California Artificial Intelligence Institute (CalAI)

Certified Artificial Intelligence Developer: Elevate Your Leadership with AI Mastery!

Overview

Embark on a transformative journey into the heart of Artificial Intelligence with our AI Developer Certification program. Designed to meet the dynamic needs of the industry, this comprehensive course takes you from the fundamentals of AI to the intricacies of creating, training, and optimizing AI models on both labeled and unlabeled datasets. Elevate your expertise and become an AI Developer, equipped with the skills demanded by today's tech landscape.

Embark on a self-paced learning journey with AI Developer Certification, where cutting-edge knowledge meets practical application. Elevate your career as an AI Developer and be at the forefront of innovation in the ever-evolving field of Artificial Intelligence.

Eligibility

This certification is tailored for individuals with a strong technical background and a passion for AI. Proficiency in programming languages such as Python is recommended, ensuring participants can fully engage with the technical intricacies of AI development.

Programming skills are mandatory

What will you learn?

- ❖ Go from zero to hero in Python, Seaborn, Matplotlib, Scikit-Learn, SVM, unsupervised Machine Learning etc
- ❖ Discover new ways to use LLMs, including how to build your own chatbot
- ❖ Skills that employers desire, helping you ace machine learning interview questions and land your dream job
- ❖ Use dense and recurrent neural networks, LSTMs, GRUs, and Siamese networks in TensorFlow and Trax to perform advanced sentiment analysis, text generation, named entity recognition, and to identify duplicate questions
- ❖ Compare generative models, use the FID method to assess GAN fidelity and diversity, learn to detect bias in GAN, and implement StyleGAN techniques
- ❖ Various ML models such as
  - ➢ Supervised Machine Learning Modelling
  - ➢ Unsupervised Machine Learning Modelling
  - ➢ Reinforcement Machine Learning Modelling

- ➢ Image Recognition and Computer Vision
- ➢ Build your own Recommendation Engine
- ❖ Skills that employers desire, helping you ace machine learning interview questions and land your dream job.

Program Curriculum

Sub-Module	Video Title	Key Topics
Week 1: Introduction to Artificial Intelligence		
Big Data and AI	Introduction to Big Data and AI	- Definition and Importance of Big Data - Overview of Artificial Intelligence - The Three Vs of Big Data - Key Technologies: Hadoop, Spark, NoSQL databases
	Data Processing and Analytics	- Data Preprocessing - Data Storage and Management - Introduction to Data Analytics - Machine Learning Basics
	Advanced Analytics and AI Techniques	- Deep Learning - Natural Language Processing (NLP) - Computer Vision - Reinforcement Learning
	Applications and Case Studies	- Big Data and AI Applications - Ethical and Legal Considerations - Real-world Case Studies - Hands-on Exercise
Artificial Intelligence on the Cloud	Introduction to Cloud Computing and AI	- Cloud Computing Basics - Major Cloud Providers - AI on the Cloud Introduction - Hands-on Exercise
	AI Services on Cloud Platforms	- Overview of AI Services - Machine Learning on the Cloud - NLP on the Cloud - Hands-on Exercise
	Big Data and AI Integration on the Cloud	- Big Data on the Cloud - Data Analytics with AI - AI-driven Big Data Solutions - Hands-on Exercise
	Advanced Topics and Future Trends	- Advanced AI Services - AI Ethics and Governance - Edge AI and IoT Integration - Future Trends

AI in Banking	Introduction to AI in Banking	- Overview of AI in Banking - AI Technologies in Banking - Use Cases - Hands-on Introduction
	AI Applications in Banking Operations	- Automated Customer Service - Fraud Detection and Prevention - Risk Management
	AI for Customer Experience Enhancement	- Personalized Marketing and Recommendations - Predictive Analytics - Sentiment Analysis and VoC Analytics
	Future Trends and Ethical Considerations	- Emerging AI Technologies - Ethical Considerations - Regulatory Landscape
Exploring Feature Selection	Introduction to Feature Selection	- Overview of Feature Selection - Types of Features - Feature Selection Techniques
	Filter Methods	- Filter Methods Overview - Information Gain and Mutual Information - Feature Importance Techniques
	Wrapper Methods	- Wrapper Methods Overview - Recursive Feature Elimination (RFE) - Genetic Algorithms
	Embedded Methods and Advanced Techniques	- Embedded Methods - Feature Selection with Deep Learning - Feature Engineering vs. Feature Selection
Chatbots	Introduction to Chatbots	- Overview of Chatbots - Types of Chatbots - Introduction to NLP - Chatbot Design Considerations
	Building AI-based Chatbots	- AI-based Chatbots Overview - Dialog Systems - Chatbot Platforms and Frameworks - Training Chatbots
	Advanced Chatbot Techniques	- NLU and Sentiment Analysis - Conversational AI - Deployment and Integration - Chatbot Analytics
	Ethical Considerations and Future Trends	- Ethical Considerations - Chatbots in Business and Society - Future Trends

