter Grade | Point when calculating GPA |
|---|---|---|
| 91 - 100 | A | 4.0 |
| 89 - 90.99 | A- | 3.7 |
| 87 - 88.99 | B+ | 3.3 |
| 81 - 86.99 | B | 3.0 |
| 79 - 80.99 | B- | 2.7 |
| 77 - 78.99 | C+ | 2.3 |
| 71 - 76.99 | C | 2.0 |
| 69 - 70.99 | C- | 1.7 |
| 60 - 68.99 | D | 1.0 |
| 0 - 59.99 | F | 0.0 |

## Homework and Exam Policies

- Homeworks are due at the **beginning of class** on the dates specified. **Late homework will not be accepted** unless an extension is approved by me in advance. Requests for extensions must be made at least **three days before the due date**.
- In the event of class cancellation due to inclement weather, any hard-copy paper assignment or test will be due in the next class meeting. Electronic submissions will still be due on the original due date.

## Schedule

Chapter numbers in the readings refer to the Provost and Fawcett textbook

| Lecture | Week | Summary | Details | Assessment | Required Reading |
|---|---|---|---|---|---|
| **2/1/22** | Week 1 | Course Overview, Data Analytics Thinking | Course overview, introduction to data-driven decision making and data-analytic thinking | | Ch 1, or Dhar, V. (2013). "Data science and prediction". Communications of the ACM. 56 (12): 64–73. |

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| **2/8/22** | Week 2 | Business Problems and Data Science Solutions | Canonical data mining tasks, the data mining process, supervised vs unsupervised learning | **HW1 Out** | Ch 2 |
| **2/15/22** | Week 3 | Introduction to Predictive Modeling | Models, induction, and prediction, finding correlations, attribute Selection, tree induction | | Ch 3 |
| **2/22/22** | Week 4 | Fitting a Model to Data | Finding "optimal" model parameters, choosing the goal for data mining, objective functions, loss functions, linear models. Sharing project ideas. | **HW1 due, HW2 out. Project groups formed by this date** | Ch 4 |
| **3/1/22** | Week 5 | Overfitting and Its Avoidance | Generalization, fitting and overfitting, complexity control, regularization, hold-out method | **Project proposal due** | Ch 5 |

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| **3/8/22** | Week 6 | Similarity, Neighbors, and Clusters | Calculating similarity, using similarity for prediction, nearest neighbors, clustering | **HW2 due, HW3 out** | Ch 6 |
| **3/15/22** | Week 7 | What Is a Good Model? | Evaluating machine learning methods, expected value framework, baselines, various evaluation metrics | | Ch 7 |
| **3/22/22** | Week 8 | Spring Break No Class | | | |
| **3/29/22** | Week 9 | Visualizing Model Performance | Visualization of model performance under uncertainty, profit curves, cumulative response curves, lift curves, ROC curves | **HW3 due, HW4 out** | Ch 8 |
| **4/5/22** | Week 10 | Mid Term | | | |
| **4/12/22** | Week 11 | Data Science Ethics | Fairness/bias in AI, privacy, accountability, transparency. | **HW4 due, HW5 out** | Angwin, J., Larson, J., Mattu, S., & Kirchner, L. (2016). Machine bias. ProPublica, May, 23, 2016. |

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| **4/19/22** | Week 12 | Toward Analytical Engineering | Solving business problems with data science, designing solutions based on the data, tools, and techniques available | **Project mid-term progress report due** | Ch 11 |
| **4/26/22** | Week 13 | Other Data Science Tasks and Techniques | Co- occurrences and associations, link prediction, causal modeling | **HW5 due** | Ch 12 |
| **5/3/22** | Week 14 | Data Science and Business Strategy | Acquiring competitive advantage via data science, curating data science capability | | Ch 13 |
| **5/10/22** | Week 15 | Conclusion<br><br>**Group Project Presentation – Part One** | Overview, limits of data science, ethics, next steps | **Digital copies of posters due (before class, can update on Blackboard until 11:59pm).** | Ch 14 |

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| **5/17/22** | Week 16 | **Group Project Presentation – Part Two** | Remaining Group Presentations | **Project final report due Tuesday 5/17/2022 (11:59pm)** | |
| **5/20/22 Friday** | Exam Week | Final Exam | | Exam from 4:30 to 7:30 PM (extra 30 min) | |

The schedule may subject to change. The summary and details columns are only a guideline of the content likely to be covered, and the dates on which material is coveredmay shift.

