**Course Syllabus**
**MIS/BUAN Applied Machine Learning**
The Naveen Jindal School of Management
The University of Texas at Dallas

## Course Information

### Course

| | |
|---|---|
| Course Number | BUAN 6341/MIS 6341 |
| Course Title | Applied Machine Learning |
| Term and Dates | Fall 2023 (Aug 21 – Dec 15) |

### Professor Contact Information

| | |
|---|---|
| Professor | Vijay Koju, Ph.D. |
| Email Address | vijay.koju@utdallas.edu |
| Office Hours | I'm available via email, MS Teams |
| TA | Harigovind Padmarajan |
| TA Email Address | Harigovind.padmarajan@utdallas.edu |

### Course Modality and Expectations

The course is officially registered as a traditional, classroom-based course and live, in-person attendance is required. Changes to this schedule may occur and will be communicated via UTD email. Active participation in class on a weekly basis is one of the best predictors of class performance. Students are strongly encouraged to attend class every week and actively participate in class discussions.

### About the Instructor

Vijay Koju is an adjunct professor at The University of Texas at Dallas, where he teaches graduate courses on data science, machine learning and business analytics. He also works as a full-time data scientist at Parkland Health. He has 6 years of experience as a data scientist in industries such as Oil & Gas, Retail, and Healthcare. He holds a Ph.D. in Computational Science from Middle Tennessee State University.

### Course Description

This course covers machine learning models for business data including text mining, natural language processing, non-linear regression models, resampling methods and advanced neural networks and artificial intelligence-based models for data-driven analytics. The course will be taught using Python language.
Prerequisites: (BUAN 6356 or BUAN 6383 or MIS 6386 or BUAN 6324 or MIS 6324 or OPRE 6399) and (OPRE 6359 or BUAN 6359).

### Student Learning Objectives/Outcomes

- Understand and be able to implement machine learning techniques for supervised and unsupervised learning problems.
- Be able to translate business problems into appropriate machine learning problems.
- Be able to comfortably use machine learning frameworks like scikit-learn and pytorch to implement various data science techniques.
- Learn data science/machine learning best practices.

- Be able to run machine learning experiments and evaluate the best performing model.
- Be able to work in a team setting to solve a complex business problem using machine learning techniques.

**Recommended Textbooks and Materials**

- 1) An Introduction to Statistical Learning with Applications in Python (https://hastie.su.domains/ISLP/ISLP_website.pdf). Authors: Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani, Jonathan Taylor
- 2) Machine Learning with PyTorch and Scikit-Learn: Develop machine learning and deep learning models with Python. Authors: Sebastian Raschka, Yuxi (Hayden) Liu, Vahid Mirjalili
- 3) Effective Pandas: Patterns for Data Manipulation. Author: Matt Harrison

**Required Software**

- Python (3.7 or higher)
- IDE: VSCode/Jupyter/Jupyterlab

**Course Policies**

**Make-up exams, Extra Credit and Late Work**

There will be **two exams** during the semester. For each exam, students will be responsible for making themselves familiar with the materials discussed in the lectures, the lecture slides, all assigned readings, and any additional content discussed and/or posted on the E-learning site. The exam is specified in the academic calendar below. **The exams will either be conducted in-person in class or at the Testing Center**. The exam must be **completed in a single attempt in the length of time specified** for that exam.
**A make-up exam can only be given for medical reasons certified by a doctor. However, such an exam may have different questions/format than the original quiz.**

Check https://utdallas.app.box.com/s/u7ei2c2jyejtsqq8fls0plm4509x99pj for all important University related dates.

There will be **NO extra-credit** in this course.

**Late assignment** submissions will be accepted for 3 days after the due date, but each day will be penalized by 25% reduction in score.

**Class Participation**

You are expected to actively participate in the discussion of readings, contribute to the learning experience of the class, and meaningfully contribute to all group work, if any. You can miss a maximum of two classes without incurring any penalties.

