



Full Course Title: Generative AI

Instructional Hours (Contact Hours): 60

Learning Activities:

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| <input checked="" type="checkbox"/> Class Discussions/Discussion Boards | <input checked="" type="checkbox"/> Student Projects |
| <input checked="" type="checkbox"/> Peer-to-Peer Work (pairs, small groups) | <input checked="" type="checkbox"/> Readings |
| <input checked="" type="checkbox"/> Written Assignments (reports, essays) | <input checked="" type="checkbox"/> Textbook/Workbook Exercises |
| <input checked="" type="checkbox"/> Case Study Analysis | <input type="checkbox"/> Other: Click to enter |

Methods of Assessment/Grading Criteria:

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|---|---|
| <input checked="" type="checkbox"/> Class/Discussion Boards Participation | <input checked="" type="checkbox"/> Individual Projects/Presentations |
| <input checked="" type="checkbox"/> Written Assignments (reports, essays) | <input checked="" type="checkbox"/> Group Projects/Presentations |
| <input checked="" type="checkbox"/> Exams/Quizzes | <input type="checkbox"/> Other: Click to enter |

Course Description

This course provides an in-depth understanding of Generative AI, including its theoretical foundations, practical applications, and ethical considerations. Students will learn about various generative models such as Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and Transformer-based models. The course includes hands-on projects and practical exercises to reinforce the concepts learned.

Learning Outcomes

By the end of this course, students will be able to:

1. Understand the theoretical foundations of generative models.
2. Implement and fine-tune various generative models using modern AI frameworks.
3. Evaluate the performance of generative models using appropriate metrics.
4. Apply generative models to real-world problems such as image generation, text generation, and data augmentation.
5. Understand and address ethical considerations related to Generative AI.
6. Develop innovative applications leveraging Generative AI techniques.

Method of Assessment

- **Assignments (30%):** Regular assignments to reinforce theoretical concepts and practical skills.
- **Projects (40%):** Two major projects where students design, implement, and present a generative AI application.
- **Quizzes (10%):** Periodic quizzes to assess understanding of key concepts.
- **Final Exam (20%):** Comprehensive exam covering all course topics.

Course Topics

1. **Introduction to Generative AI**
 - Overview of AI and Machine Learning
 - History and evolution of Generative AI
 - Applications of Generative AI
2. **Fundamentals of Generative Models**
 - Probability distributions and sampling
 - Introduction to neural networks and deep learning
 - Generative vs. discriminative models
3. **Generative Adversarial Networks (GANs)**
 - Architecture and components of GANs
 - Training GANs and addressing common challenges
 - Variants of GANs (DCGAN, CycleGAN, StyleGAN)
4. **Variational Autoencoders (VAEs)**
 - Theoretical foundations of VAEs
 - Implementing VAEs and understanding latent space
 - Applications of VAEs
5. **Transformer-based Models**
 - Introduction to transformers and self-attention mechanism
 - BERT, GPT, and other transformer models
 - Applications in text and image generation
6. **Advanced Topics in Generative AI**
 - Conditional generative models
 - Sequence generation and autoregressive models
 - Transfer learning and fine-tuning for specific tasks
7. **Capstone Project**
 - Project design and proposal
 - Implementation and testing
 - Presentation and peer review

Prerequisites

To enroll in this course, students should have:

- Basic knowledge of Python programming
- Understanding of fundamental machine learning concepts
- Experience with deep learning frameworks (TensorFlow or PyTorch)
- Familiarity with basic statistics and probability

This curriculum provides a comprehensive guide to learning Generative AI, balancing theoretical knowledge with practical skills and ethical considerations.

OBJECT AUTOMATION