AI CERTs™

AI+ Developer™

Program Detailed Curriculum

Executive Summary

AI+ Developer™ certification program offers a tailored journey in key AI domains for developers. Master Python, advanced concepts, math, stats, optimization, and deep learning. The curriculum covers data processing, exploratory analysis, and allows specialization in NLP, computer vision, or reinforcement learning. The program includes time series analysis, model explainability, and deployment intricacies. Upon completion, you'll receive a certification, showcasing your AI proficiency for real-world challenges.

Certification Prerequisites

- **Basic Math:** Familiarity with high school-level algebra and basic statistics.
- **Computer Science Fundamentals:** Understanding basic programming concepts (variables, functions, loops) and data structures (lists, dictionaries).
- **Python Programming:** Proficiency in Python is mandatory for hands-on exercises and project work.

Exam Blueprint

Number of Questions	Passing Score	Duration	Format	Question Type
50	35/50 or 70%	90 Minutes	Online via AI Proctoring platform	Multiple Choice/Multiple Response

Module 1

Foundations of Artificial Intelligence

1.1 Introduction to AI

- **History:** Delve into the historical development of Artificial Intelligence, tracing its evolution over time.
- **What is AI?:** Uncover the definition and fundamental concepts of AI, laying the groundwork for a deeper exploration of this field.

1.2 Types of Artificial Intelligence

- **Artificial Intelligence based on capabilities:** Understand the differences between Narrow AI, General AI, and Super AI, based on their cognitive abilities.
- **Artificial Intelligence on Functionalities: Reactive Machines, Limited Theory, Theory of Mind, Self-awareness:** Explore Reactive Machines, Limited Theory, Theory of Mind, and Self-awareness functionalities, and their significance in artificial intelligence.

1.3 Branches of Artificial Intelligence

- **Method Based - Machine Learning, Deep Learning, Fuzzy Logic, Generative AI:** Learn about Machine Learning, Deep Learning, Fuzzy Logic, and Generative AI, including their distinctions and practical applications.
- **Application Based - Computer Vision, NLP, Robotics, Expert Systems:** Explore Computer Vision, Natural Language Processing (NLP), Robotics, and Expert Systems, discovering their real-world applications and relevance.

1.4 Applications and Business Use Cases

- **Case Study:** Examine a real-world example showcasing AI's application and its impact in action.
- **Business Applications:** Discover how AI is utilized in different industries, spotlighting its practical applications and business use cases.

Module 2

Mathematical Concepts for AI

2.1 Linear Algebra

- **Vectors and matrices:** Dive into the foundational structures used to represent and manipulate data in AI applications, setting the stage for understanding complex datasets.
- **Matrix operations (addition, multiplication, inverse):** Master core operations like addition, multiplication, and inversion essential for mathematical modeling in AI, providing the building blocks for advanced analysis.
- **Eigenvalues and eigenvectors:** Explore key concepts facilitating dimensionality reduction and transformations, enabling a deeper understanding of data manipulation techniques.
- **Linear transformations:** Learn how to apply matrices to transform and analyze datasets, uncovering insights and patterns crucial for AI development.
- **Determinants:** Understand the mathematical tool used in solving systems of linear equations and transformations, empowering problem-solving skills essential for AI applications.

2.2 Calculus

- **Derivatives and partial derivatives:** Learn the fundamentals necessary to grasp how functions change over time or with respect to specific variables.
- **Gradients:** Explore the critical role of gradients in optimization algorithms, enabling the discovery of optimal solutions in function spaces.
- **Optimization techniques:** Master strategies for fine-tuning parameters to enhance model performance, a fundamental aspect of refining AI models.
- **Integration:** Understand the significance of integration in computing cumulative effects and determining areas under curves, essential for various AI applications.

2.3 Probability & Statistics

- **Probability distributions:** Gain a comprehensive understanding of the normal, binomial, and Poisson distributions, exploring their traits, real-world applications, and importance in modeling diverse phenomena.

- **Hypothesis testing:** Delve into the foundational concept of hypothesis testing, a vital statistical technique empowering informed decision-making using sample data.
- **Bayesian inference:** Discover Bayesian inference, a potent statistical approach integrating prior knowledge with observed data to yield powerful insights.

2.4 Discrete Mathematics

- **Sets and logic:** Understand the groundwork for algorithmic thinking, essential for problem-solving strategies.
- **Graph theory:** Explore methods for modeling data relationships and structures to uncover insights.
- **Combinatorics:** Master techniques for counting and arranging elements, vital skills for effective algorithm design.

