Machine learning

(40h / 5 Days)

Description:

This training course offers a deep dive into machine learning, using AWS as the primary platform for implementation. It begins with an **Introduction to Machine Learning and AWS**, covering core concepts and the use of AWS services like SageMaker for ML workflows. The course progresses into Data Preparation and Feature Engineering, teaching participants how to prepare data for optimal model performance, followed by **Exploratory Data Analysis**, where students learn to analyse and visualise data effectively.

In Building Machine Learning Models, participants will develop models using both supervised and unsupervised techniques. Model Evaluation and Tuning will equip them with the skills to assess model performance and improve accuracy through hyper-parameter tuning. The Deploying Machine Learning Models module covers how to operationalise models in production environments using AWS services. The program

further explores specialised areas like Natural Language Processing (NLP) in the Working with Text Data module, and computer vision in the Working with Image and Video Data module.

For advanced learners, Advanced Topics in Machine Learning delves into cutting-edge techniques like deep learning and reinforcement learning. Finally, the course wraps up with ML Best Practices and Case Studies, offering insights into real-world applications and common challenges in the machine learning lifecycle.

Target Audience:

The target audience for this training program includes data engineers, data architects, and IT professionals who are responsible for designing, building, and managing data pipelines and architectures. It is also suitable for individuals who are looking to enhance their skills in leveraging AWS services for data engineering tasks, as well as those interested in incorporating artificial intelligence and machine learning into their data workflows. Prior experience with AWS and basic knowledge of data engineering concepts are recommended for participants.

Training Expected Outcomes:

Trainees will be able to :

Upon completing this training program, participants will be able to:

1. **Understand Machine Learning Fundamentals:** Grasp the core concepts, types, and applications of machine learning, and understand the importance of data preparation, feature engineering, and exploratory data analysis.
2. **Leverage AWS Services for ML:** Utilise key AWS services such as Amazon SageMaker, AWS Glue, Amazon QuickSight, AWS Comprehend, and Amazon Rekognition for various machine learning tasks, including model building, training, deployment, and monitoring.
3. **Build and Deploy ML Models:** Develop, train, and deploy supervised and unsupervised machine learning models using Amazon SageMaker, and implement NLP and computer vision solutions with AWS AI services.
4. **Optimise and Evaluate Models:** Perform model evaluation and tuning to improve performance, and use techniques for ensuring model explainability, fairness, and reliability.
5. **Implement Advanced ML Solutions:** Apply advanced machine learning techniques, including deep learning, and understand the best practices for scaling ML workloads and integrating machine learning into data engineering pipelines.
6. **Apply ML in Real-World Scenarios:** Gain practical experience through hands-on labs and projects, and learn from real-world case studies to understand the challenges and solutions in implementing machine learning projects.

By the end of the program, participants will have hands-on experience and a solid understanding of how to leverage Cloud services to build and manage

comprehensive Machine learning solutions, preparing them to tackle real-world data challenges effectively.

Training Strategy

1. **Module-Based Learning:** The program is divided into 10 modules, each focusing on different aspects of machine learning and AWS services. Each module builds upon the previous one, ensuring a cohesive and comprehensive learning experience.
2. **Theoretical Lessons:** Each module begins with theoretical lessons that introduce key concepts, techniques, and best practices. These lessons provide the foundational knowledge needed for practical applications.
3. **Hands-On Labs:** Practical labs are integrated into each module, allowing participants to apply what they have learned in real-world scenarios. Labs focus on using AWS services like Amazon SageMaker, AWS Glue, Amazon QuickSight, AWS Comprehend, and Amazon Rekognition.
4. **Assessments:** Each module includes quizzes and hands-on projects to assess participants' understanding and application of the concepts covered. A final comprehensive quiz and project ensure that participants have mastered the material.
5. **Case Studies:** Real-world case studies are presented to illustrate successful machine learning projects, highlighting best practices and lessons learned from industry examples.

Course Modules

1. **Introduction to Machine Learning and AWS** – Learn fundamental ML concepts and explore AWS services for ML workflows
2. **Data Preparation and Feature Engineering** – Master data cleaning, preprocessing, and feature engineering for model building.
3. **Exploratory Data Analysis** – Perform exploratory data analysis to uncover patterns and insights using AWS QuickSight
4. **Building Machine Learning Models** – Build supervised and unsupervised machine learning models using AWS SageMaker .
5. **Model Evaluation and Tuning** – Evaluate and optimise models through hyperparameter tuning using AWS tools.
6. **Deploying Machine Learning Models** – Deploy and monitor ML models in production environments with AWS SageMaker.
7. **Working with Text Data and NLP** – Implement natural language processing models using AWS Comprehend and SageMaker.
8. **Working with Image and Video Data** – Use AWS Rekognition for image and video analysis and build computer vision models.
9. **Advanced Topics in Machine Learning** – Explore advanced ML topics such as deep learning and reinforcement learning.
10. **ML Best Practices and Case Studies** – Review real-world case studies and discuss best practices for ML deployment.

