CENTRE FOR OUTREACH AND DIGITAL EDUCATION · IIT MADRAS ·

IIT Madras CODE offers
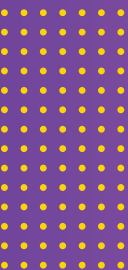Certificate Program on

MACHINE LEARNING FOR
INDUSTRY PROFESSIONALS

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ABOUT **THE COURSE**

Centre for Outreach and Digital Education (CODE), IIT Madras in collaboration with Wadhwani School of Data Science and Artificial Intelligence, IIT Madras offers a short-term executive certificate programme on Foundations of Machine Learning. This is a 2 month course that aims to give a high level overview of machine learning/deep learning along with deployability and responsibility aspects of AI.

The course will include case studies that will help managers appreciate the practical applications of the algorithms and how to effectively translate to their work/domains of interest. The goal is to keep the course less mathematical and at a high level.

In the course, there will be TA driven walkthroughs of code for key algorithms discussed.

Target audience :
Technical/semi-technical managers with a typical experience of 3+ years who are/wish to manage a team of ML engineers. No coding pre-requisite needed.

Course Fees Rs. 70,000/- + GST

Mode of Course: 24 hours of recorded videos and 16 hours of online live interactive sessions with the faculty

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MATHEMATICAL FOUNDATIONS

Prof. Sridharakumar Narasimhan
Department of Chemical Engineering
IIT Madras

TOPICS →

Data representation as vectors, matrices

Discovering relationships in data

Descriptive statistics

Predictive statistics

LEARNING OUTCOMES

- Represent data as vectors and matrices
- Manipulate data through vector and matrix operations
- Test for relationships between different variables
- Apply simple data compression tools
- Compute fundamental statistical quantities and understand their importance for data analysis
- Compute basic probabilities from data for predictive modelling

SUPERVISED LEARNING -1

Prof. Nandan Sudarsanam
Wadhwani School of Data Science and
Artificial Intelligence, IIT Madras

TOPICS →

Overview of supervised learning

Regression Analysis

K-Nearest Neighbours algorithm

Bias-Variance dichotomy

Regularization, Model Validation

LEARNING OUTCOMES

- To get introduced to the basics of supervised learning.
- To analyse different types of data and prediction problems with its practical applications based on the output variable.
- To understand techniques for regression problems, including Regression analysis (OLS) and K-Nearest Neighbours.
- To gain familiarity with advanced concepts like Bias-Variance dichotomy, Regularization, and Model Validation with a goal of improving the performance of models.

SUPERVISED LEARNING – 2

Prof. Nandan Sudarsanam
Wadhwani School of Data Science and Artificial Intelligence, IIT Madras

TOPICS →

Introduction to classification

Logistic Regression

Linear Discriminant Analysis

Support Vector Machines , Decision Trees

Ensemble methods – Bagging, Boosting, Random Forests

LEARNING OUTCOMES

- To understand the differences between classification and regression problems, and the need for separate models for classification.

- To understand techniques for classification problems, including Logistic Regression, Linear Discriminant Analysis and Support Vector Machines.

- To learn techniques such as Decision Trees and Ensemble methods which can be implemented for both regression and classification problems.

UNSUPERVISED LEARNING

Prof. Balaji S. Srinivasan
Wadhwani School of Data Science and Artificial Intelligence, IIT Madras

TOPICS →

Overview of Unsupervised Learning

Clustering Techniques – K-Means, Hierarchical Clustering, DBSCAN

Dimensionality Reduction – PCA, t-SNE

Association Rules, Anomaly Detection

Overview of Neural Networks for Unsupervised Learning

LEARNING OUTCOMES

- Primary Outcome – Ability to identify appropriate use-cases for and challenges in various unsupervised algorithms in a business context.

- How unsupervised learning differs from supervised learning.

- Key concepts and terminology in unsupervised learning.

- Understand the basics and applications of different clustering algorithms.

- Understand the concept of dimensionality reduction and why it is important in handling high-dimensional data.

