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KAUST ACADEMY

جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
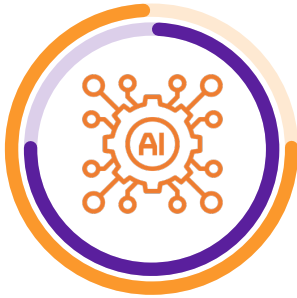Science and Technology

KAUST Academy Course Catalogue 2023

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Broaden KAUST's education, engagement, and **impact in the Kingdom**

By developing 21st century capabilities for **Saudi students, professionals, and citizens** to accelerate the development of sectors across the Kingdom – sustainably and together with national partners.
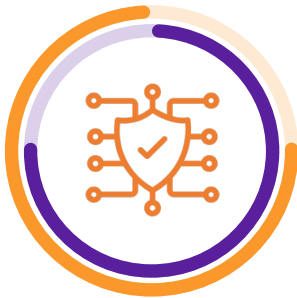
Course 1

Artificial Intelligence

Course 2

Introduction to Data Science and Machine Learning

Course 3

Cybersecurity Fundamentals
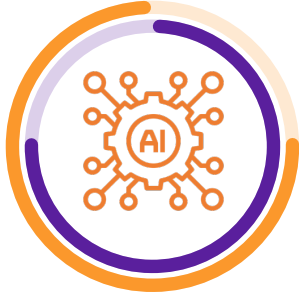
Course 4

Internet of Things

Course 5

Sustainability Foundations

Course 6

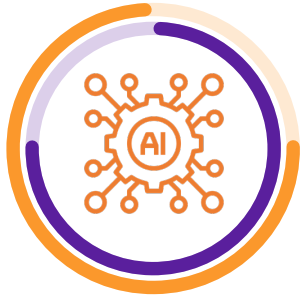**Computational Architecture**

Course 1
Artificial Intelligence

KAUST Academy will provide artificial intelligence training for governance and sustainable development in two tracks:

Track 1
AI for leaders

Track 2
For early career professional

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Course 1

Artificial Intelligence

Track 1

# Artificial Intelligence for Governance and Sustainable Development for Leaders

This course is designed for leaders working in the government and development sector. The aim of the course is to provide the leaders with the high-level knowledge of the field of artificial intelligence to bring about the digital transformation in their respective fields through AI tools

Artificial Intelligence for Governance and Sustainable Development for Leaders

Objectives

The prime objective of the course is to provide a broad overview of the field of artificial intelligence to the leaders working in the government sector. The course will provide the participants with the relevant knowledge of the field to allow them to develop and oversee the AI powered digital transformation in their department.
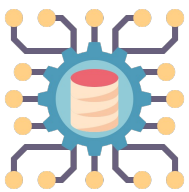
Learning Outcomes

By completing this course, you will be able to:

- Understand the use machine learning and artificial intelligence

- Explore the future of AI in government and challenges of applying AI in government agencies

- Understand AI infrastructure (hardware and software)

- Overview of AI Ethics and Governance

- Understand the strengths and limitations of the AI algorithms

Artificial Intelligence for Governance and Sustainable Development **for Leaders**

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Day 1

Introduction to Artificial Intelligence
- Broad overview of the field of artificial intelligence
- Key Areas of AI, including machine learning, deep learning, and natural language processing
- Applications and benefits of AI across domains

Day 2

AI Ethics and Governance
- Ethical and social implications of AI, including bias, transparency, and accountability
- Overview of AI governance frameworks and best practices for responsible AI development and deployment
- Case studies of AI governance

Day 3

AI Strategy and Implementation
- Developing the AI strategy for your organization
- Identifying, prioritizing, and implementing AI use cases and projects
- Building and managing an AI team and ecosystem
- Case studies of successful AI implementation across industries

Day 4

AI and the Future of Work
- The critical impact of AI on the future of work and employment
- Best practice of managing and upskilling your workforce in the age of AI
- Case studies of organizations that have successfully integrated AI
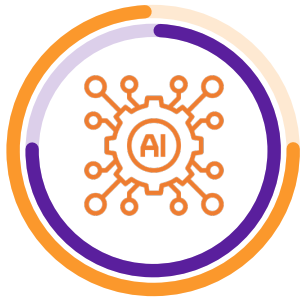
Day 5

AI and Leadership
- The role of leaders in driving the adoption, growth, and ethical use of AI
- Best practices for communicating and managing transformation related to AI
- Case studies of leaders who have successfully navigated the introduction and implementation of AI in their organizations
- Discussion of the future of AI and its potential impact on leadership and organizations

Artificial Intelligence for Governance and Sustainable Development **for Leaders**

Potential Audience

- Leaders from government agencies and non-profit organizations, who are responsible for making strategic decisions and managing resources.