Module 3

Python for Developer

3.1 Python fundamentals

- **Basic Syntax:** Learn foundational elements such as variables, data types (strings, integers, floats, booleans), operators, expressions, and indentation for writing code.
- **Control Flow:** Explore conditional statements (if/else, elif), loops (for, while), functions, arguments, and return values to control the flow of code execution.
- **Data Structures:** Understand essential data structures like lists, tuples, dictionaries, sets, and nested structures, along with operations performed on them.
- **Modules and Packages:** Discover how to import modules, manage packages, and understand namespaces to organize and reuse code effectively.

3.2 Python Libraries

- **NumPy:** Dive into numerical arrays, vector operations, linear algebra, and scientific computing for efficient numerical processing.
- **Pandas:** Explore data analysis and manipulation with data frames, series, indexing, filtering, and various operations for effective data handling.
- **Matplotlib and Seaborn:** Master data visualization techniques, creating diverse plots and charts with styling and customization options for clear and insightful graphical representations.

Module 4

Mastering Machine Learning

4.1 Introduction to Machine Learning

- **Definition and scope of machine learning:** Learn the fundamental concepts and applications of machine learning, laying the foundation for deeper exploration.
- **Types of machine learning:** Gain an overview of Supervised, Unsupervised, and Reinforcement Learning techniques, understanding their respective approaches and applications.
- **Key Terminologies:** Learn about the essential terminology in machine learning, enabling clearer communication and comprehension.

- **Overview of machine learning lifecycle:** Understand the stages involved in the machine learning process, from data preparation to model deployment, for a holistic understanding of the workflow.

4.2 Supervised Machine Learning Algorithms

- **Regression:** Explore different regression models including Linear Regression, Polynomial Regression, and Decision Trees for predictive analysis.
- **Hands-on:** Engage in practical application scenarios such as predicting stock prices and sentiment analysis to reinforce learning through real-world examples.
- **Classification:** Delve into classification techniques such as Logistic Regression, Support Vector Machines, and Random Forests for pattern recognition and data categorization.
- **Hands-on:** Apply classification algorithms to tasks like image classification (e.g., cat vs. dog), spam email detection, and sentiment analysis for hands-on experience with classification problems.

4.3 Unsupervised Machine Learning Algorithms

- **Clustering:** Explore clustering techniques such as K-means clustering and hierarchical clustering to group similar data points for pattern identification.
- **Hands-on:** Apply clustering algorithms to real-world scenarios like customer segmentation and anomaly detection, gaining practical experience.
- **Dimensionality Reduction:** Learn algorithms like PCA and t-SNE for simplifying high-dimensional data, aiding in the visualization and interpretation of complex datasets.
- **Hands-on:** Visualize complex data structures using dimensionality reduction techniques for enhanced analysis and insight extraction.

4.4 Model Evaluation and Selection

- **Metrics for regression and classification:** Learn how to quantify model performance using metrics tailored for both regression and classification tasks.
- **Model comparison and cross-validation:** Explore techniques for comparing models and conducting cross-validation to ensure robust model selection.
- **Hands-on:** Engage in practical exercises focused on evaluating and selecting models tailored to specific project requirements, reinforcing theoretical concepts with real-world applications.

Module 5

Deep Learning

5.1 Neural Networks

- **Building blocks of artificial neural networks:** Explore fundamental components such as perceptrons, activation functions, and feedforward networks, laying the foundation for understanding neural network architectures.
- **Deep Learning Frameworks:** Gain insight into popular frameworks like TensorFlow, PyTorch, and Keras, understanding their capabilities and use cases in deep learning development.
- **Hands-on:** Develop practical skills by building a simple neural network tasked with classifying handwritten digits, applying theoretical knowledge to real-world implementation.

5.2 Convolutional Neural Networks (CNNs)

- **CNN Architecture:** Explore the key components of Convolutional Neural Networks (CNNs), specialized for image recognition tasks. Learn about popular architectures such as LeNet, AlexNet, VGG, and ResNet.
- **Hands-on: Image classification for a custom dataset (e.g., flowers, animals, clothing items):** Engage in practical image classification tasks using a custom dataset. Learn how to train and evaluate CNN models for real-world image classification challenges.

5.3 Recurrent Neural Networks (RNNs)

- **LSTM, GRU, applications for sequential data:** Delve into Recurrent Neural Network (RNN) architectures including Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU), tailored for processing sequential data like text, speech, and time series.
- **Hands-on:** Experience the practical applications of RNNs in natural language processing and other sequential tasks such as text generation, sentiment analysis, and machine translation through interactive exercises and projects.

Module 6

Computer Vision

6.1 Image Processing Basics

- **Image representation, filtering, transformations:** Gain insight into digital image representation and techniques for manipulating images through filtering and transformations to accomplish diverse tasks.
- **Hands-on: Image manipulation and enhancement:** Engage in practical exercises involving image manipulation and enhancement, applying image processing techniques to real-world scenarios for hands-on experience and skill development.