Graphs and Graph Databases	Introduction to Graphs	- Graph Theory Basics - Types of Graphs - Graph Representation - Graph Algorithms
	Graph Databases	- Introduction to Graph Databases - Graph Database Models - Popular Graph Database Systems - Query Languages
	Graph Algorithms and Applications	- Traversal Algorithms - Centrality Measures - Community Detection - Applications of Graphs
	Advanced Topics and Case Studies	- Graph Embeddings - Time Series Analysis - Spatial Analysis
White box XAI for AI Bias & Ethics	Introduction to AI Bias and Ethics	- Overview of AI Bias - Importance of Ethical AI - Legal and Regulatory Landscape - Bias Mitigation Techniques
	Interpretability and Explainability in AI	- Importance of Interpretability - Interpretability Techniques - Explainability vs. Transparency - Bias Detection with Interpretability
	Fairness in AI	- Definition of Fairness - Fairness Metrics - Fairness-aware AI Techniques - Evaluating Fairness
	Case Studies and Best Practices	- Real-world Case Studies - Best Practices for Ethical AI Development - Stakeholder Engagement - Responsible AI Governance

Week 2: Essential ML

Machine Learning and Python	Introduction to Python for Machine Learning	- Python Basics - Data Structures - Control Flow - Functions and Modules
	Introduction to NumPy and Pandas	- Introduction to Pandas - Data Cleaning and Preprocessing - Data Visualization
	Introduction to Machine Learning with Scikit-Learn	- Overview of Machine Learning - Supervised Learning: Classification and Regression - Model Evaluation

	Model Deployment and Real-world Applications	- Model Deployment - Real-world Applications of Machine Learning - Best Practices and Pitfalls
Supervised Learning: Classification and Regression	Introduction to Supervised Learning and Linear Regression	- Overview of Supervised Learning - Introduction to Linear Regression - Simple Linear Regression - Multiple Linear Regression - Model Evaluation Metrics
	Classification Algorithms	- Introduction to Classification - Logistic Regression - Decision Trees - Model Evaluation for Classification
	Advanced Classification Techniques	- Support Vector Machines (SVM) - Ensemble Methods - Hyperparameter Tuning - Model Selection and Evaluation
	Project Work and Real-world Applications1	- Project Work - Real-world Applications - Best Practices and Pitfalls - Case Studies
Unsupervised Learning: Detecting Patterns	Introduction to Unsupervised Learning and Clustering	- Overview of Unsupervised Learning - Introduction to Clustering - K-means Clustering - Hierarchical Clustering - Evaluating Clustering Performance
	Density-based Clustering and Dimensionality Reduction	- Density-based Clustering: DBSCAN - Model Evaluation for Density-based Clustering - Introduction to Dimensionality Reduction - Principal Component Analysis (PCA)
	Association Rule Mining and Anomaly Detection	- Introduction to Association Rule Mining: Apriori Algorithm - Evaluating Association Rules - Introduction to Anomaly Detection - Anomaly Detection Techniques
	Advanced Topics and Real-world Applications	- Advanced Clustering Techniques: Gaussian Mixture Models (GMM), spectral clustering - Semi-supervised Learning - Real-world Applications - Best Practices and Pitfalls
Dimensionality Reduction	Introduction to Dimensionality Reduction and Principal Component Analysis (PCA)	- Overview of Dimensionality Reduction - Curse of Dimensionality - Introduction to PCA

