# Machine Learning on Google Cloud Training

Duration: **5 Day**

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## Overview

This course provides a comprehensive introduction to the **Artificial Intelligence (AI)** and **Machine Learning (ML)** capabilities available on Google Cloud. Participants explore the data-to-AI lifecycle through AI foundations, AI development, and AI solutions.

Throughout the programme, learners examine the technologies, products, and tools used to develop Machine Learning models, ML pipelines, and Generative AI projects. Participants learn how to create **AutoML** models without writing code, build **BigQuery ML** models with SQL, and configure custom training jobs on Vertex AI using **Keras and TensorFlow**.

The course also covers data quality, exploratory data analysis, data preprocessing, feature engineering, model evaluation and optimisation, deployment, prediction, model monitoring, and MLOps.

Generative AI concepts are also introduced, including Large Language Models (LLMs), relevant APIs, and the generative AI capabilities available for AI development on Google Cloud.

### Google Cloud Products and Technologies

The course covers a range of Google Cloud products and related technologies, including:

- Vertex AI
- AutoML
- BigQuery ML
- Vertex AI Pipelines
- TensorFlow
- Keras
- Model Garden
- Generative AI Studio
- Large Language Model (LLM) APIs
- Natural Language API
- Vertex AI Workbench
- Vertex AI Feature Store
- Vertex AI Vizier
- Dataplex
- Analytics Hub
- Data Catalog
- Vertex AI TensorBoard
- Dataflow
- Dataprep

## Prerequisites

To gain the most from this course, participants should have:

- Some familiarity with fundamental Machine Learning concepts,
- Basic proficiency with a scripting language, preferably Python.

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## Who Should Attend

This course is particularly suitable for:

- Aspiring Machine Learning Data Scientists and Engineers,
- Data Scientists,
- ML Developers,
- ML Engineers,
- Data Engineers,
- Data Analysts,
- Technical professionals developing AI/ML solutions on Google Cloud,
- Google and partner field personnel supporting customers in these roles.

## What You Will Learn

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

- Describe the main Google Cloud technologies used to build ML models, ML pipelines, and Generative AI projects,
- Determine when AutoML and BigQuery ML are appropriate,
- Create managed datasets in Vertex AI,
- Work with features in Vertex AI Feature Store,
- Explain the roles of Analytics Hub, Dataplex, and Data Catalog,
- Identify techniques for improving model performance,
- Work with notebook environments in Vertex AI Workbench,
- Create custom training jobs and understand deployment using Docker containers,
- Explain Batch and Online Predictions,
- Understand Model Monitoring,
- Improve data quality and perform exploratory data analysis,
- Build and train Supervised Learning models,
- Evaluate and optimise models using Loss Functions and Performance Metrics,
- Create repeatable and scalable Training, Evaluation, and Test datasets,
- Implement ML models using TensorFlow and Keras,
- Explain the benefits of Feature Engineering,
- Understand Vertex AI Model Monitoring and Vertex AI Pipelines.

## Outline

### Section 1 – Introduction to AI and Machine Learning on Google Cloud

- Understanding the Google Cloud AI/ML framework
- Identifying the major components of Google Cloud infrastructure
- Understanding how Data and ML products support the data-to-AI lifecycle
- Building an ML model with BigQuery ML
- Exploring different approaches to building ML models on Google Cloud
- Comparing Pre-trained APIs, AutoML, and Custom Training
- Analysing text with the Natural Language API
- Understanding the ML model development workflow

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- MLOps and workflow automation on Google Cloud
- Building an end-to-end ML model with AutoML on Vertex AI
- Introduction to Generative AI
- Understanding Large Language Models (LLMs)
- Using Generative AI capabilities during AI development
- Exploring Google Cloud AI solutions and embedded Generative AI capabilities
- Hands-On Labs
- Module Quizzes
- Module Readings

## Section 2 – Launching into Machine Learning

- Techniques for improving Data Quality
- Performing Exploratory Data Analysis
- Building and training Supervised Learning models
- Understanding AutoML
- Building, training, and deploying ML models without writing code
- Understanding BigQuery ML and its benefits
- Working with Loss Functions
- Evaluating models with Performance Metrics
- Optimising model performance
- Identifying and mitigating common Machine Learning problems
- Creating repeatable and scalable Training, Evaluation, and Test datasets
- Hands-On Labs
- Module Quizzes
- Module Readings

## Section 3 – TensorFlow on Google Cloud

- Creating Machine Learning models with TensorFlow and Keras
- Understanding the main TensorFlow components
- Using tf.data to work with data and large datasets
- Building models with tf.keras preprocessing layers
- Using the Keras Sequential API for straightforward model architectures
- Using the Keras Functional API for more advanced models
- Training models at scale with Vertex AI Training Service
- Deploying and productionalising ML models
- Hands-On Labs
- Module Quizzes
- Module Readings

## Section 4 – Feature Engineering

- Understanding Vertex AI Feature Store
- Identifying the characteristics of effective features
- Using tf.keras.preprocessing utilities with Image Data
- Preprocessing Text Data
- Preprocessing Sequence Data
- Performing Feature Engineering with BigQuery ML
- Feature Engineering with Keras
- Feature Engineering with TensorFlow
- Understanding the impact of features on model performance

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### Section 5 – Machine Learning in the Enterprise

- Tools for Data Management and Data Governance
- Comparing Data Preprocessing approaches
- Overview of Dataflow
- Preprocessing with Dataprep
- Using SQL for preprocessing tasks
- Comparing AutoML, BigQuery ML, and Custom Training
- Selecting an appropriate ML development approach for different use cases
- Hyperparameter Tuning with Vertex AI Vizier
- Improving model performance
- Understanding Prediction workflows
- Model Monitoring
- Managing ML models with Vertex AI
- Understanding the benefits of Vertex AI Pipelines
- Best practices for Model Deployment and Serving
- Model Monitoring best practices
- Best practices for Vertex AI Pipelines
- Organising ML artifacts
- Hands-On Labs
- Module Quizzes
- Module Readings