AI CERTs™

AI + Network ™ (5 Days)
Program Detailed Curriculum

Executive Summary

This course provides professionals with the basic knowledge and advanced skills needed to understand the combination of artificial intelligence and current networking technologies. It discusses fundamental networking concepts, newer technologies such as SDN and NFV, and how AI can enhance network efficiency. Important focus areas consist of AI-powered network automation, orchestration, and security upgrades, combined with hands-on projects and practical labs for real-life implementation. The class ends by examining new developments and upcoming pathways in AI-enhanced networking, getting students ready for leading positions in this quickly changing sector.

Course Prerequisites

- Basic understanding of networking fundamentals.

- Familiarity with programming languages such as Python.

- Fundamental knowledge of AI and machine learning concepts.

- Experience with network management tools and technologies is a plus.

Module 1

Networking Foundations

1.1 Basic Networking Concepts

- **Understanding Network Types (LAN, WAN, MAN, PAN):** Explore the different network types: Local Area Networks (LAN), Wide Area Networks (WAN), Metropolitan Area Networks (MAN), and Personal Area Networks (PAN), and their applications.

- **Networking Topologies and Architectures:** Learn about various network topologies like star, ring, and mesh, and how network architectures are designed to optimize performance, reliability, and scalability.

- **Network Components and Devices (Routers, Switches, Hubs):** Examine key network components: routers, switches, and hubs, including their roles, functions, and how they interconnect to facilitate efficient network communication.

1.2 Networking Protocols and Standards

- **OSI and TCP/IP Models:** Understand the OSI and TCP/IP models, their layers, and how they structure network communication, providing a framework for troubleshooting and designing networks.

- **Common Protocols (HTTP, HTTPS, FTP, SMTP, DNS):** Study essential network protocols including HTTP, HTTPS, FTP, SMTP, and DNS, focusing on their functions and roles in enabling data exchange and internet services.

- **Wireless Networking Standards (Wi-Fi, Bluetooth):** Explore wireless networking standards such as Wi-Fi and Bluetooth, their specifications, uses, and how they support wireless communication and device connectivity.

1.3 Network Infrastructure and Design

- **Structured Cabling Systems:** Learn about structured cabling systems, including their design, components, and installation practices, to ensure efficient and organized network infrastructure.

- **IP Addressing and Subnetting:** Understand IP addressing and subnetting techniques, including address allocation, subnet masks, and CIDR notation, to effectively manage and optimize network IP space.

- **Network Segmentation and VLANs:** Explore network segmentation strategies and Virtual Local Area Networks (VLANs) to enhance network performance, security, and management by logically dividing network traffic.

1.4 Introduction to Network Security

- **Basic Security Concepts and Terminologies:** Discover fundamental security concepts and terminologies, including threats, vulnerabilities, and risk management, to build a foundational understanding of network security.

- **Firewalls and Network Security Appliances:** Explore firewalls and other network security appliances, their functions, configurations, and how they protect networks from unauthorized access and threats.

- **Security Policies and Best Practices:** Learn about developing and implementing security policies and best practices to safeguard networks, ensure compliance, and mitigate risks through effective security management.

Module 2

Advanced Networking Technologies

2.1 Network Virtualization and Cloud Networking

- **Virtual LANs (VLANs) and Virtual Networks (VNETs):** Explore VLANs and VNETs, focusing on their roles in creating isolated network segments and virtual networks to enhance network management and security.

- **Software-Defined Networking (SDN):** Understand Software-Defined Networking (SDN) principles, including its architecture and benefits, which enable centralized control and programmability of network resources.

- **Network Functions Virtualization (NFV):** Learn about Network Functions Virtualization (NFV), its use in virtualizing network services, and how it improves scalability, flexibility, and efficiency in network operations.

2.2 Emerging Network Architectures

- **5G Networking and Beyond:** Explore 5G networking technologies, their advancements over previous generations, and their impact on speed, latency, and connectivity for future networks.

- **nternet of Things (IoT) Networking:** Understand IoT networking, focusing on the protocols, architectures, and challenges involved in connecting and managing a vast array of smart devices.