6.2 Object Detection

- **Region proposal methods, YOLO, SSD:** Explore techniques such as region proposal methods, YOLO, and SSD for efficiently identifying and locating objects within images.
- **Hands-on: Building an object detection app for real-time object recognition:** Develop a real-time object detection application for recognizing objects in images, employing popular algorithms to design and implement an application for practical use.

6.3 Image Segmentation

- **Semantic segmentation, instance segmentation, U-Net:** Explore methods like semantic segmentation, instance segmentation, and U-Net for partitioning images into meaningful regions or identifying individual objects within them.
- **Hands-on: Medical image segmentation, autonomous driving tasks:** Dive into medical image segmentation and autonomous driving tasks, applying image segmentation techniques to real-world scenarios in healthcare and robotics for tasks such as medical diagnosis and object detection in autonomous vehicles.

6.4 Generative Adversarial Networks (GANs)

- **Architecture, training, applications:** Explore the architecture, training process, and applications of Generative Adversarial Networks (GANs), which generate realistic images or transform styles through adversarial learning.
- **Hands-on-Generating realistic images or transforming styles:** Engage in practical exercises involving GANs for generating realistic images or transforming styles, experimenting with creative image generation and style transfer techniques.

Module 7

Natural Language Processing

7.1 Text Preprocessing and Representation

- **Tokenization, stemming, lemmatization, word embeddings:** Learn techniques such as tokenization, stemming, lemmatization, and word embeddings for preprocessing text data to prepare it for machine learning applications.
- **Hands-on: Cleaning and preparing text data for NLP tasks:** Gain practical experience by cleaning and preparing text data for NLP tasks, utilizing text preprocessing pipelines to enhance data quality and usability in real-world applications.

7.2 Text Classification

- **Sentiment analysis, topic modelling, spam detection:** Learn methods such as sentiment analysis, topic modeling, and spam detection for categorizing and identifying themes within textual data.
- **Hands-on: Building a sentiment analyzer for social media posts:** Develop a sentiment analyzer for social media posts, where you'll implement a text classification model to analyze and classify sentiment in user-generated content.

7.3 Named Entity Recognition (NER)

- **Identifying people, places, organizations, etc.:** Explore techniques for extracting specific entities, such as individuals, locations, and organizations, from textual data.
- **Hands-on: Extracting key information from news articles or legal documents:** Gain practical experience by extracting key information from news articles or legal documents, leveraging NER techniques to perform information extraction tasks effectively.

7.4 Question Answering (QA)

- **BERT, T5, question-answering systems:** Explore the utilization of large language models such as BERT and T5 for performing question-answering tasks by understanding contextual relationships within textual data.
- **Hands-on: Building a simple QA system to answer questions based on a given text:** Develop a simple Question-Answering (QA) system capable of answering questions based on a provided text. Implement this system using pre-trained models to understand the basics of QA system construction and deployment.

Module 8

Reinforcement Learning

8.1 Introduction to Reinforcement Learning

- **Agents, environments, rewards, actions, states:** Gain a foundational understanding of the core concepts and terminology essential for reinforcement learning, including agents, environments, rewards, actions, and states.

- **Hands-on: Building a simple game environment for RL experimentation:** Construct a simple game environment tailored for experimentation with reinforcement learning algorithms. Develop a basic environment conducive to testing and refining RL techniques through practical implementation.

8.2 Q-Learning and Deep Q-Networks (DQNs)

- **Value-based RL, Q-tables, function approximation:** Explore methods such as value-based reinforcement learning, Q-tables, and function approximation to learn optimal policies through state-action values, enabling efficient decision-making in dynamic environments.
- **Hands-on: Training an AI to play Atari games or navigate a maze:** Engage in training AI agents to play Atari games or navigate mazes, leveraging techniques like Q-learning and Deep Q-Networks (DQNs) to develop intelligent agents capable of mastering complex gaming scenarios or solving navigation tasks autonomously.

8.3 Policy Gradient Methods

- **Policy-based RL, REINFORCE algorithm, actor-critic methods:** Explore methods like policy-based reinforcement learning, the REINFORCE algorithm, and actor-critic methods for directly optimizing policies to maximize rewards in dynamic environments.
- **Hands-on: Training a robot to perform a task with continuous control:** Engage in training a robot to perform a task requiring continuous control, utilizing policy gradient methods to implement effective control strategies in real-world robotics scenarios.

Module 9

Cloud Computing in AI Development

9.1 Cloud Computing for AI

- **Benefits, popular platforms (AWS, Azure, GCP):** Discover the advantages of leveraging cloud platforms for AI development and learn about leading cloud service providers such as Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).
- **Hands-on: Setting up a cloud-based AI development environment:** Gain practical experience by setting up a cloud-based AI development environment, where you'll configure and customize cloud services tailored to AI development needs, fostering real-world skills in cloud computing for AI projects.

