

## Course Information

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|----------------|-----------------------------------------------------------------------------------------------------|
| Course Number: | ICPE 638                                                                                            |
| Course Title:  | Data Science Fundamentals for Energy I                                                              |
| Section:       | 600, 701                                                                                            |
| Time:          | Jan 8, 10, 12, 15, 17, <b>1:00 pm to 5:30 pm</b>                                                    |
| Location:      | GERB 315 (Frederick E. Giesecke Engineering Research Building, 1617 Research Pkwy, College Station) |
| Credit Hours:  | 1.5                                                                                                 |

## Instructor Details

|               |                                                  |
|---------------|--------------------------------------------------|
| Instructor:   | Haoyu Niu                                        |
| Office:       | BLOC 221E                                        |
| Phone:        | 530-566-6577                                     |
| E-Mail:       | <a href="mailto:hniu@tamu.edu">hniu@tamu.edu</a> |
| Office Hours: | By appointment                                   |

## Course Description

*This is an introductory course about fundamental concepts and methods applied in data science, focusing on energy applications. Participants will explore topics such as probability theory, probability distributions, statistical data modeling and inference, linear regression and predictive models, time series forecasting, dimension reduction, introduction to machine learning, etc. Through a combination of lectures and hands-on lab sessions, students will gain practical skills in implementing algorithms such as K-means, PCA, SVM, t-SNE, etc. By the end of the course, participants will be equipped to analyze visual data and apply fundamental data science skills to solve real-world energy related problems.*

## Course Prerequisites

*Nice to have basic Python or similar programming skills.*

## Course Learning Outcomes

*Upon successfully completing this course, a student will be able to*

- Understand key concepts of probability theory essential for data science, including conditional probability, probability distributions, and their characteristics.
- Develop probability models tailored to data sets, involving the formulation of models, estimation of parameters, and the execution of statistical inference techniques.
- Utilized linear regression and diverse models to solve practical problems encountered in energy domain.

- Implement dimension reduction methodologies, such principal component analysis (PCA), for the purpose of data simplification and feature extraction.
- Apply fundamental supervised and unsupervised machine learning algorithms proficiently in addressing the real-world challenges and tasks.
- Develop a comprehensive understanding of probabilistic models suitable for handling dependent data structures like time series and spatial data.

### Textbook and/or Resource Materials

No textbook is required. All course materials will be provided on Canvas.

### Grading Policy

- *Assignments and Quizzes: 40 %*
  - There will be a quiz (20 mins) at the beginning of each lecture except the first lecture. Topics will be selected from the previous lecture and will be provided on Canvas.
  - Quiz is required for every student.
- *Final Exam: 60 %*
  - Final exam plan will be provided at the beginning of the class and will be due on the last day. The exam must be completed individually. Each lecture and quiz will include the context that you will use in completing your final exam.
- *Letter grade conversions from total scores will use the following standard conventions:*
  - *A = 90 to 100*
  - *B = 80 to 89*
  - *C = 70 to 79*
  - *D = 60 to 69*
  - *F < 60*

### Course Schedule

This will be a 5-day course. The course schedule can be adjusted based on the feedback from the students. The tentative schedule is as follows:

- *Day 1: Introduction to Data Science.*
  - *Final exam explanation*
- *Day 2: Concepts of Probability Theory & Statistics.*
  - *Quiz 1 at the beginning of the lecture*
- *Day 3: Predictive Modeling, Linear Regression, & Dimension Reduction.*
  - *Quiz 2 at the beginning of the lecture*
- *Day 4: Introduction to Machine Learning.*
  - *Quiz 3 at the beginning of the lecture*
- *Day 5: Modeling Dependence, Time Series, & Spatial Modeling.*
  - *Quiz 4 at the beginning of the lecture*
  - *Final exam*

## University Policies

*This section outlines the university level policies that must be included in each course syllabus. The TAMU Faculty Senate established the wording of these policies.*

**NOTE:** Faculty members should not change the written statements. A faculty member may add separate paragraphs if additional information is needed.

### Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to [Student Rule 7](#) in its entirety for information about excused absences, including definitions, and related documentation and timelines.

### Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to [Student Rule 7](#) in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" ([Student Rule 7, Section 7.4.1](#)).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" ([Student Rule 7, Section 7.4.2](#)).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. (See [Student Rule 24](#).)

### Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

"Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one's work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case" ([Section 20.1.2.3, Student Rule 20](#)).

### Texas A&M at College Station

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at [aggiehonor.tamu.edu](http://aggiehonor.tamu.edu).

**Texas A&M at Galveston**

You can learn more about the Honor Council Rules and Procedures as well as your rights and responsibilities at [tamug.edu/HonorSystem](http://tamug.edu/HonorSystem).

**Texas A&M at Qatar**

You can learn more about academic integrity and your rights and responsibilities at Texas A&M University at Qatar by visiting the [Aggie Honor System](#) website.

## Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact the Disability Resources office on your campus (resources listed below). Disabilities may include, but are not limited to attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability related needs with Disability Resources and their instructors as soon as possible.

**Texas A&M at College Station**

Disability Resources is located in the Student Services Building or at (979) 845-1637 or visit [disability.tamu.edu](http://disability.tamu.edu).

**Texas A&M at Galveston**

Disability Resources is located in the Student Services Building or at (409) 740-4587 or visit [tamug.edu/counsel/Disabilities](http://tamug.edu/counsel/Disabilities).