- Learn how dimensionality reduction can be applied to simplify datasets for easier analysis and visualization.

- Understand the concept of association rules and their significance in discovering relationships in data.

- Gain insights into how association rules can drive business strategies like product placement and inventory management.

- Understand what anomaly detection is and its importance in various domains like fraud detection, network security, and industrial defect detection.

- Basic understanding of how neural networks can be applied in unsupervised learning.

DEEP LEARNING-1

Prof. Balaji S. Srinivasan
Wadhwani School of Data Science
and Artificial Intelligence, IIT Madras

TOPICS →

Overview of deep learning
Basic principles and terminologies in neural networks.
The Neural Network Architecture
The backpropagation algorithm
Convolutional Neural Networks (CNNs) for Vision.
Recurrent Neural Networks (RNNs) for Sequential Data
Key Ideas in Deep Learning: Regularization, Embeddings, Transfer Learning

LEARNING OUTCOMES

- **Primary Outcome –** Understand when to use Deep Learning for your applications, what architectures would be most appropriate, and what the various components of a typical Deep Learning pipeline are.
- Develop an understanding of the evolution and fundamentals of deep learning
- Grasp the mechanics of deep neural networks, including the backpropagation process and various network architectures.
- Understand the role of CNNs in image and visual data processing, including their applications and impact.
- Recognize the importance of RNNs and LSTMs in handling sequential data.
- Gain insights into key deep learning concepts such as regularization, embeddings, and transfer learning, and understand their significance in practical applications.

DEEP LEARNING-2

Prof. Ganapathy Krishnamurthi
Wadhwani School of Data Science
and Artificial Intelligence, IIT Madras

TOPICS →

Advanced CNN
- State of the Art CNN Architectures
- Image Recognition
- Object Detection

Advanced Sequential Models
- Recurrent Neural Networks (RNNs)
- Attention Mechanism
- Transformer Architecture - Large Language Models

Generative Adversarial Networks (GANs)

Diffusion Models

LEARNING OUTCOMES

- Appreciate practical applications and implications of deep learning in different domains.
- Gain knowledge about various state of the art CNN architectures and their applications like object detection used in computer vision.
- Understand mechanisms behind image generating models like Dall-E and Stable Diffusion
- Understand transformer architectures that drive LLMs like chatGPT

DEPLOYABILITY

Prof. Ganapathy Krishnamurthi
Wadhwani School of Data Science
and Artificial Intelligence, IIT Madras

TOPICS →

Introduction to AI Deployability
- Challenges in Deploying AI Models
- Lifecycle of a Deployed Model

Model Serving and Management
- APIs
- Cloud Deployment
- Model Versioning

Monitoring and Maintenance
- Continuous Monitoring
- Performance Metrics
- Updating Models

LEARNING OUTCOMES

- Understand the complexities and lifecycle of AI model deployment.
- Learn how to serve and manage AI models in production
- Grasp the importance and methods of maintaining AI models post-deployment.

GENERATIVE AND RESPONSIBLE AI

Prof. B. Ravindran
Head - Wadhwani School of Data Science
and Artificial Intelligence, IIT Madras

TOPICS →

Intro to Generative AI - Large Language Models and Image Generation

Principles of RAI - Transparency; Accountability; Safety, Robustness and Reliability; Privacy and Security; Fairness and non-discrimination; Human-Centred Values; Inclusive and Sustainable development

Examples of AI/ML systems going wrong - bias, robustness, explanations, hallucinations, prompt injection, data leakage, deanonymization, deep fakes, copyright infringement, etc. Examples will be drawn from various incidents

Examples of tools for RAI - measuring bias/fairness, explanations (Lime/SHAP/Gradcam), audit mechanisms

Regulation landscape - DPDP Act (India), GDPR (EU), EU AI Act, US Presidential Declaration