		● PCA Algorithm ● Interpreting PCA Results
	Linear Dimensionality Reduction Techniques	● Singular Value Decomposition (SVD) ● Non-negative Matrix Factorization (NMF) ● Comparison of PCA, SVD, and NMF
	Non-linear Dimensionality Reduction Techniques	● Introduction to Non-linear Dimensionality Reduction ● Locally Linear Embedding (LLE) ● t-Distributed Stochastic Neighbor Embedding (t-SNE) ● Comparison of Linear and Non-linear Techniques
	Advanced Topics and Applications	● Autoencoders ● Variational Autoencoders (VAEs) ● Applications of Dimensionality Reduction ● Best Practices and Pitfalls
Visualising Data for Machine Learning	Introduction to Data Visualization and Basic Plotting	● Importance of Data Visualization ● Overview of Visualization Libraries ● Basic Plotting Techniques ● Customizing Plots
	Advanced Plotting Techniques	● Statistical Visualization ● Multivariate Visualization ● Interactive Visualization ● Geographic Data Visualization
	Dimensionality Reduction Techniques for Visualization	● Introduction to Dimensionality Reduction ● Visualizing High-dimensional Data ● PCA for Visualization ● t-SNE for Visualization
	Interactive Dashboards and Real-world Applications	● Introduction to Interactive Dashboards ● Creating Interactive Visualizations ● Deployment of Dashboards

Week 3: Deep Learning

TensorFlow and its functionalities	Introduction to TensorFlow Basics	● Overview of TensorFlow ● TensorFlow Architecture ● Building Computational Graphs ● Session Management
	TensorFlow Operations and Optimization	● TensorFlow Operations ● Optimizers ● TensorFlow Variables and Initialization ● Saving and Restoring Models
	TensorFlow High-level APIs	● TensorFlow High-level APIs (Keras,

	and Advanced Topics	TensorFlow Estimators) ● Building Models with Keras ● Training and Evaluating Models ● Advanced TensorFlow Topics
	TensorFlow Deployment and Real-world Applications	● TensorFlow Serving ● TensorFlow Lite ● TensorFlow Extended (TFX) ● Real-world Applications
Deep Learning with TensorFlow on the Cloud	Introduction to Deep Learning and TensorFlow Basics	● Deep Learning Overview ● TensorFlow Basics ● Building Neural Networks ● Training Neural Networks
	Advanced Deep Learning Models with TensorFlow	● Convolutional Neural Networks (CNNs) ● Recurrent Neural Networks (RNNs) ● Transfer Learning ● Fine-tuning Models
	TensorFlow on the Cloud	● Cloud Computing Introduction ● Setting up TensorFlow on the Cloud ● Training Models on the Cloud ● Deploying Models on the Cloud
	Advanced Topics and Real-world Applications	● Distributed Training ● Hyperparameter Tuning ● Real-world Applications ● Best Practices and Pitfalls
TensorFlow for Mobile and IOT	Introduction to TensorFlow and Mobile Development	● Overview of TensorFlow ● Introduction to Mobile Development ● TensorFlow Lite ● TensorFlow Lite Models
	TensorFlow for Mobile Applications	● TensorFlow Lite Converter ● Model Optimization Techniques ● TensorFlow Lite Interpreter ● Mobile Acceleration
	TensorFlow for IoT Devices	● Introduction to IoT Devices ● TensorFlow Lite for Microcontrollers ● Supported Hardware Platforms ● Deploying Models to IoT Devices
	Real-world Applications and Case Studies	● Real-world Applications ● Case Studies ● Best Practices and Pitfalls ● Future Trends and Opportunities
Life Cycle of Model Creation	Data Acquisition and Preprocessing	● Data Collection ● Data Exploration ● Data Cleaning ● Feature Engineering