## Online Instruction

This course will be taught online via Blackboard Collaborate, with synchronous lectures at the scheduled time. You can access lectures by navigating to the course onBlackboard, then clicking on the "Bb Collaborate" tab. Lectures will be recorded on Blackboard for later viewing, however participation during the scheduled time is expected and participation in polls during the lessons counts toward your grade.

Some of you are attending from other time zones or have other difficulties attending the class. If so, please let me know and we can discuss the possibility of alternative arrangements.

## Instructional Methods

Traditional lectures will be augmented with active learning methods, primarily in the form of peer instruction exercises. Research has strongly indicated that active learning improves student outcomes in STEM fields versus traditional lecturing (Freeman et al., 2013). We will be using the Blackboard service for polls and quizzes. You will need to bring a mobile device, laptop, or tablet to class in order to participate in the exercises. If you do not have a suitable device, please let me know as soon as possible.

Pre-class reading assignments will be given for each lesson, which are very important for learning, and for making the best use of our limited time together. These readings are therefore required.

## Software

This course will make use of the free, open source WEKA data mining toolkit.

## COVID-19 Policies

Please see this Google doc for UMBC Policies and Resources during COVID-19.

## Spring 2022 Safety Protocols and Compliance Statement:

> "UMBC has set clear expectations for masking while on campus that include the requirement that you must wear a KN95 face mask or equivalent that covers your nose and mouth in all classrooms regardless of your vaccination status. For information on masks equivalent to KN95s please click the following link: https://covid19.umbc.edu/masks/ This is to protect your health and safety as well as the health and safety of your classmates, instructor, and the university community. Anyone attending class without a KN95 mask or wearing one improperly will be asked by the instructor to put on a KN95 mask or fix their mask in the appropriate position. Any student that refuses to comply with this directive will be asked to leave the classroom immediately and failure to do so may result in the instructor requesting the assistance of the University Police. Students who refuse to wear KN95 masks may be referred to Student Conduct and Community Standards and may face disciplinary action for violations of the Code of Student Conduct, specifically, Rule 2: Behavior Which Jeopardizes the Health or Safety of Self or Others and Rule 16: Failure to Comply with the Request of a University Official. UMBC's on-campus safety protocols, including masking requirements, are subject to change in response to the evolving situation with Covid-19."

## Academic Integrity

> UMBC's policies on academic integrity will be strictly enforced (see the University System of Maryland's policy document, UMBC's academic integrity overview page, the student academic conduct policy and the UMBC catalog). In particular, **all of your work must be your own.** Acknowledge and cite source material in your papers or assignments. While you may verbally discuss assignments with your peers, **you may not copy or look at anyone else's written assignment work or code or share your own solutions. Any exceptions will result in a zero on the assessment in question and may leadto further disciplinary action.** Some relevant excerpts from UMBC's policies,as linked to above, are:

- "By enrolling in this course, each student assumes the responsibilities of an active participant in UMBC's scholarly community in which everyone's academic work and behavior are held to the highest standards of honesty. Cheating, fabrication, plagiarism, and helping others to commit these acts are all forms of academic

dishonesty, and they are wrong." (UMBC's academic integrity overview) "Students shall not submit as their own work any work which has been prepared by others." (USM policy document)

- "Students shall refrain from acts of cheating and plagiarism or other acts of academic dishonesty." (USM policy document)
- "Plagiarism means knowingly, or by carelessness or negligence, representing as one's own, in any academic exercise, the intellectual or creative work of someone else." (Student academic conduct policy)
- "Cheating means using or attempting to use unauthorized material, information, study aids, or another person's work in any academic exercise" (student academic conduct policy)

## Accessibility and Disability Accommodations, Guidance and Resources

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations.The Office of Student Disability Services (SDS) is the UMBC department designated tocoordinate accommodations that would create equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations inyour courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures.

SDS email: disAbility@umbc.edu
SDS phone: (410) 455-2459

If you will be using SDS approved accommodations in this class, please contact me (instructor) to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essentialfor success.

## Counseling Center

Diminished mental health can interfere with optimal academic performance. The sourceof symptoms might be related to your course work; if so, please speak with me.
However, problems with other parts of your life can also contribute to decreased academic performance. UMBC provides cost-free and confidential mental health services through the Counseling Center to help you manage personal challenges thatthreaten your personal or academic well-being.

Remember, getting help is a smart and courageous thing to do -- for yourself and for those who care about you. For more resources get the Just in Case mental health resources Mobile and Web App. This app can be accessed by clicking: counseling.umbc.edu/justincase.

The UMBC Counseling Center is in the Student Development & Success Center (between Chesapeake and Susquehanna Halls). Phone: 410-455-2472. Hours: Monday-Friday 8:30am-5:00pm.