Training Program

Machine Learning
Training Objectives: • Understanding of Core Machine Learning Concepts • Utilisation of Cloud Services for Machine Learning • Building and Deployment of Machine Learning Models • Optimisation and Evaluate Machine Learning Models • Implementation Advanced Machine Learning Solutions • Analysis and Visualise Data • Deployment and Monitor Machine Learning Models in Production

4 Hours
1h
 	
1h
 	
2h
	Module 1: Introduction to Machine Learning and AWS
	
	Objective: Introduce the fundamental concepts of machine learning, different types of learning and algorithms, and explore AWS services that support machine learning workflows
	
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	• **Overview of Machine Learning.**
	  ◦ Definition and key concepts of machine learning.
	  ◦ Types of machine learning: supervised, unsupervised, and reinforcement learning.
	  ◦ Common applications and use cases.
	• **Machine Learning on AWS**
	  ◦ Overview of AWS services for machine learning.
	  ◦ Key features of Amazon SageMaker.
	  ◦ Introduction to other AWS AI services: AWS Comprehend, Amazon Rekognition.
	• **Setting Up the Environment.**
	  ◦ Setting up an AWS account.
	  ◦ Introduction to AWS Management Console, AWS CLI, and SDKs.
	  ◦ Configuring the development environment for machine learning projects.
	
	Lab: Setting Up Your Machine Learning Environment
	
	◦ Provisioning resources on AWS.
	◦ Setting up a local development environment.
	◦ Installing necessary libraries and tools.
	
	Assessment:
	
	◦ Quiz on machine learning fundamentals and AWS services.

4 Hours
1h
1h
1h
	Module 2: Data Preparation and Feature Engineering.
	
	Objective: Master the skills of performing data cleaning, preprocessing, and feature engineering to prepare data for effective machine learning modelling.
	
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	- **Introduction to Data Preparation**
	  - Importance of data preparation.
	  - Common techniques for data cleaning and preprocessing.
	- **Feature Engineering**
	  - Techniques for feature extraction and selection.
	  - Importance of feature engineering in model performance.
	- **Data Transformation and Scaling**
	  - Techniques for data transformation and normalisation.
	  - Using AWS Glue for data preprocessing.
	
	Lab: Data Preparation and Feature Engineering
	
	- Cleaning and preprocessing a dataset.
	- Feature extraction and selection using AWS Glue.
	
	Assessment:
	
	- Quiz on data preparation and feature engineering techniques.

3 Hours
 	
1h
 	
1h
 	
1h
	Module 3: Exploratory Data Analysis.
	
	Objective: Perform exploratory data analysis to uncover trends, patterns, and insights from data using visual and quantitative methods.
	
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	- **Introduction to Exploratory Data Analysis (EDA)**
	  - Importance of EDA in machine learning.
	  - Common techniques and tools for EDA.
	- **Visualisation Techniques**
	  - Using visualisation tools to understand data.
	  - Common visualisation libraries and tools.
	- **Using AWS for EDA**
	  - Using Amazon QuickSight for data visualisation.
	  - Integrating EDA with AWS machine learning workflows.
	
	Lab: Exploratory Data Analysis
	
	- Performing EDA on a sample dataset.
	- Visualising data using Amazon QuickSight.
	
	Assessment:
	
	- Quiz on exploratory data analysis techniques and tools.

4 Hours

Module 4: Building Machine Learning Models

1h

Objective: Provide hands-on experience in building various types of machine learning models using Python and AWS tools, focusing on understanding model selection and algorithm implementation.

1h

- **Introduction to Model Building**
  - Steps in building machine learning models.
  - Overview of common machine learning algorithms.

1h

- **Supervised Learning Models**
  - Overview of regression and classification algorithms.
  - Building supervised learning models using Amazon SageMaker.
- **Unsupervised Learning Models**
  - Overview of clustering and dimensionality reduction algorithms.
  - Building unsupervised learning models using Amazon SageMaker.

Lab: Building Machine Learning Models

- Building and training supervised and unsupervised learning models using SageMaker.
- Evaluating model performance.

Assessment:

- Quiz on machine learning algorithms and model building techniques.

4 Hours

Module 5: Model Evaluation and Tuning

1h

Objective: Instruct on evaluating machine learning models using different metrics and techniques, and optimise model performance through hyperparameter tuning and validation strategies.

1h

- **Introduction to Model Evaluation**
  - Importance of model evaluation.
  - Common evaluation metrics for regression and classification.

1h

- **Model Tuning Techniques**
  - Hyperparameter tuning and model optimization.
  - Techniques for improving model performance.
- **Using SageMaker for Model Tuning**
  - Automating hyperparameter tuning with SageMaker.
  - Using SageMaker to evaluate and optimize models.

Lab: Model Evaluation and Tuning

- Evaluating model performance using SageMaker.
- Hyperparameter tuning with SageMaker.