		● Data Splitting	
	Model Development	● Model Selection ● Model Training ● Hyperparameter Tuning ● Model Evaluation ● Iterative Development	
	Model Deployment and Monitoring	● Model Deployment ● Performance Monitoring ● Model Versioning ● A/B Testing ● Model Maintenance	
	Model Interpretation and Documentation	● Model Interpretability ● Documentation ● Knowledge Transfer ● Model Governance ● Continuous Improvement	
Deep Learning with KERAS	Introduction to Deep Learning and Keras Basics	● Overview of Deep Learning ● Introduction to Keras ● Building Sequential Models ● Model Compilation ● Training Neural Networks	
	Advanced Deep Learning Models with Keras	● Functional API ● Model Regularization ● Batch Normalization ● Custom Loss Functions and Metrics ● Callbacks ● Hands-on: Implementing advanced neural network architectures and techniques	
	Transfer Learning and Model Fine-tuning	● Transfer Learning ● Fine-tuning Pre-trained Models ● Fine-tuning Strategies ● Handling Imbalanced Data	
	Deployment and Real-world Applications	● Model Deployment ● Serving Keras Models ● Real-world Applications ● Best Practices and Pitfalls ● Case Studies	
Activation Function	Introduction and Basic Activation Functions	● Introduction to Activation Functions ● Sigmoid Activation ● Tanh Activation ● ReLU Activation	
	Advanced Activation Functions	● Leaky ReLU Activation ● ELU Activation ● Swish Activation ● Softmax Activation	

	Activation Functions for Specific Tasks		● Activation Functions Selection for Tasks ● Regression Activation Functions ● Classification Activation Functions ● Generative Models Activation Functions
	Activation Functions Optimization and Applications		● Hyperparameter Tuning for Activation Functions ● Activation Functions in CNNs ● Activation Functions in RNNs ● Activation Functions in Advanced Architectures
Confusion Matrix	Introduction to Confusion Matrix		● Introduction to Classification ● Basics of Confusion Matrix ● Interpreting Confusion Matrix
	Evaluation Metrics Derived from Confusion Matrix		● Accuracy ● Precision ● Recall (Sensitivity) ● Specificity ● F1 Score
	Advanced Evaluation Metrics and Analysis		● ROC Curve ● AUC ● Precision-Recall Curve ● Threshold Selection
	Application and Interpretation		● Real-world Applications ● Interpreting Results ● Limitations and Pitfalls ● Case Studies
Underfitting and Overfitting	Introduction to Model Generalization		● Model Generalization ● Bias and Variance Trade-off ● Underfitting ● Overfitting ● Model Complexity
	Techniques to Address Underfitting		● Increasing Model Complexity ● Feature Engineering ● Hyperparameter Tuning ● Model Ensemble
	Techniques to Address Overfitting		● Regularization Techniques ● Dropout Regularization ● Early Stopping ● Data Augmentation
	Model Evaluation and Fine-tuning		● Cross-validation ● Validation and Test Sets ● Model Selection ● Fine-tuning

Week 4: Natural Language Processing

Natural Language Processing using Python	Introduction to Natural Language Processing (NLP) Fundamentals	- Introduction to NLP - Text Preprocessing - Text Normalization - EDA for Text Data
	Text Representation and Feature Extraction	- Bag of Words (BoW) Model - TF-IDF - Word Embeddings - Document Embeddings
	Text Classification and Sentiment Analysis	- Text Classification - Naive Bayes Classifier - Support Vector Machines (SVM) - Sentiment Analysis
	Advanced NLP Techniques and Applications	- Named Entity Recognition (NER) - Part-of-Speech (POS) Tagging - Topic Modeling - Text Summarization
Transform Text File into Data Structures	Reading and Parsing Text File	- File Input/Output (I/O) - Text File Formats - Parsing Techniques - Regular Expressions
	Data Structure Selection and Design	- Data Structure Selection - List, Dictionary, and Set - Nested Data Structures - Custom Data Structures
	Transforming Text Data into Data Structures	- Data Transformation Techniques - Structuring Text Data - Handling Data Variability - Error Handling
	Data Structure Manipulation and Analysis	- Data Structure Manipulation - Data Analysis - Visualization - Optimization Techniques
Word Embeddings and Text Distance Metrics	Introduction to Word Embeddings	- Word Representations - Word Embeddings Introduction - Word2Vec - Training Word Embeddings
	Advanced Word Embeddings Techniques	- GloVe - FastText - Contextualized Word Embeddings - Fine-tuning Pre-trained Word Embeddings
	Introduction to Text Distance Metrics	- Text Similarity Metrics - Edit Distance