9.2 Cloud-Based Machine Learning Services

- **Pre-trained models, AutoML, model deployment:** Explore the utilization of pre-trained models, automated machine learning tools (AutoML), and model deployment services provided by cloud platforms for efficient AI development and deployment workflows.
- **Hands-on: Building an AI application using cloud services:** ·Engage in building an AI application using cloud services, leveraging the capabilities of cloud platforms to develop, train, and deploy AI models seamlessly. Gain practical experience in building and deploying AI applications from scratch, utilizing cloud-based resources for scalability and efficiency.

Module 10

Large Language Models

10.1 Understanding LLMs

- **Architecture, training, applications:** Understand the structure, training process, and versatile applications of large language models (LLMs), including their architectural design, training methodologies, and wide-ranging use cases across different domains.
- **Hands-on: Exploring LLM capabilities through open-source examples:** Dive into exploring the capabilities of LLMs through open-source examples, engaging in practical experimentation with open-source LLM implementations to uncover their potential for addressing diverse tasks and challenges in natural language processing and beyond.

10.2 Text Generation and Translation

- **Creative text formats and language translation:** Understand how to employ LLMs to generate diverse writing styles and facilitate language translation tasks, leveraging their natural language processing capabilities for creative text generation and multilingual communication.
- **Hands-on: Generating different text styles or translating between languages:** Engage in practical exercises exploring LLM's abilities in generating various text styles and translating between languages. Experiment with LLM-based tools and frameworks to generate creative text outputs and perform language translation tasks effectively.

10.3 Question Answering and Knowledge Extraction

- **Information retrieval, knowledge base construction:** Understand how LLMs can retrieve relevant information from large datasets to answer questions effectively. Explore different question-answering architectures and techniques.
- **Hands-on: Building a knowledge base or question-answering system using LLMs:** Learn how LLMs can be used to build and update knowledge bases by extracting information from text and code.

Module 11

Cutting-Edge AI Research

11.1 Neuro-Symbolic AI

- **Fundamentals of Neuro-Symbolic AI:** Explore the integration of symbolic reasoning and deep learning in Neuro-Symbolic AI. Understand how different approaches combine knowledge representation with neural networks.
- **Combining symbolic reasoning and deep learning:** Learn about hybrid architectures that combine symbolic reasoning rules with deep learning models to improve explainability and reasoning capabilities.

11.2 Explainable AI (XAI)

- **Introduction to XAI:** Understand the importance of explainability in AI models and the challenges in making them interpretable.
- **Interpreting AI models and building trust:** Explore different XAI techniques to explain how AI models make predictions and build user trust. Discuss the ethical implications of using black-box models without proper explain ability.

11.3 Federated Learning

- **Introduction & Importance:** Understand the concept of federated learning, where models are trained on decentralized data without sharing the data itself. Learn about the benefits of federating learning for privacy-preserving data analysis and collaborative learning.
- **Privacy-preserving collaborative learning:** Explore different federated learning algorithms and discuss the challenges and trade-offs involved in this approach to AI training.

11.4 Meta-Learning and Few-Shot Learning

- **Introduction & Importance:** Showcase meta-learning and few-shot learning as cutting-edge AI methodologies that specialize in quickly adapting to new tasks with minimal data, showcasing their significance in addressing the challenges of learning from limited datasets.
- **Learning to learn, rapid adaptation:** Understand how meta-learning and few-shot learning techniques empower models to rapidly adapt to new tasks by leveraging prior knowledge and efficiently learning from small amounts of data, highlighting their effectiveness in enabling quick and efficient learning in dynamic environments.

Module 12

AI Communication and Documentation

12.1 Communicating AI Projects

- **Presenting to technical and non-technical audiences:** Learn effective communication strategies for presenting AI projects to technical and non-technical audiences.
- **Hands-on: Preparing a presentation or blog post about an AI project:** Engage in practical application by selecting an AI project of interest and developing a presentation or blog post aimed at explaining it to a specific audience. Practice conveying complex technical concepts in an accessible manner or providing sufficient depth for technical audiences, enhancing your ability to communicate AI projects effectively.

12.2 Documenting AI Systems

- **Code documentation and model explanations:** Understand the importance of documenting AI systems for clarity, reproducibility, and maintainability. Learn best practices for documenting code, model architecture, and decision-making processes.
- **Hands-on: Writing clear and concise documentation for an AI model:** Gain practical experience in writing clear and concise documentation for an AI model by exploring various tools tailored for documenting AI projects. Engage in hands-on exercises to develop effective documentation that enhances transparency and accessibility for stakeholders.

12.3 Ethical Considerations

- **Bias, fairness, transparency, accountability:** It includes a fundamental understanding of those terminologies. It provides practical skills in applying ethical considerations to real-world scenarios.
- **Hands-on: Evaluating an AI system for ethical considerations:** It provides practical skills in applying ethical considerations to real-world scenarios.