- Executives and managers from businesses and organizations across various industries, such as finance, healthcare, manufacturing, retail, and more.

- Service Managers who are interested in incorporating AI into their operations and developing new AI-based products and services.

- Public servants and policy makers who are responsible for shaping the regulations and policies that govern the use of AI in government and public services.

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Course 1

Artificial Intelligence

Track 2

Artificial Intelligence for Governance and Sustainable Development for Professionals

This course is designed for early-career professional working in the government and development sector who are either working with large data or digital technology areas.

Artificial Intelligence for Governance and Sustainable Development for Professionals

Objectives

The prime objective of the course is to provide a broad overview of the field of artificial intelligence to the professionals working in the government sector. The course will provide the participants with the relevant knowledge of the field to allow them to use the AI tools at their work.
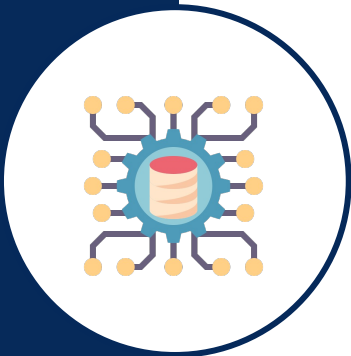
Learning Outcomes

By completing this course, you will be able to:

- Understand the theory of machine learning and artificial intelligence

- Explore the future of AI in government and challenges of applying AI in government agencies

- Know how to implement basic algorithms of AI and ML and train small networks for practical problems

- Be able to identify and use relevant AI and ML tools

- Know how to implement and deploy ML and AI algorithms on AWS/Google cloud.

Track 2

Artificial Intelligence for Governance and Sustainable Development for Professionals
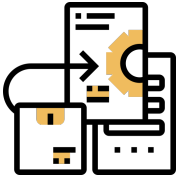
Prerequisite

The course is designed for early-career professionals. The course is self-contained and does not require any significant prior knowledge. However, the following will be useful:

- Basic knowledge of linear algebra

- Basic knowledge of calculus

- Basic understanding of programming

Artificial Intelligence for Governance and Sustainable Development for Professionals

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Day 1

Introduction to Artificial Intelligence
- Definition and history of the field artificial intelligence
- Overview of AI technologies, including machine learning, deep learning, and natural language processing
- Applications and benefits of AI across industries

Day 2

Machine Learning Basics
- Definition and history of machine learning
- Types of ML, including supervised and unsupervised learning, classification and regression, and clustering
- Hands-on exercises and projects using the state of the art machine learning libraries and tools

Day 3

Advanced Machine Learning Techniques
- Deep learning: neural networks, convolutional neural networks, and recurrent neural networks
- Natural language processing: text analysis, language translation, and voice recognition
- Hands-on exercises and projects using advanced machine learning libraries and techniques

Day 4

AI Ethics and Governance
- Discussion of the ethical and social implications of AI, including bias, transparency, and accountability
- Overview of AI governance frameworks and best practices for responsible AI development and deployment
- Case studies of AI governance in action across domains

Day 5

AI in the Real World
- Discussion on the future of AI and its potential impact on professions
- Emerging AI trends and technologies
- The role of professionals in shaping the future of AI
- The ethical and social implications of AI for professions

Course 2

Introduction to Data Science and Machine Learning

INTRODUCTION TO DATA SCIENCE

Data science skills and expertise to solve challenging business problems both global and locally in KSA. This micro-credential course will help learners build capacity in core data science tools and methods and enable them to develop their own data science applications.
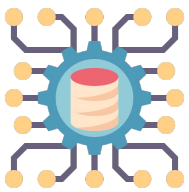
Course 2

Introduction to Data Science and Machine Learning

Objectives

This micro-credential curriculum aims to provide the participants a quick overview of the filed of Data Science and Machine Learning. The key objective is to provide the students the tools to make use of data.

Learning Outcomes

By completing this course, you will be able to:

- Understand and preprocess data

- Visualize data and use it for maximum impact

- Introduction to machine learning tools

- Overview of machine learning tools

- Machine Learning use cases

Introduction to Data Science and Machine Learning

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Day 1

Introduction to Data Science
- Definition and history of data science
- Key concepts and technologies in data science, including data acquisition, cleaning, and exploration
- Applications and benefits of data science in various industries

Day 2

Data Visualization and Exploration
- Techniques for visualizing and understanding data, including charts, graphs, and maps
- Exploring and finding patterns and trends in data
- Case studies and best practices for data visualization and exploration