- **Edge Computing and Fog Networking:** Learn about edge computing and fog networking, which bring computation and data storage closer to the network edge to enhance performance and reduce latency.

2.3 Advanced Routing and Switching

- **Dynamic Routing Protocols (OSPF, BGP, EIGRP):** Examine dynamic routing protocols such as OSPF, BGP, and EIGRP, including their functionalities, advantages, and how they manage route updates and network efficiency.

- **Layer 3 Switching and Multicast Routing:** Learn about Layer 3 switching for efficient routing between VLANs and multicast routing techniques to manage the distribution of data streams across networks.

- **Advanced Traffic Engineering and QoS:** Explore advanced traffic engineering and Quality of Service (QoS) principles to optimize network performance, ensure reliable service delivery, and prioritize critical applications.

2.4 Network Storage and Data Centers

- **Storage Area Networks (SAN) and Network Attached Storage (NAS):** Explore SAN and NAS technologies, focusing on their differences, use cases, and how they provide scalable, high-performance storage solutions for networks.

- **Data Center Networking and Design:** Learn about data center networking, including design principles, architectures, and best practices to optimize performance, scalability, and reliability in data center environments.

- **Cloud Computing and Virtualization:** Understand cloud computing and virtualization concepts, including their benefits, deployment models, and how they enable flexible, scalable, and efficient IT resource management.

AI in Networking

3.1 Introduction to AI and Machine Learning

- **Understanding AI Concepts and Terminologies:** Dive into fundamental AI concepts and terminologies, including machine learning, neural networks, and natural language processing, to build a strong foundation in artificial intelligence.

- **Overview of Machine Learning Techniques:** Explore key machine learning techniques, including supervised, unsupervised, and reinforcement learning, to understand their applications, algorithms, and how they drive intelligent systems.

- **AI Tools and Frameworks (TensorFlow, PyTorch):** Learn about popular AI tools and frameworks such as TensorFlow and PyTorch, focusing on their features, capabilities, and how they facilitate the development and deployment of AI models.

3.2 AI-Driven Network Optimization

- **Network Performance Optimization with AI:** Explore how AI can enhance network performance through intelligent analysis, predictive analytics, and automated adjustments to optimize speed, reliability, and efficiency.

- **Traffic Analysis and Load Balancing using AI:** Learn how AI-driven techniques can analyze network traffic patterns and automate load balancing to improve resource utilization, manage congestion, and ensure smooth data flow.

- **AI-Powered Network Diagnostics and Troubleshooting:** Discover how AI tools assist in network diagnostics and troubleshooting by identifying issues, analyzing root causes, and providing automated solutions to enhance network reliability.

3.3 AI for Network Security and Threat Detection

- **Machine Learning for Intrusion Detection:** Explore how machine learning algorithms enhance intrusion detection systems by identifying patterns, detecting anomalies, and mitigating potential security threats in real time.

- **Anomaly Detection and Threat Intelligence:** Learn about anomaly detection techniques and threat intelligence integration to identify unusual activities and emerging threats, improving proactive security measures and incident response.

- **AI in Security Information and Event Management (SIEM):** Discover how AI enhances SIEM systems by automating threat detection, correlating events, and providing actionable insights to improve overall security posture and incident management.

3.4 AI-Enhanced Network Management

- **Network Automation with AI:** Explore how AI-driven network automation streamlines routine tasks, enhances efficiency, and reduces human intervention by automating network configuration, monitoring, and management.

- **Predictive Network Maintenance and Monitoring:** Learn how predictive analytics and AI tools forecast network issues, perform proactive maintenance, and enable continuous monitoring to prevent downtime and optimize performance.

- **AI-Powered Network Configuration and Management:** Discover how AI technologies assist in network configuration and management by optimizing settings, automating adjustments, and ensuring optimal network performance and security.

Network Automation and Orchestration

4.1 Fundamentals of Network Automation

- **Automation Tools and Technologies (Ansible, Puppet, Chef):** Explore automation tools like Ansible, Puppet, and Chef, focusing on their capabilities for managing configurations, automating deployments, and improving operational efficiency.