## Diversity Statement on Respect

Students in this class are encouraged to speak up and participate during our meetings. Because the class will represent a diversity of individual beliefs, backgrounds, and experiences, every member of this class must show respectfor every other member of this class. (Statement from California State University, Chico's Office of Diversity and Inclusion).

## Family Educational Rights and Privacy Act(FERPA) Notice

Please note that as per federal law I am unable to discuss grades over email. If you wishto discuss grades, please come to my office hours.

## Sexual Assault, Sexual Harassment, and GenderBased Violence and Discrimination

UMBC's Policy on Sexual Misconduct, Sexual Harassment and Gender Discriminationand Federal Title IX law prohibit discrimination and harassment on the basis of sex in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment or retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources:

Mikhel A. Kushner, Title IX Coordinator (she/her/hers)
410-455-1250 (direct line), kushner@umbc.edu

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety ofthe community.

## Hate, Bias, Discrimination and Harassment

UMBC values safety, cultural and ethnic diversity, social responsibility, lifelong learning, equity, and civic engagement.

Consistent with these principles, UMBC Policy prohibits discrimination and harassment in its educational programs and activities or with respect to employmentterms and conditions based on race, creed, color, religion, sex, gender, pregnancy, ancestry, age, gender identity or expression, national origin, veterans status, marital status, sexual orientation, physical or mental disability, or genetic information.

Students (and faculty and staff) who experience discrimination, harassment, hate or biasor who have such matters reported to them should use the online reporting/referral formto report discrimination, hate or bias incidents; reporting may be anonymous.

If you are interested in or thinking about making a report, please see the Online Reporting Form. Please note that, while University options to respond may be limited,there is an anonymous reporting option via the online form and every effort will be made to address concerns reported anonymously.

## Notice that Faculty are Responsible Employees with Mandatory Reporting Obligations:

All faculty members are considered Responsible Employees, per UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination. Faculty are therefore required to report possible violations of the Policy to the Title IX Coordinator,even if a student discloses something they experienced before attending UMBC.

While faculty members want you to be able to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report Sexual Misconduct to the Title IX Coordinator so that theUniversity can inform students of their rights, resources and support.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of Confidential Resources available to support you:

- The Counseling Center: 410-455-2472 / After-Hours 410-455-3230
- University Health Services: 410-455-2542
- Pastoral Counseling via Interfaith Center: 410-455-3657; interfaith@umbc.edu

Other Resources:

- Women's Center (for students of all genders): 410-455-2714; womenscenter@umbc.edu.
- Shady Grove Student Resources, Maryland Resources, National Resources.

Child Abuse and Neglect:

Please note that Maryland law and UMBC policy require that I report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and/or the police.

**This course follows all other policy guidelines from the UMBC Office of Equityand Inclusion (OEI) listed at https://oei.umbc.edu/sample-title-ix-responsible- employee-syllabus-language/**

## Campus Resources

- Diversity and inclusion resources: about.umbc.edu/diversity-and-inclusion/
- The Mosaic Center for Culture and Diversity: osl.umbc.edu/diversity/mosaic
- Career Center's resources for diverse populations (including student organizations): http://careers.umbc.edu/students/resources/diverse/
- Resources for LGBTQ students: osl.umbc.edu/lgbtq/community_resources/
- Office of International Education Services (IES): ies.umbc.edu/
- Information regarding recent executive actions: ies.umbc.edu/executive-actions/
- Wellness Initiative: wellness.umbc.edu/
- Counseling Center: counseling.umbc.edu/
- Women's Center: womenscenter.umbc.edu/
- Center for Women in Technology (CWIT): cwit.umbc.edu/
- Women Involved in Learning and Leadership (WILL) Program: gwst.umbc.edu/will/
- Sexual assault and relationship violence on-campus resources: womenscenter.umbc.edu/sexual-assault-and-relationship-violence-response-team-and-umbcs-voices-against-violence/
- Sexual misconduct policies and procedures (including filing a complaint): humanrelations.umbc.edu/sexual-misconduct/policies-and-procedures/
- University System of Maryland's Policy of Non-Discrimination on the Basis of Sexual Orientation and Gender Identity or Expression: humanrelations.umbc.edu/files/2014/12/USMPolicyNonDiscrimSOrientGenderIEJune2012.pdf
- Office of Student Disability Services: sds.umbc.edu/
- Academic Center for Student Athletes: umbcretrievers.com/information/academiccenter/acsa
- Veteran Services veterans.umbc.edu/
- The Interfaith Center: osl.umbc.edu/diversity/interfaith/
- Graduate Student Association: gsa.umbc.edu/