LEARNING OUTCOMES

- Understand the intuition behind Gen AI models
- Understand the principles of responsible AI
- Appreciate the pitfalls of using AI without proper oversight/auditing mechanism
- Exposure to RAI tools
- Exposure to Data Protection Laws and AI regulations
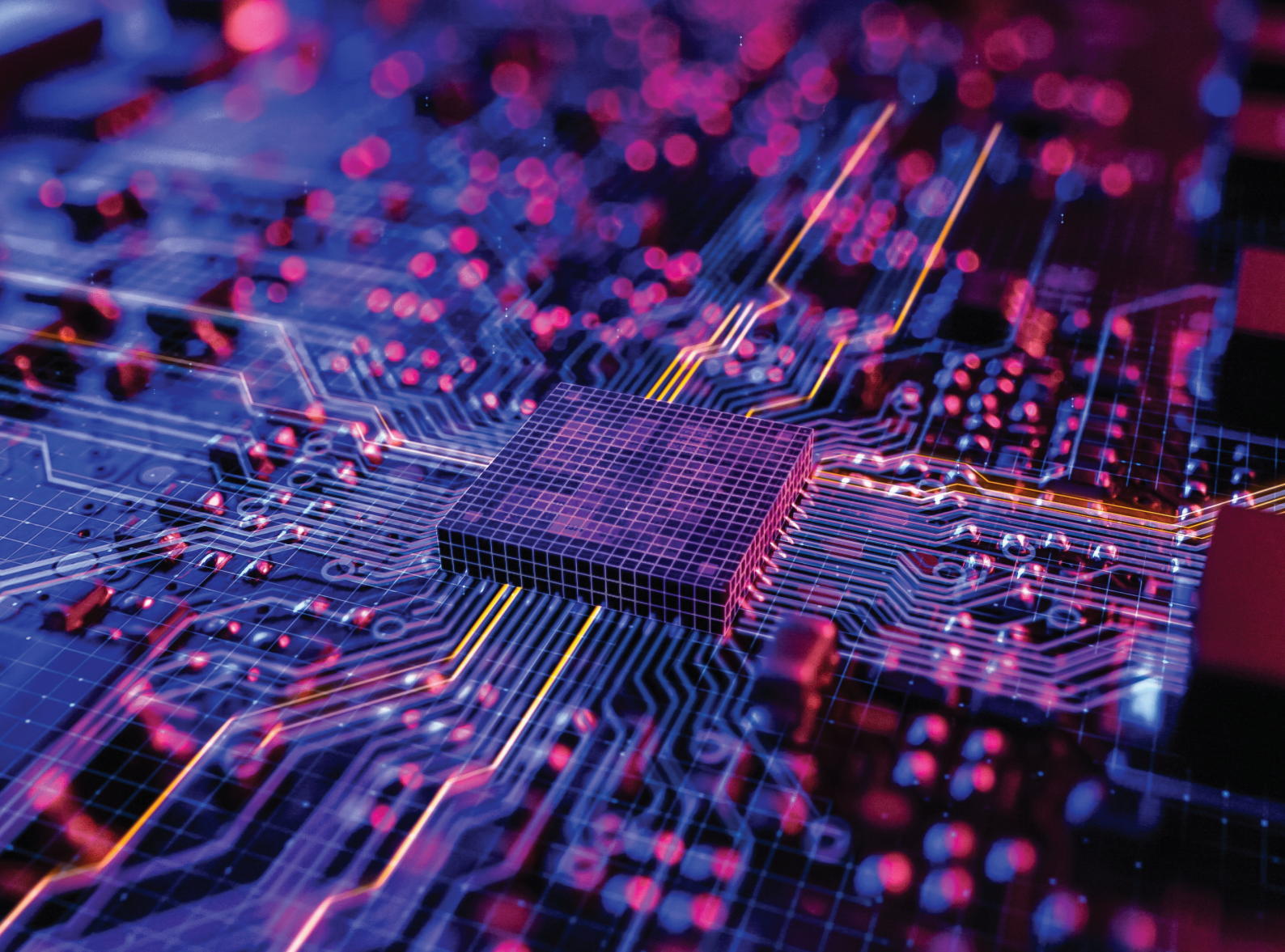
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