Assessment:

- Quiz on model evaluation and tuning techniques.

4 Hours

1h

1h

1h

Module 6: Deploying Machine Learning Models

Objective: Instruct on how to deploy machine learning models effectively using AWS services, ensuring models are scalable, maintainable, and integrate seamlessly into business applications.

- **Introduction to Model Deployment**
  - Importance of model deployment.
  - Overview of deployment strategies.
- **Deploying Models with SageMaker**
  - Steps for deploying machine learning models using SageMaker.
  - Managing deployed models and endpoints.
- **Monitoring Deployed Models**
  - Techniques for monitoring model performance in production.
  - Using AWS tools for model monitoring and management.

Lab: Deploying Machine Learning Models

- Deploying a machine learning model using SageMaker.
- Setting up monitoring for the deployed model.

Assessment:

- Quiz on model deployment and monitoring techniques.

4 Hours
 	
1h
 	
1h
 	
1h
	Module 7: Working with Text Data and NLP.
	
	Objective: Introduce natural language processing (NLP) concepts and tools, enabling participants to build applications that can analyze and interpret human language using AWS services.
	
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	- Introduction to Natural Language Processing (NLP)
	  - Overview of NLP and its applications.
	  - Common techniques for working with text data.
	- **Using AWS Comprehend for NLP**
	  - Key features of AWS Comprehend.
	  - Performing text analysis with AWS Comprehend.
	- **Building NLP Models with SageMaker**
	  - Steps for building NLP models using SageMaker.
	  - Techniques for preprocessing and feature extraction from text data.
	
	Lab: Working with Text Data and NLP
	
	- Performing text analysis with AWS Comprehend.
	- Building and training an NLP model using SageMaker.
	
	Assessment:
	
	- Quiz on NLP concepts and techniques.
	- Hands-on project: Building and querying a data pipeline using AWS Step Functions and Athena.

4 Hours	**Module 8: Working with Image and Video Data.**
1h	**Objective**: Enable trainees to implement computer vision models that can process and analyse image and video data effectively using AWS services like Amazon Rekognition.

1h	- Introduction to Computer Vision
	  - Overview of computer vision and its applications.
	  - Common techniques for working with image and video data.

1h	- **Using Amazon Rekognition for Computer Vision**
	  - Key features of Amazon Rekognition.
	  - Performing image and video analysis with Rekognition.
	- **Building Computer Vision Models with SageMaker**
	  - Steps for building computer vision models using SageMaker.
	  - Techniques for preprocessing and feature extraction from image data.
	
	Lab: Working with Image and Video Data
	
	  - Performing image and video analysis with Amazon Rekognition.
	  - Building and training a computer vision model using SageMaker.
	
	Assessment:
	
	  - Quiz on computer vision concepts and techniques.

4 Hours

Module 9: Advanced Topics in Machine Learning.

1h

Objective: Explore advanced machine learning topics such as deep learning, reinforcement learning, and their applications in real-world scenarios, leveraging AWS for complex computational tasks.

1h

- **Introduction to Deep Learning**
  - Overview of deep learning and its applications.
  - Common deep learning architectures and algorithms.
- **Using SageMaker for Deep Learning**
  - Building and training deep learning models with SageMaker.
  - Using pre-built deep learning frameworks in SageMaker.

1h

- **Model Explainability and Fairness**
  - Importance of model explainability and fairness.
  - Techniques for ensuring model transparency and fairness.

Lab: Advanced Machine Learning Topics

- Building and training a deep learning model with SageMaker.
- Evaluating model explainability and fairness.

Assessment:

- Quiz on deep learning and advanced machine learning topics.

4 Hours
 	
1h
 	
1h
 	
1h
 	
1h
	Module 10: ML Best Practices and Case Studies
	
	Objective: Discuss best practices in machine learning project deployment and maintenance, and review detailed case studies that demonstrate successful machine learning applications in industry.
	
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	• **Machine Learning Best Practices**
	  ◦ Best practices for machine learning model development.
	  ◦ Techniques for ensuring model robustness and reliability.
	• **Scaling Machine Learning Workloads**
	  ◦ Techniques for scaling machine learning models and workflows.
	  ◦ Using AWS tools for scaling machine learning workloads.
	• **Case Studies in Machine Learning**
	  ◦ Real-world case studies showcasing successful machine learning projects.
	  ◦ Lessons learned and best practices from industry examples.
	• **Final Project and Assessment**
	  ◦ Hands-on project: Implementing a complete machine learning workflow using AWS.
	  ◦ Final assessment: Comprehensive quiz covering all modules.
	Lab: Implementing a Machine Learning Workflow
	  ◦ Designing, building, and deploying a complete machine learning solution using AWS services.
	  ◦ Integrating various machine learning techniques and AWS tools.
	
	Assessment:
	
	  ◦ Final comprehensive quiz and hands-on project evaluation.