# Course Syllabus: MIS 64060 – Fundamentals of Machine Learning

Fall 2022 – Section 002 – CRN 15526

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Delivery: 100% Web-Based, Asynchronous
Dates: August 25, 2022 to December 11, 2022

## Course Information

**Course Description**
In this course, you learn some fundamentals of machine learning. Specifically, we concentrate on classification modelling, segmentation and clustering and recommendation systems.

**About this Course**
Fundamentals of Machine Learning is one of the core courses of the Master of Science in Business Analytics (MSBA) program. In this course, students learn some fundamentals of machine learning as they can be applied to solve various business problems. Specifically, the course concentrates on classification modelling, segmentation and clustering, and recommendation systems. Students entering the course should be able to operate a computer and navigate Canvas, have skills in word processing software such as Microsoft Word and have the willingness to learn some basic computer programming using the R language.

**Course Times and Location**
This is a fully online, 15-week course. There will be no face-to-face meetings. All assignments have due dates; please refer to the assignment schedule located within the course.

**Office Hours**
Office Hours: TR 9:30 AM-12:00 PM

**Prerequisites**
Graduate Standing

**Course Learning Outcomes**

By the end of the course, you will be able to:

1. Think critically about how to use machine learning algorithms to solve a given business problem.
2. Know how to formulate business problems and identify relevant data to use in modeling frameworks.
3. Know how to evaluate the appropriateness and estimate the performance of various machine learning models for a given task.
4. Know how to use software tools (such as R) effectively to implement machine learning algorithms for data mining/visualization and analytics;
5. Foster the communication and presentation of statistical results and inferences.

**Module Structure**

- Module 1: Introduction to Machine Learning (August 25 - September 4)
- Module 2: Introduction to R (September 5 - September 11)
- Module 3: Fundamental Concepts in Supervised Learning (September 12 to September 18)
- Module 4: k-NN Classification (September 19 to October 2)
- Module 5: Naïve Bayes Classification (October 3 - October 16)
- Module 6: K-mean Clustering Algorithm (October 17 - October 30)
- Module 7: DBSCAN Clustering Algorithm (October 31 to November 13)
- Module 8: Hierarchical Clustering (November 14 to November 28)
- Module 9: Recommended Systems and Final Exam (November 28 – December 18)

**Learning Materials**

**Textbook**: The following books are required:

- Peng, Roger D. R programming for data science. Lulu. com, 2015. This book is freely available at: https://leanpub.com/rprogramming. The following parts of the book should be covered:
    - Part 4: Getting Started with R, page 9
    - Part 5: R Nuts and Bolts, pages 10-22
    - Part 6: Getting Data in and out of R, pages 23-30
    - Part 14: Control Structures 62-69
- Data Mining for Business Analytics, Galit Shmueli et al., Wiley. ISBN-10: 1118879368; ISBN-13: 978-1118879368 (https://www.dataminingbook.com/book/r-edition)

**Software**:

- We will be using R. Please also install a copy of RStudio. Extensive help for R is available online. You can also install Swirl, which will help you learn R. Here is further documentation from the library on the use of R.

- You will also build a Shiny app for your presentation. Install that.
- We will also be using GitHub and Git. Please install them, and create a personal account on GitHub. You can also install the desktop client for GitHub. Both Git and GitHub are well documented.
- The GitHub address for our class is https://github.com/KSU-MSBA/64060.git. Synchronize that to your computer.

## Technology Requirements and Skills

**Computer Hardware and Software**
Review the Technology Requirements section of the Getting Started in Your Online Course site (located within your course) for important information including links to free or discounted versions of required software.
A personal computer with consistent, reliable Internet access is required:

1. A DSL or cable connection to the Internet; dial-up is not sufficient.
2. Laptop or desktop computer with a minimum of a 2 GHz processor and 2 GB of RAM

You should have the following software installed on your computer:

1. An actively supported operating system such as Windows 10 for PC computers OR Mac OS X 10.11 or newer for Apple Mac computers.
2. Microsoft Office Suite (Word, Excel, PowerPoint).
3. Antivirus for Windows OS, Microsoft Security Essentials OR Antivirus for Mac OS, Sophos
4. A compatible browser, such as the latest version of Firefox, Chrome, or Safari. **Internet Explorer is NOT a supported browser and should not be used.**

**Technology Skills**
For this course, you will be using a software called R. R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. You will also need to download and install RStudio, an open source and enterprise-ready professional software for R.