- **Scripting and Automation with Python:** Learn how to use Python for scripting and automation, including writing scripts to automate tasks, process data, and enhance network operations.

- **Introduction to Network APIs and Protocols (REST, NETCONF):** Understand network APIs and protocols such as REST and NETCONF, including their roles in enabling network automation, integration, and communication between network devices and applications.

4.2 AI-Driven Network Orchestration

- **Intent-Based Networking and Automation:** Discover intent-based networking, which uses high-level policies to automate network configurations and adjustments, ensuring alignment with business objectives and operational efficiency.

- **AI in Network Configuration Management:** Explore how AI enhances network configuration management by automating settings, optimizing performance, and predicting adjustments based on data-driven insights.

- **Orchestration Platforms and Tools (Kubernetes, OpenStack):** Learn about orchestration platforms like Kubernetes and OpenStack, focusing on their roles in managing and automating containerized applications and cloud resources for efficient deployment and scaling.

4.3 Policy-Driven Network Management

- **Policy-Based Network Access Control:** Explore policy-based network access control, focusing on how policies are defined and enforced to manage and restrict access to network resources based on predefined criteria.

- **AI for Dynamic Policy Enforcement:** Learn how AI enhances dynamic policy enforcement by analyzing real-time data, adapting policies on-the-fly, and improving security and compliance in network environments.

- **Role-Based Access Control and Zero Trust Architecture:** Understand role-based access control (RBAC) and zero trust architecture, including their principles and implementation strategies to secure network resources and enforce stringent access controls.

4.4 Case Studies in Network Automation

- **Real-World Network Automation Scenarios:** Examine practical examples of network automation in action, illustrating how automation solutions are applied to solve real-world network management challenges and improve efficiency.

- **Industry Use Cases and Best Practices:** Explore industry-specific use cases and best practices for network automation, highlighting successful implementations and strategies for optimizing network operations and performance.

- **Emerging Trends in Network Automation:** Discover the latest trends in network automation, including innovations, technologies, and approaches shaping the future of network management and enhancing automation capabilities.

AI-Enhanced Network Security

5.1 Advanced Threat Detection with AI

- **AI Techniques for Malware Detection:** Explore AI techniques for detecting malware, including machine learning models and pattern recognition methods that enhance the identification and mitigation of malicious software.

- **Behavioral Analysis and User Profiling:** Learn about behavioral analysis and user profiling techniques that leverage AI to identify unusual activities, detect potential threats, and enhance security measures based on user behavior.

- **AI in Incident Response and Threat Hunting:** Discover how AI supports incident response and threat hunting by automating detection, analyzing security events, and providing actionable insights to swiftly address and neutralize threats.

5.2 Secure Network Design and Architecture

- **Designing Secure Networks with AI:** Explore how AI can be leveraged in designing secure networks, including its role in threat modeling, vulnerability assessment, and implementing proactive security measures.

- **Zero Trust and AI-Based Access Control:** Learn about integrating AI with Zero Trust principles to enhance access control, ensuring continuous verification and dynamic enforcement of security policies based on real-time data.

- **AI in Network Segmentation and Microsegmentation:** Discover how AI enhances network segmentation and microsegmentation by automating the creation and management of network segments, improving security and isolating potential threats effectively.

5.3 AI for Cybersecurity Intelligence

- **AI in Security Information and Event Management (SIEM):** Explore how AI enhances SIEM systems by automating threat detection, analyzing security events, and providing advanced insights for more effective incident management and response.

- **Predictive Analytics for Cyber Threat Intelligence:** Learn how predictive analytics utilizes AI to forecast potential cyber threats, analyze trends, and provide actionable intelligence for proactive security measures and risk management.

- **AI-Driven Security Operations Centers (SOC):** Discover how AI transforms Security Operations Centers (SOCs) by automating threat detection, incident response, and security monitoring, leading to more efficient and effective security operations.

5.4 Ethical Considerations in AI-Driven Security

- **Data Privacy and Ethical Concerns:** Explore data privacy issues and ethical concerns in AI and security, focusing on safeguarding personal information and ensuring responsible use of technology.