Day 3

Machine Learning Basics
- Overview of machine learning
- Key concepts and techniques in machine learning, including supervised and unsupervised learning, classification and regression, and clustering
- Hands-on exercises and projects using machine learning libraries and tools
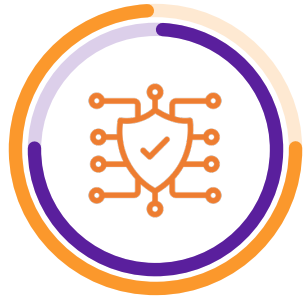
Day 4

Advanced Machine Learning Techniques
- Deep learning: neural networks, convolutional neural networks, and recurrent neural networks
- Natural language processing: text analysis, language translation, and voice recognition
- Hands-on exercises and projects using advanced machine learning techniques using state of the art libraries

Day 5

Machine Learning Applications and Use Cases
- Case studies of real-world machine learning applications
- Discussion of the ethical and social implications of machine learning
- Discussion on the future of machine learning and its potential impact on society.

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Cybersecurity Fundamentals

Cybersecurity Fundamentals

Cybersecurity fundamentals provides technical and managerial concepts in cybersecurity. This will include cybersecurity principles, concepts, and terms used by the industry. This course is intended to provide foundational understanding of cybersecurity. Issues covered include 'hackers to defenders of the enterprise', risk management to business continuity, encryption, passwords and firewalls to multi-factor authentication. Learn about wireless, mobile, data, privacy, web, endpoint, and cloud security.

Course 3

CYBERSECURITY FUNDAMENTALS
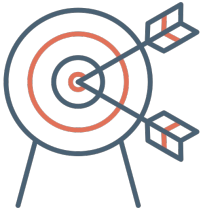
Objectives

In this module, you will understand the principles of Least Privilege and Need To Know and why they drive all security decisions. You know the Confidentiality, Integrity, and Availability (CIA) method of prioritizing your security program. You understand the fundamentals of risk management, security policy, and authentication/ authorization/ accountability (AAA). you learn about numbering schemes, computer and network architectures and communications protocols among many other topics. You will learn that we use a lot of Three Letter Acronyms (TLAs) in Information Technology. We will cover LAN, WAN, MAN, OSI, TCP/IP, UDP, DNS, ICMP, DHCP, and NAT to name a few.
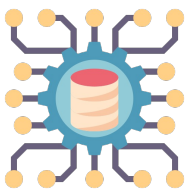
Learning Outcomes

By completing this course, you will be able to:

- knowledge and understanding of the foundations, theories, principles, and technical concepts in the field of cybersecurity

- Knowledge and understanding of the analytical methodologies used in cybersecurity topics and the interpretation of information related to them.

CYBERSECURITY FUNDAMENTALS

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Day 1

Introduction to Cyber Security
- Overview of the field of cyber security
- Key concepts and technologies in cyber security
- Types of cyber threats and attacks
- Overview of cyber security standards and frameworks

Day 2

Cyber Security Risk Management
- Identifying and assessing cyber security risks
- Developing and implementing a cyber security risk management plan
- Case studies and best practices for cyber security risk management

Day 3

Cyber Security Policies and Procedures
- Developing and implementing cyber security policies and procedures
- Ensuring compliance with cyber security regulations and standards
- Case studies and best practices for cyber security policies and procedures

Day 4

Cyber Security Awareness and Training
- Developing and implementing a cyber security awareness and training program
- Best practices for cyber security awareness and training
- Case studies and best practices for cyber security awareness and training

Day 5

Cyber Security Incident Response
- Developing and implementing a cyber security incident response plan
- Responding to and managing a cyber security incident
- Case studies and best practices for cyber security incident response
- Discussion on the future of cyber security and its potential impact on organizations.

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Course 4

Internet of Things

INTERNET OF THINGS

This micro-credential course covers hands-on sensor modules programming, acquiring data, processing the data using Tiny ML on the node, connecting them in a network to do an app application. This would cover theory of sensors, hardware programming, networking protocols, ML basics and app development.
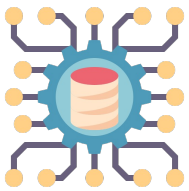
INTERNET OF THINGS
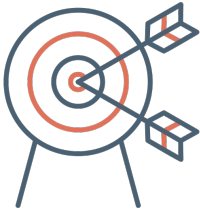
Objectives

This micro-credential course covers hands-on sensor modules programming, acquiring data, processing the data using Tiny ML on the node, connecting them in a network to do an app application. This would cover theory of sensors, hardware programming, networking protocols, ML basics and app development.