		- Cosine Similarity - Jaccard Similarity
	Advanced Text Distance Metrics and Applications	- Word Mover's Distance (WMD) - Sentence Embeddings - Document Similarity - Application Examples
Document, Sentence, and Character-Level Embeddings	Introduction to Document Embeddings	- Document Embeddings Introduction - Bag-of-Words (BoW) Model - TF-IDF - Doc2Vec
	Introduction to Sentence Embeddings	- Sentence Embeddings Introduction - Universal Sentence Encoder (USE) - Skip-thought Vectors - InferSent
	Character-Level Embeddings	- Character-Level Embeddings Introduction - Character-Level CNNs - Character-Level RNNs - Byte Pair Encoding (BPE)
	Advanced Techniques and Applications	- Attention Mechanisms - Transformer Models - Fine-tuning Pre-trained Embeddings - Application Examples
Text Data Analysis	Introduction to Text Data Analysis	- Text Data Analysis Overview - Text Data Preprocessing - Exploratory Data Analysis (EDA) - Text Visualization
	Text Mining and Feature Extraction	- Text Mining Techniques - Bag-of-Words (BoW) Model - TF-IDF - Word Embeddings
	Text Classification and Sentiment Analysis	- Text Classification Overview - Sentiment Analysis Techniques - Text Classification Pipeline
	Advanced Text Analysis Techniques and Applications	- Topic Modeling - Named Entity Recognition (NER) - Text Summarization - Text Analysis Applications

Week 5: LLM Ops

Foundations of LLMOps	Introduction to Language Models and LLMOps	- Language Models Overview - Introduction to LLMOps - LLMOps Components - Hands-on: Basic LLMOps Environment Setup

	Model Training and Optimization	- Data Preparation - Model Training Techniques - Hyperparameter Tuning - Evaluation Metrics
	Model Deployment and Management	- Deployment Strategies - Scalability and Performance Optimization - Monitoring and Logging - Model Versioning
	Continuous Integration and Deployment (CI/CD) for LLMOps	- CI/CD Pipelines - Automated Testing - Rolling Updates and Rollbacks - Security and Compliance
Advanced LLMOps Techniques	Advanced Model Training Techniques	- Transfer Learning - Multi-task Learning - Model Compression - Curriculum Learning
	Advanced Deployment Strategies	- Serverless Architectures - Edge Computing - Federated Learning - Load Balancing and Auto-scaling
	Model Versioning and Management	- Advanced Model Versioning - Blue-Green Deployments - Canary Releases - Chaos Engineering
	Monitoring, Optimization, and Ethical Considerations	- Advanced Monitoring and Logging - Auto-scaling Based on Real-time Metrics - Ethical Considerations in LLMOps - Model Optimization Techniques
LLMOps in Production Environments	Introduction to LLMOps in Production	- Overview of LLMOps in Production - Production Considerations - Infrastructure Requirements - Hands-on: Setting up a production-ready LLMOps environment
	Scalability and Performance Optimization	- Scalability Strategies - Performance Optimization - Load Balancing and Auto-scaling - Hands-on: Implementing scalability and performance optimization
	Monitoring, Logging, and Error Handling	- Monitoring and Logging - Real-time Monitoring - Error Handling and Recovery - Hands-on: Implementing monitoring, logging, and error handling

	Security, Compliance, and Maintenance	● Security Best Practices ● Compliance Considerations ● Model Maintenance ● Hands-on: Implementing security, compliance, and maintenance procedures
LLM Prompt Engineering	Introduction to LLM Prompt Engineering	● Overview of Prompt Engineering ● Types of Prompts ● Prompt Design Principles ● Hands-on: Prompt Generation
	Advanced Prompt Engineering Techniques	● Fine-tuning Prompt Strategies ● Dynamic Prompts ● Prompt Expansion Techniques ● Hands-on: Prompt Fine-tuning
	Evaluation and Optimization of Prompted LLMs	● Evaluation Metrics ● Optimization Techniques ● Bias and Fairness Considerations ● Hands-on: Evaluation and Optimization
	Applications and Future Directions	● Applications of Prompted LLMs ● Challenges and Future Directions ● Case Studies and Best Practices ● Hands-on Project Application