You will also have to set up a GitHub account.

Other technology skills students will need to be successful in this course might include: navigating a computer operating system, launching and quitting applications, connecting to the Internet, using a web browser to search the World Wide Web, downloading, saving, and uploading files, and sending and replying to email. It might also include basic skills in MS Word, MS PowerPoint, and any other software applications that the course will be using.

**Canvas**
This class will use Canvas, the official learning management system (LMS) used by Kent State University to deliver course materials to university students. ALL course materials and activities will take place in Canvas.
In order to login to the online Canvas LMS, you will need a Kent State FlashLine User Name ID and password.

- You can login to Canvas either through FlashLine or via a direct link to the login page: https://kent.instructure.com/login

For help using the LMS, use the "Canvas Student Guides" link in your course.
In general, Canvas works best using the latest version of most major web browsers, including Firefox, Chrome, and Safari.

**Technology Help Guidelines**

A. **30-Minute Rule:** When you encounter struggles with technology, give yourself 30 minutes to 'figure it out.' If you cannot, then post a message to the discussion board; your peers may have suggestions to assist you. You are also directed to contact the KSU Helpdesk 24/7. As a last resort, contact me. However, do not expect an immediate reply, and I cannot guarantee that I will be able to help with any and all technology issues.

B. When posting or sending email requesting help with technology issues to the Helpdesk use the following guidelines:

    1. Include a descriptive title for the subject field that includes 1) the name of course 2) the issue. Do NOT just simply type "Help" into the subject field or leave it blank.
    2. List the steps or describe the circumstance that preceded the technical issue or error. Include the exact wording of the error message.
    3. When possible, always include a screenshot(s) demonstrating the technical issue or error message.
    4. Also include what you have already tried to do to remedy the issue (rebooting, trying a different browser, etc.).

## Policies and Expectations

**Online Attendance Policy**
Online courses are conducted on the premise that regular attendance requires students to log into the learning management system (LMS). Attendance is measured both by virtual presence in the online course and student interaction with course learning materials and assignments. Students are expected to check their Kent State e-mail and to log into the system multiple times (at least every other day) during the week.

All actions by students in the LMS can be tracked. At any time during the course, an instructor may generate a report that indicates when and how long individual students have been logged into the LMS, or engaged with course materials or course tools.

Students who anticipate an absence from the online course due to technical or medical reasons should consult with the instructor individually. An absence due to illness or injury requires verification from a medical professional and should be presented to the instructor.

**Communication Policy**

1. Email course questions and personal concerns, including grading questions, to me privately using your @kent.edu email. Do NOT submit posts of a personal nature to the discussion board.
2. I will make every effort to respond to all emails in a timely manner.
3. For questions related to technology, please contact: 330-672-HELP for 24/7 support.

**Online Student Conduct and Etiquette**

Communicating appropriately in the online classroom can be challenging. In order to minimize this challenge, it is important to remember several points of "internet etiquette" that will smooth communication for both students and instructors:

1. **Read first, Write later.** Read the ENTIRE set of posts/comments on a discussion board before posting your reply, in order to prevent repeating commentary or asking questions that have already been answered.
2. **Avoid language that may come across as strong or offensive.** Language can be easily misinterpreted in written electronic communication. Review email and discussion board posts BEFORE submitting. Humor and sarcasm may be easily misinterpreted by your reader(s). Try to be as matter-of-fact and professional as possible.
3. **Follow the language rules of the Internet.** Do not write using all capital letters, because it will appear as shouting. Also, the use of emoticons can be helpful when used to convey nonverbal feelings. ☺
4. **Consider the privacy of others.** Ask permission prior to giving out a classmate's email address or other information.
5. **Keep attachments small.** If it is necessary to send pictures, change the size to an acceptable 250kb or less (there are several programs you can use to do this such as: Photoshop, Paint, GIMP, and picresize.com).
6. **No inappropriate material.** Do not forward virus warnings, chain letters, jokes, etc. to classmates or instructors. The sharing of pornographic material is forbidden.