- **AI Bias and Fairness in Security Applications:** Learn about AI bias and fairness in security applications, addressing challenges related to algorithmic bias and ensuring equitable and unbiased decision-making in security systems.

- **Legal and Regulatory Compliance:** Understand the legal and regulatory requirements for AI and security, including compliance with data protection laws, industry standards, and guidelines to ensure lawful and ethical practices.

Module 6

Practical Labs and Hands-On Projects

6.1 Network Simulation and Emulation

- **Using Network Simulation Tools (GNS3, Cisco Packet Tracer):** Learn how to utilize network simulation tools like GNS3 and Cisco Packet Tracer to design, test, and troubleshoot network configurations in a virtual environment.

- **Emulating Real-World Network Scenarios:** Explore techniques for emulating real-world network scenarios to simulate various network conditions and challenges, enhancing testing, training, and troubleshooting capabilities.

6.2 AI-Driven Network Automation Projects

- **Automating Network Tasks with AI:** Discover how AI can automate routine network tasks, including configuration, monitoring, and management, to improve efficiency and reduce manual intervention.

- **Developing AI-Powered Network Management Solutions:** Learn how to develop AI-powered network management solutions that leverage machine learning and data analytics to optimize performance, enhance security, and streamline network operations.

6.3 AI for Network Security Projects

- **Building AI Models for Threat Detection:** Explore the process of building AI models for threat detection, including data collection, model training, and evaluation to identify and mitigate security threats effectively.

- **Implementing AI-Based Security Solutions:** Learn how to implement AI-based security solutions, focusing on integrating AI technologies into existing security frameworks to enhance threat detection, response, and overall protection.

6.4 Capstone Project (Using Google Colab and Azure cloud)

- **Designing and Implementing an AI-Enhanced Network:** Learn how to design and implement networks enhanced with AI, focusing on integrating AI technologies to optimize performance, security, and network management.

- **AI-Powered Intrusion Detection System (IDS):** Explore the development and deployment of AI-powered Intrusion Detection Systems (IDS) that use machine learning to identify and respond to security threats in real-time.

- **Dynamic Network Resource Allocation Using AI:** Discover how AI can dynamically allocate network resources, optimizing bandwidth, and improving overall network efficiency based on real-time traffic patterns and demands.

- **AI-Driven Network Traffic Analysis:** Understand how AI-driven tools analyze network traffic, providing insights into usage patterns, detecting anomalies, and enhancing network performance and security.

- **AI-Enhanced SD-WAN Optimization:** Learn about AI-enhanced SD-WAN solutions that improve network performance, reliability, and management by leveraging AI to optimize traffic routing and resource utilization.

Module 7

Emerging Trends and Future Directions

7.1 Future of AI in Networking

- **AI and 5G: The Next Generation of Networking:** Explore how AI integrates with 5G technology to drive advancements in network performance, enhance connectivity, and enable new applications with higher speeds and lower latency.

- **Quantum Computing and AI in Networking:** Discover the potential impact of quantum computing on AI in networking, including how quantum algorithms might revolutionize data processing, security, and network optimization.

7.2 AI-Powered IoT Networks

- **AI for Smart Cities and IoT Solutions:** Explore how AI is used in smart cities and IoT solutions to enhance infrastructure, optimize resource management, and improve services through data-driven insights and automation.

- **Managing IoT Networks with AI:** Learn how AI helps manage IoT networks by automating device monitoring, optimizing network performance, and providing predictive maintenance to ensure seamless operation and scalability.

7.3 Blockchain and AI in Networking

- **Blockchain for Network Security and Management:** Explore how blockchain technology can enhance network security and management by providing decentralized, tamper-proof data storage and improving transparency and trust in network transactions.

- **Integrating AI with Blockchain Technologies:** Learn how integrating AI with blockchain technologies can optimize blockchain processes, enhance security, and enable intelligent decision-making through advanced data analysis and automation.

7.4 Continuous Learning and Career Development

- **Certifications and Career Paths in AI Networking:** Discover various certifications and career paths in AI networking, including key qualifications, skills required, and potential job roles to advance your career in integrating AI with network technologies.