Week 6: Computer Vision, GANs

Computer Vision, Raspberry Pi	Introduction to Computer Vision and Raspberry Pi	● Basics of Image Processing ● Image Filtering ● Hands-on: Basic image processing techniques
	Image Acquisition and Processing	● Object Detection Techniques ● Introduction to OpenCV ● Raspberry Pi Setup
	Object Detection and Recognition	● Image Classification Techniques ● Introduction to Deep Learning ● Transfer Learning
	Advanced Topics and Project	● Real-time Object Tracking ● Facial Recognition ● Raspberry Pi Camera Module
Multiclassifier to recognize traffic signals	Introduction to Traffic Sign Recognition	● Introduction to Traffic Sign Recognition ● Dataset Exploration ● Data Preprocessing
	Image Classification Techniques	● Image Classification Algorithms ● Convolutional Neural Networks (CNNs) ● Model Training

	Evaluation and Optimization	● Model Evaluation ● Hyperparameter Tuning ● Data Augmentation
	Deployment and Future Enhancements	● Model Deployment ● Real-time Inference ● Future Enhancements
GANs: Applications, Architecture, Variants and Advantages	Introduction to GANs and Applications	● Introduction to GANs ● GANs Applications ● Hands-on: GANs application exploration
	GAN Architecture and Training	● GAN Architecture ● Training GANs ● Loss Functions
	Variants of GANs	● Conditional GANs (cGANs) ● Wasserstein GANs (WGANs) ● CycleGANs
	Advantages and Future Directions	● Advantages of GANs ● Ethical Considerations ● Future Directions
Object Detection Using OpenCV	Introduction to Object Detection	● Introduction to Object Detection ● Object Detection Approaches ● Introduction to OpenCV
	Object Detection Techniques	● Haar Cascade Classifiers ● Histogram of Oriented Gradients (HOG) ● Deep Learning-based Object Detection
	Deep Learning-based Object Detection	● CNNs for Object Detection ● Single Shot Multibox Detector (SSD) ● You Only Look Once (YOLO)
	Advanced Object Detection Applications	● Real-time Object Detection ● Custom Object Detection ● Hands-on Project: Building an advanced object detection application using OpenCV
Face detection and recognition	Introduction to Face Detection	● Introduction to Face Detection ● Face Detection Approaches ● Introduction to OpenCV
	Face Detection Techniques	● Histogram of Oriented Gradients (HOG) ● Deep Learning-based Face Detection ● Hands-on: Implementing face detection techniques
	Introduction to Face Recognition	● Introduction to Face Recognition ● Face Recognition Approaches

		• Introduction to OpenCV for Face Recognition
	Face Recognition Techniques and Applications	• Eigenfaces and Fisherfaces • Deep Learning-based Face Recognition • Hands-on: Implementing face recognition techniques
Real-time Face, Age and Gender Detection	Introduction to Face Detection	• Face Detection Overview • Face Detection Techniques • Introduction to OpenCV
	Introduction to Age and Gender Detection	• Age and Gender Detection Overview • Detection Techniques and Algorithms • Pre-trained Models
	Real-time Face Detection and Tracking	• Real-time Face Detection Techniques • Face Tracking Algorithms • Webcam Integration
	Integration and Application Development	• Integration of Detection Systems • Application Development • Performance Optimization
Image, Age and Gender Detection	Introduction to Image Analysis	• Image Analysis Overview • Image Preprocessing • Introduction to OpenCV • Hands-on: Basic image preprocessing using OpenCV
	Real-time Image, Age, and Gender Detection	• Real-time Image Analysis • Face Detection and Recognition • Age and Gender Estimation
	Advanced Techniques and Applications	• Advanced Image Analysis Techniques • Application Development • Performance Optimization

Week 7: Reinforcement Learning

Reinforcement Learning	Introduction to Reinforcement Learning	• Reinforcement Learning Overview • Markov Decision Processes (MDPs) • Dynamic Programming Methods
	Model-Free Methods	• Model-Free Reinforcement Learning Overview • Temporal Difference Learning • Eligibility Traces
	Policy Gradient Methods	• Policy Gradient Methods Overview • Actor-Critic Architecture • Advantage Actor-Critic (A2C)
	Advanced Topics and	• Deep Reinforcement Learning

