

**RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA,
BHOPAL**

New Scheme Based On AICTE Flexible Curricula

CSE-Artificial Intelligence and Machine Learning/ Artificial Intelligence and Machine Learning, VII-Semester

AL702(A) AI in Gaming

Course Objective: The students should be able to understand and use AI techniques for generating efficient, intelligent behavior in games. Additional attention is to be given to AI algorithms for improving game play experience.

Detailed contents:

Unit I: Introduction: Introduction to Game AI, kind of AI used in game development, model of game AI, AI engine structure.

Unit II: Movement Algorithms and Steering Behaviour kinematic movement algorithms, problems related to the steering behaviour of objects and Solutions. **Coordinated Movement and Motor Control** This unit discusses the concepts related to coordinated movements and motor control.

Unit III: Pathfinding Basic Path finding Algorithms in game development, Path finding for complex solutions

Unit IV: Decision-Making and Uncertainty decision trees and state machines for game development, models for implementing knowledge uncertainty, such as fuzzy logic and Markov systems.

Unit V: Introduction to Learning Mechanisms Board game theory and discusses the implementation of some key algorithms, such as minimax and negamax, Random Number Generation and Minimizing, algorithms for implementing action prediction, decision learning and reinforcement learning.

Alternative NPTEL/SWAYAM Course:

NPTEL Course Name, Artificial Intelligence: Search Methods For Problem Solving, Instructor H Prof. Deepak Khemani, Host Institute IIT Madras

Suggested Reference:

1. <https://www.athabasca.ca/syllabi/comp/comp452.php>
2. <https://www.udemy.com/course/artificial-intelligence-for-simple-games>
- / 3. Artificial Intelligence for Games, Ian Millington and John Funge, CRC Press; 2nd edition, 2009.
4. Artificial Intelligence and Games, Georgios N. Yannakakis and Julian Togelius, Springer International Publishing, 2018.

Course outcomes: After completion of course, students would be able to:

1. Understand identify tasks that can be tackled using AI techniques.
2. Apply appropriate AI technique for the problem under investigation.
3. Create efficient and robust AI algorithms for game tasks.
4. Apply learning mechanisms to gaming problems.

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AL702 (B) Advance Machine Learning

Course Objective: To introduce advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. To design and implement various machine learning algorithms in a range of real-world applications.

Unit I: Artificial Neural Network: Introduction to ANN, Perceptron, Cost Function, Gradient Checking, multi-layer perceptron and backpropagation algorithm that is used to help learn parameters for a neural network, Random Initialization

Unit II: Decision Trees: Representing concepts as decision trees, Recursive induction of decision trees, best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting, noisy data, and pruning.

Unit III: Ensemble Methods: Bagging, boosting, stacking and learning with ensembles. Random Forest

Unit IV: Introduction to reinforcement learning (RL), Reinforcement Learning, RL-framework, MDP, Bellman equations, Value Iteration and Policy Iteration, Actor-critic model, Q-learning, SARSA, Bandit algorithms – UCB, PAC, Median Elimination, Policy Gradient, Full RL & MDPs, Bellman Optimality,

Unit V: Dynamic Programming - Value iteration, Policy iteration, and Q-learning & Temporal Difference Methods, Temporal-Difference Learning, Eligibility Traces, Function Approximation, Least Squares Methods, Fitted Q, Deep Q-Learning, Advanced Q-learning algorithms, Inverse reinforcement learning, Deep Inverse Reinforcement Learning, Generative Adversarial Imitation Learning, Recent Trends in RL Architectures.

Recommended Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer-Verlag New York Inc., 2nd Edition, 2011.
2. Tom M. Mitchell, "Machine Learning", McGraw Hill Education, First edition, 2017.
3. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.
4. Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021
5. Ethem Apaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010
6. Reinforcement Learning: An Introduction, Sutton and Barto, 2nd Edition.
7. Reinforcement Learning: State-of-the-Art, Marco Wiering and Martijn van Otterlo, Eds

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AL702 (C) Predictive Analytics

Course Objective:

The students should be able to understand how to transform data and make it suitable for data driven predictive tasks. Understand how to compute basic statistics using real-world datasets of consumer activities, like product reviews.