**NOTE***: The instructor reserves the right to remove posts that are not collegial in nature and/or do not meet the Online Student Conduct and Etiquette guidelines listed above.*

**University Use of Electronic Email**

A university-assigned student e-mail account is the official university means of communication with all students at Kent State University. Students are responsible for all information sent to them via their university-assigned e-mail account. If a student chooses to forward information in their university e-mail account, he or she is responsible for all information, including attachments, sent to any other e-mail account. To stay current with university information, students are expected to check their official university e-mail account and other electronic communications on a frequent and consistent basis. Recognizing that some communications may be time-critical, the university recommends that electronic communications be checked minimally twice a week.

## Assignments and Grades

A detailed breakdown of course assignments and due dates by lesson module is available as a separate .pdf document that can be accessed by clicking on the **Syllabus** link in the course menu.

**Assignment 1:**

This assignment is to get familiar with using R and GitHub. You will download a dataset involving different types of variables, and output descriptive statistics on these variables. You will then upload your data and code to GitHub.
CLOs: 4

**Assignment 2:**

The assignment is a machine learning model building exercise where you need to train and optimize a classifier to solve the given business problem. You will use k-NN for this assignment. You are expected to submit your implementation code in R along with the interpretation of the mode results.
CLOs: 1, 2, 3, 4, 5

**Assignment 3:**

The assignment is a machine learning model building exercise where you need to train and optimize a classifier to solve the given business problem. You will use Naive Bayes for this assignment. You are expected to submit your implementation code in R along with the interpretation of the mode results.
CLOs: 1, 2, 3, 4, 5

**Assignment 4:**

The assignment involves you building an unsupervised customer segmentation model using K-Means. You should consider aspects such as selecting the optimal number of

segments and provide a description of the customer segments detected by your models. You are expected to submit your implementation code in R along with the interpretation of the mode results.
CLOs: 1, 2, 3, 4, 5

**Assignment 5:**
The assignment involves you building an unsupervised customer segmentation model using Hierarchical Clustering. You should consider aspects such as selecting the optimal number of segments and provide a description of the customer segments detected by your models. You are expected to submit your implementation code in R along with the interpretation of the mode results.
CLOs: 1, 2, 3, 4, 5

**Final Exam:**
The final exam for this course will be a self-selected project that satisfies the following conditions:

1. The project should use real-world data. You may either collect this data or use available data. You may also use data from competitions, e.g., Kaggle.
2. The project may use any appropriate machine-learning technique to solve the problem. Please be clear on your objectives for the problem.
3. Finally, you will create a short presentation and report to be presented to top-level management.

CLOs: 1, 2, 3, 4, 5

**Graded Discussions**
Throughout the course, there will be questions posted on different topics as part of discussions on Canvas. Your initial posts and responses will be graded.

**Practice Learning Activities**
A series of additional examples and practices will be available to you. You can also do problems from the chapter exercises in *Data Mining for Business Analytics*.
CLOs: 1, 2, 3, 4, 5

**Late and Make-up Work Policy**
If you run into an unusual circumstance that prohibits you from meeting the assignment deadline, please contact me immediately. The opportunity for partial credit for late work submitted or for make-up work may be available depending on the circumstances. I will consider each request on a case-by-case basis. Timely communication of the circumstance to me is critical in an 15-week class.

**Grading and Feedback**
I will try to grade and provide feedback on assignments as soon as possible but hopefully no later than 6 days from the deadline. I will try to post discussion grades by the following Wednesday and assignments by the following Saturday.

**Assignment Distribution and Grading Scale**

Your grade will be based on your performance of the following assessments.