**Texas A&M at Qatar**

Disability Services is located in the Engineering Building, room 318C or at +974.4423.0316 or visit <https://www.qatar.tamu.edu/students/student-affairs/disability-services>.

## Title IX and Statement on Limits to Confidentiality

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit gender-based discrimination and sexual harassment, including sexual assault, sexual exploitation, domestic violence, dating violence, and stalking.

With the exception of some medical and mental health providers, all university employees (including full and part-time faculty, staff, paid graduate assistants, student workers, etc.) are Mandatory Reporters and must report to the Title IX Office if the employee experiences, observes, or becomes aware of an incident that meets the following conditions (see [University Rule 08.01.01.M1](#)):

- The incident is reasonably believed to be discrimination or harassment.
- The incident is alleged to have been committed by or against a person who, at the time of the incident, was (1) a student enrolled at the University or (2) an employee of the University.

Mandatory Reporters must file a report regardless of how the information comes to their attention – including but not limited to face-to-face conversations, a written class assignment or paper, class discussion, email, text, or social media post. Although Mandatory Reporters must file a report, in most instances, a person who is subjected to the alleged conduct will be able to control how the report is handled, including whether or not to pursue a formal investigation. The University’s goal is to make sure you are aware of the range of options available to you and to ensure access to the resources you need.

**Texas A&M at College Station**

*Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with [Counseling and Psychological Services \(CAPS\)](#).*

*Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University’s [Title IX webpage](#).*

**Texas A&M at Galveston**

*Students wishing to discuss concerns in a confidential setting are encouraged to make an appointment with the Counseling Office in the Seibel Student Center, or call (409)740-4587. For additional information, visit [tamug.edu/counsel](http://tamug.edu/counsel).*

*Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the Galveston Campus’ [Title IX webpage](#).*

**Texas A&M at Qatar**

*Texas A&M University at Qatar students wishing to discuss concerns in a confidential setting are encouraged to visit the [Health and Wellness](#) website for more information.*

*Students can learn more about filing a report, accessing supportive resources, and navigating the Title IX investigation and resolution process on the University’s [Title IX webpage](#).*

## Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors that influence a student’s academic success and overall wellbeing. Students are encouraged to engage in healthy self-care by utilizing available resources and services on your campus

**Texas A&M College Station**

*Students who need someone to talk to can contact Counseling & Psychological Services (CAPS) or call the TAMU Helpline (979-845-2700) from 4:00 p.m. to 8:00 a.m. weekdays and 24 hours on weekends. 24-*

hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at [988lifeline.org](https://988lifeline.org) [Links to an external site.](#).

#### **Texas A&M at Galveston**

Students who need someone to talk to can call (409) 740-4736 from 8:00 a.m. to 5:00 p.m. weekdays or visit [tamug.edu/counsel](https://tamug.edu/counsel) for more information. For 24-hour emergency assistance during nights and weekends, contact the TAMUG Police Dept at (409) 740-4545. 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at [988lifeline.org](https://988lifeline.org) [Links to an external site.](#).

#### **Texas A&M at Qatar**

Texas A&M University at Qatar students wishing to discuss concerns in a confidential setting are encouraged to visit the [Health and Wellness](#) website for more information.

## Campus-Specific Policies

### **Texas A&M at Galveston**

#### **Classroom Access and Inclusion Statement**

Texas A&M University is committed to engaged student participation in all of its programs and courses and provides an accessible academic environment for all students. This means that our classrooms, our virtual spaces, our practices and our interactions are as inclusive as possible and we work to provide a welcoming instructional climate and equal learning opportunities for everyone. If you have an instructional need, please notify me as soon as possible.

The Aggie Core values of respect, excellence, leadership, loyalty, integrity and selfless service in addition to civility, and the ability to listen and to observe others are the foundation of a welcoming instructional climate. Active, thoughtful and respectful participation in all aspects of the course supports a more inclusive classroom environment as well as [our mutual](#) responsibilities to the campus community.

*The following statements below are optional. Leave as is to include, or delete if preferred. Either way, delete this note.*

#### **Statement on the Family Educational Rights and Privacy Act (FERPA)**

FERPA is a federal law designed to protect the privacy of educational records by limiting access to these records, to establish the right of students to inspect and review their educational records and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings. Currently enrolled students wishing to withhold any or all directory information items may do so by going to [howdy.tamu.edu](https://howdy.tamu.edu) and clicking on the "Directory Hold Information" link in the Student Records channel on the MyRecord tab. The complete [FERPA Notice to Students](#) and the student records policy is available on the Office of the Registrar webpage.

Items that can never be identified as public information are a student's social security number, citizenship, gender, grades, GPR or class schedule. All efforts will be made in this class to protect your privacy and to ensure confidential treatment of information associated with or generated by your participation in the class.

Directory items include name, UIN, local address, permanent address, email address, local telephone number, permanent telephone number, dates of attendance, program of study (college, major, campus), classification, previous institutions attended, degrees honors and awards received, participation in officially recognized activities and sports, medical residence location and medical residence specialization.

## College and Department Policies

College and departmental units may establish their own policies and minimum syllabus requirements. As long as these policies and requirements do not contradict the university level requirements, colleges and departments can add them in this section. Please remove this section if not needed.