Course outcomes: After completion of course, students would be able to:

1. Apply Python to create interactive data visualizations to make meaningful predictions and build simple demo systems.
2. Apply simple regressions and classifications on datasets using machine learning libraries.
3. Understand the usage of different python libraries.

contents:

Unit I: Introduction Data Product, Data Product Examples in Enterprise, Developing a Data Product Strategy.

Unit II: Reading Data in Python Reading CSV & JSON Files, Processing Structured Data in Python, Live-Coding: JSON, Extracting Simple Statistics from Datasets Data Processing in Python Data Filtering and Cleaning, Processing Text and Strings in Python, Processing Times and Dates in Python

Unit III: Python Libraries and Toolkits Matrix Processing and Numpy, Introduction to Data Visualization, Introduction to Matplotlib, urllib and BeautifulSoup

Unit IV: Gradient Descent Classification in Python, Introduction to Training and Testing, Gradient Descent in Python, Gradient Descent in TensorFlow

Unit V: Diagnostics for Data Meaningful Predictive modelling, Regression Diagnostic, Over- and Under-Fitting, Classification Diagnostics: Accuracy and Error, Classification Diagnostics: Precision and Recall. Codebase for Evaluation and Validation, Model Complexity and Regularization, Evaluating Classifiers for Ranking.

Text Books/Suggested References:

1. <https://www.coursera.org/learn/basic-data-processing-visualization-python>
2. <https://www.coursera.org/learn/design-thinking-predictive-analytics-data-products>
3. <https://www.coursera.org/learn/meaningful-predictive-modeling>
4. Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst, Dean Abbott, 2014, Wiley.
5. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking, Tom Fawcett, O'Reilly, 1st edition, 2013.

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AL 702(D) Machine Learning for Data Science

Course Objective: The students will be able to derive practical solutions using predictive analytics. They will also understand the importance of various algorithms in Data Science.

Detailed Contents:

Unit I: Introduction

Algorithms and Machine Learning, Introduction to algorithms, Tools to analyze algorithms, Algorithmic techniques: Divide and Conquer, examples, Randomization, Applications

Unit II: Algorithms

Graphs, maps, Map searching, Application of algorithms: stable marriages example, Dictionaries and hashing, search trees, Dynamic programming

Unit III: Application to Personal Genomics

Linear Programming, NP completeness, Introduction to personal Genomics, Massive Raw data in Genomics, Data science on Personal Genomes, Interconnectedness on Personal Genomes, Case studies

Unit IV: Machine Learning

Introduction, Classification, Linear Classification, Ensemble Classifiers, Model Selection, Cross Validation, Holdout

Unit V: Machine Learning Applications

Probabilistic modelling, Topic modelling, Probabilistic Inference, Application: prediction of preterm birth, Data description and preparation, Relationship between machine learning and statistics

Text Books/Suggested References:

1. Introduction to Machine Learning, Jeeva Jose, Khanna Book Publishing House.
2. Machine Learning, Rajiv Chopra, Khanna Book Publishing House.
3. Data Science and Machine Learning: Mathematical and Statistical Methods Machine Learning & Pattern Recognition, by Dirk P. Kroese, Zdravko Botev, Thomas Taimre, Radislav Vaisman, Chapman & Hall/Crc, 2019.
4. Hands-On Data Science and Python Machine Learning, Frank Kane, Packt Publishers, 2017.
5. <https://www.edx.org/course/machine-learning-for-data-science-and-analytics>
6. Dr. Nageswara Rao, "Machine Learning in Data Science Using Python", Publisher by Dreamtech, 2022

Course Outcomes: After completion of course, students would be able to:

1. Apply practical solutions using predictive analytics.
2. Understand the importance of various algorithms in Data Science.
3. Create competitive advantage from both structured and unstructured data.
4. Predict outcomes with supervised machine learning techniques.
5. Unearth patterns in customer behavior with unsupervised techniques