1. 5 Discussions: 100 pts (10% of Grade)
2. 5 Assignments: 700 pts (70% of Grade)
3. Final Examination: 200 pts (20% of Grade)

**Grades**
The course will follow the standard +/- grading system. Total percentage below 64 will result in a failing grade for the course.

| Grade | A | A- | B+ | B | B- | C+ | C | C- | D+ | D |
|---|---|---|---|---|---|---|---|---|---|---|
| Min % | 94 | 90 | 87 | 84 | 80 | 77 | 74 | 70 | 67 | 64 |

## University Policies

Students are required to be aware of and follow all general and academic policies established by Kent State University. A list of the general academic policies is listed on the Kent State University Policy Register, which can be found in the **University policies section** of the Getting Started in Your Online Course link within your course. Specific policies related to the successful completion of this online course can be located and reviewed in your course.

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**Students with Disabilities**
Kent State University is committed to inclusive and accessible education experiences for all students. University Policy 3342-3-01.3 requires that students with disabilities be provided reasonable accommodations to ensure equal access to course content. Students with disabilities are encouraged to connect with Student Accessibility Services as early as possible to establish accommodations. If you anticipate or experience academic barriers based on a disability (including mental health, chronic medical conditions, or injuries), please let me know immediately.

Student Accessibility Services (SAS) Contact Information: University Library, Suite 100, Email: sas@kent.edu, Phone: 330-672-3391; VP 330-968-0490, Web: www.kent.edu/sas

The LMS accessibility statement can be found in the **University policies section** of the Getting Started in Your Online Course link within your course.

**Course Enrollment/Official Registration**
Students have the responsibility to ensure they are properly enrolled in classes. You are advised to review your official class schedule (using Student Tools on FlashLine) during the first week of the semester to ensure you are properly enrolled in this class and section. You may add a full-term class, change sections of a class, or elect audit, pass/fail or credit hour options up until 11:59 PM on Wednesday, August 31.

The last day to "drop" a class (i.e., the class does not appear on your transcript) is 11:59 PM on Wednesday, September 7. After that date, a "W" is assigned, and the class will appear on your transcript. Your registration must be correct by these dates. Do not continue to attend and participate in classes for which you are not officially enrolled because you will not receive a grade at the conclusion of the semester for any class in which you are not properly registered.

**Course Withdrawal**
For Fall 2022, the course withdrawal deadline is 11:59 PM on Wednesday, November 2, 2022.

**Title IX Statement**
Kent State is committed to fostering a safe, productive learning environment. As an instructor, one of my responsibilities is to help create a safe learning environment in our class. Kent State's (and federal law Title IX) policy prohibit discrimination based on sex, which includes sexual misconduct — (sexual harassment, domestic and dating violence, sexual assault, and stalking). We understand that sexual violence can undermine students' academic success and we encourage students who have experienced some form of sexual misconduct to talk to someone about their experience, so they can get the support they need.

It is my goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in our one-on-one meetings. I will seek to keep information you share private to the greatest extent possible. However, I also have a responsibility to notify the Title IX Coordinator when I become aware of incidents of sexual misconduct.

Students may speak privately (without disclosing name) to the Sexual and Relationship Violence Support Services (SRVSS) 330-672-8016 or www.kent.edu/srvss.
Safe Space Allies can be located at https://www.kent.edu/lgbtq/list-safe-space-allies.
Students may speak confidentially to Psychological Services 330-672-2487.

**Plagiarism and Academic Integrity**
Students enrolled in the university, at all its campuses, are to perform their academic work according to standards set by faculty members, departments, schools and colleges of the university; and cheating and plagiarism constitute fraudulent misrepresentation for which no credit can be given and for which appropriate sanctions are warranted and will be applied.

For more information see the Kent State policy on plagiarism in the University policies section of the Getting Started in Your Online Course link within the Start Here area.

## Subject to Change Statement

The syllabus and course schedule may be subject to change. Changes will be communicated via email or the course announcement tool. It is the responsibility of students to check email messages and course announcements to stay current in their online courses.