	Applications	Overview ● Deep Q-Networks (DQN) ● Continuous Control Methods
Bellman Equation and Dynamic Programming	Introduction to Dynamic Programming	● Dynamic Programming Overview ● Bellman Equation ● Policy Evaluation
	Policy Iteration	● Policy Iteration Overview ● Policy Improvement ● Policy Iteration Algorithm
	Value Iteration	● Value Iteration Overview ● Value Iteration Algorithm ● Convergence Properties
	Extensions and Applications	● Dynamic Programming Extensions ● Applications of Dynamic Programming ● Hands-on Project: Dynamic programming solution development
Monte Carlo (MC) Methods	Introduction to Monte Carlo Methods	● Monte Carlo Methods Overview ● Monte Carlo Prediction ● First-Visit Monte Carlo Method
	Monte Carlo Control	● Monte Carlo Control Overview ● On-Policy Monte Carlo Control ● Off-Policy Monte Carlo Control
	Exploration Strategies and Improvements	● Exploration in Monte Carlo Methods ● Exploring Starts ● Incremental Implementation
	Extensions and Applications	● Temporal Difference Methods vs. Monte Carlo Methods ● Batch Reinforcement Learning ● Applications of Monte Carlo Methods
Temporal Difference Learning	Introduction to Temporal Difference Learning	● Temporal Difference Learning Overview ● TD Prediction ● TD(0) Prediction
	Temporal Difference Control	● TD Control Overview ● SARSA Algorithm ● Q-Learning Algorithm
	Eligibility Traces and Improvements	● Introduction to Eligibility Traces ● TD(λ) Algorithm ● n-step TD Methods
	Extensions and Applications	● TD Learning Extensions ● Applications of TD Learning ● Hands-on Project: TD-based solution development

Multi-Armed Bandit(MAB) Problem	Introduction to Multi-Armed Bandit Problem	● MAB Problem Overview ● Exploration vs Exploitation ● Epsilon-Greedy Strategy
	Upper Confidence Bound (UCB) Methods	● UCB Methods Overview ● UCB1 Algorithm ● UCB-Tuned Algorithm
	Thompson Sampling	● Thompson Sampling Overview ● Thompson Sampling Algorithm ● Bayesian Updating
	Extensions and Applications	● Contextual Bandits ● Applications of MAB Problems ● Hands-on Project: MAB algorithms implementation

Week 7: Deep Reinforcement Learning

Deep Q Network	Introduction to Reinforcement Learning	● Reinforcement Learning Overview ● Markov Decision Processes (MDPs) ● Q-Learning
	Introduction to Deep Q-Network (DQN)	● Challenges with Q-Learning ● Introduction to DQN ● Experience Replay
	Advanced DQN Techniques	● Double DQN ● Dueling DQN ● Prioritized Experience Replay
	Applications and Future Directions	● Applications of DQN ● Recent Advances and Future Directions ● Hands-on Project: DQN-based agent development
Actor Critic and Policy Gradient	Introduction to Policy Gradient Methods	● Reinforcement Learning Overview ● Markov Decision Processes (MDPs) ● Policy Gradient Methods Introduction
	Introduction to Actor-Critic Methods	● Challenges with Policy Gradient Methods ● Introduction to Actor-Critic Methods ● Advantage Actor-Critic (A2C)
	Advanced Actor-Critic Techniques	● Advantage Actor-Critic (A3C) ● Proximal Policy Optimization (PPO) ● Trust Region Policy Optimization (TRPO)
	Applications and Future Directions	● Applications of Actor-Critic Methods ● Recent Advances and Future Directions ● Hands-on Project: Developing an

		actor-critic-based agent
Method Learning DDPG, TD3 and SAC	Introduction to DDPG	- Introduction to Policy Gradient Methods - Deep Deterministic Policy Gradient (DDPG) - Hands-on: Basic DDPG implementation
	Advanced Deep Deterministic Policy Gradient (DDPG) Techniques	- Challenges with DDPG - Twin Delayed DDPG (TD3) - Exploration Strategies
	Introduction to Soft Actor-Critic (SAC)	- Soft Actor-Critic (SAC) Overview - Entropy Regularization - Target Entropy and Temperature
	Advanced Topics and Applications	- Continuous Control Applications - Recent Advances and Future Directions - Hands-on Project: Developing a continuous control agent