**Weekly Schedule**

| Week (Class Date) | Topics/Lecture | Readings | Assignments |
|---|---|---|---|
| 1 (8/22) | Introduction/Syllabus Overview, Python Fundamentals, Numerical computation in Python with NumPy, | | |
| 2 (8/29) | Data wrangling in Pandas, Data Visualization with Matplotlib, Pandas, Seaborn | | Assignment 1 |
| 3 (9/5) | Feature engineering - Dimensionality Reduction, Unsupervised Learning – Clustering Analysis – K-Means and Hierarchical Clustering | Chapter 5 (2) Chapter 12 (1), Chapter 10 (2) | Assignment 1 due |
| 4 (9/12) | Supervised Learning – Regression Analysis | Chapter 3 (1) Chapter 9 (2) | Assignment 2 |
| 5 (9/19) | Supervised Leaning – Classification Evaluation Metrics for Classification Algorithms Cross Validation | Chapter 4 (1), Chapter 5 (1) | Assignment 2 due |
| 6 (9/26) | Feature Selection, Regularization | Chapter 6 (1) Chapter 4 (2) | Project Proposal due |
| 7 (10/3) | Supervised Learning – Classification Continued | Chapter 9 (1) Chapter 3 (2) | |
| 8 (10/10) | Supervised Learning – Ensemble Methods | Chapter 8 (1), Chapter 7 (2) | Assignment 3 |
| 9 (10/17) | Supervised Learning – Ensemble Methods Continued, Model Tuning – Hyperparameter Optimization | Chapter 6 (2) | |
| **10 (10/24)** | **Exam 1** | | |
| 11 (10/31) | Artificial Neural Network Forward and Backward Propagation | Chapter 11 (2) | Assignment 3 due, Assignment 4 |
| 12 (11/7) | Introduction to PyTorch, Machine learning using PyTorch | Chapter 12 (2) | |
| 13 (11/14) | Machine learning using PyTorch continued | Chapter 13 (2) | Assignment 4 due |
| 14 (11/21) | Thanksgiving holiday (No class) | | |
| 15 (11/28) | Project Presentation | | Project due |
| **16 (12/5)** | **Exam 2** | | |

**NOTE(s):**
**(1) There will be no classes during exam weeks.**
**(2) The schedule provided is tentative and subject to minor changes at the discretion of the instructor.**

**Student Assessments**

**Grading Information**

| | |
|---|---|
| 2 Exams (12.5% each) | 25% |
| 4 Homework assignments<br>- Assignment 1, 2 & 4 -> 10% each<br>- Assignment 3 -> 15% | 45% |
| Attendance | 2.5% |
| Project Proposal | 2.5% |
| Project Presentation | 7.5% |
| Final Project submission (code) | 10% |
| Final Project Report | 7.5% |
| Total | 100% |

**GradingScale**

| Scaled Score | Letter Equivalent |
|---|---|
| >= 93 | A |
| >= 89 and < 93 | A- |
| >= 86 and <89 | B+ |
| >= 83 and < 86 | B |
| >= 79 and < 83 | B- |
| >= 76 and < 79 | C+ |
| >= 69 and < 76 | C |
| Less than 69 | F |

**Accessing Grades**

Students can check their grades by clicking “My Grades” under Course Tools after the grade for each assessment task is released.

**Assignment submission instructions**

You will submit your assignments (in the required file format with a simple file name and a file extension) by using the Assignments tool on the course site. Please see the Assignments link on the course menu or see the icon on the designated page. You can click each assignment name link and follow the on-screen instructions to upload and submit your file(s). Please refer to the Help menu for more information on using this tool. **Please note**: each assignment link will be deactivated after the assignment due time. After your submission is graded, you may click each assignment’s “Graded” tab to check the results and feedback.

**Scholastic Honesty**

The University has policies and discipline procedures regarding scholastic dishonesty. Detailed information is available on the UTD Judicial Affairs web page. All students are expected to maintain a high level of responsibility with respect to academic honesty. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students and the integrity of the University, policies on scholastic dishonesty will be strictly enforced.

**Course Evaluation**
As required by UTD academic regulations, every student must complete an evaluation for each enrolled course at the end of the semester. An online instructional assessment form will be made available for your confidential use. A link to an online instructional assessment form will be emailed to you for your confidential use.

**University Policies**
The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.
Please go to http://go.utdallas.edu/syllabus-policiesfor these policies.
***These descriptions and timelines are subject to change at the discretion of the Professor.***