Learning Outcomes

By completing this course, you will be able to:

- Learning about the IoT fundamentals

- Understanding the functioning of the Sensor & Actuators

- Knowledge of the IoT Protocols

- Hands on experience on the Cloud Platforms for IOT

Internet of Things

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Day 1

Introduction to the Internet of Things
- Overview of the field of Internet of Things
- Key concepts and technologies in IoT
- Applications and use cases of IoT in various industries

Day 2

IoT Architecture and Design
- Overview of the different layers of an IoT system
- Design considerations for building an IoT system
- Case studies and best practices for designing IoT systems in practice

Day 3

IoT Security and Privacy
- Overview of the security and privacy risks in IoT
- Best practices for securing and protecting IoT systems and data
- Case studies of IoT security and privacy in action

Day 4

IoT Data Management and Analysis
- Overview of the challenges and opportunities of managing and analyzing IoT data
- Best practices for storing, processing, and visualizing IoT data
- Case studies of IoT data management and analysis in action

Day 5

IoT Trends and Future Directions
- Discussion on the future of IoT and its potential impact on society, including:
- Emerging IoT applications and industries
- Societal and cultural implications
- Opportunities and challenges for businesses and individuals

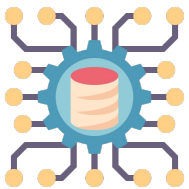**Course 5**

Sustainability Foundations

A micro-credential course provides working professionals that want to broaden their knowledge in sustainability.

Sustainability Foundations

Objectives

Participants will have the opportunity to exercise creative and critical thinking skills, expand technical knowledge and historical understanding of the global sustainability movement, and apply the framework of the Sustainable Development Goals (SDGs) in their careers.

Learning Outcomes

By completing this course, you will be able to:

- Understand sustainable development models and principles and the UN Sustainable Development Goals

- Critically evaluate the complex drivers and consequences of global sustainability challenges

- Identify relevant assessment tools and methodologies to evaluate or generate sustainability projects and policies

- Apply a multidisciplinary systems approach to sustainability by incorporating environmental, social, and economic dimensions in project management

- Apply critical and creative thinking skills for the development of theory to practice

- Communicate science-based sustainability solutions to the public and to industrial, governmental, and institutional stakeholders

- Acquire advanced transversal competencies in problem-solving, entrepreneurialism, innovation, and a life-long learning disposition

Sustainability Foundations

Day 1

SUSTAINABLE DEVELOPMENT IN ACTION
- Sustainability: Principles and Practice
- Biodiversity crisis
- Environmental Pollution and Management
- Sustainable natural resources management
- Cradle to Cradle inspired Thinking for Net-Positive
- Sustainability Course Project

Day 2

CLIMATE CHANGE AND SUSTAINABILITY
- Climate fundamentals
- Climate change Impacts and Adaptation
- Clean Energy Transition
- Carbon accounting and management
- Sustainability Course Project

Day 3

SOCIO-ECONOMICS OF SUSTAINABILITY
- Circular Economy: Transition for Future Sustainability
- The economics of climate change and energy transition
- Sustainable finance and investments
- Product Design for a Circular Carbon Economy
- Sustainability Course Project

Day 4

SUSTAINABILITY GOVERNANCE, ETHICS AND POLICY
- Geopolitics and sustainability
- Just Transition
- Pragmatic optimism for policy-making in complex systems
- Sustainability Course Project

Day 5

STAKEHOLDERS AND PUBLIC ENGAGEMENT FOR SUSTAINABILITY & SUSTAINABILITY COURSE PROJECT
- Roundtable - Paradigm shift towards a sustainable society: NEOM and RSG case studies
- Sustainability roadmaps at the national, city, community, and corporate levels
- Human behavior as a driver of impacts and solutions for climate change
- Behavior change for sustainable development/socio-economic implications of climate policy, e.g., Sustainability awareness campaigns
- Sustainability Course Project: Final Presentations (All faculty)

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Course 6

**Computational Architecture**

A micro-credential course provide training for interested professionals in computational architecture

Computational Architecture

Objectives

Participants will have the opportunity to discuss potential applications in design as well as the needs of designers. Complementary to this theoretical part, we dive right into the design practice.
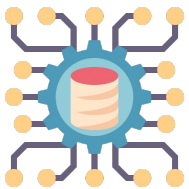
Learning Outcomes

By completing this course, you will be able to:

- Learn about geometry, surfaces, and shells by working on practical design tasks.

- Use the latest research in geometry, computer graphics, simulation and modeling, machine learning and design practice

- Explore the fascinating world of deployable grid shells and web structures

- Deepen your knowledge and experience using Rhinoceros 3D and Grasshopper standard tools

- Access digital fabrication and rapid prototyping to build physical models.

Computational Architecture

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Day 1

Grid Shells
Overview of the Visual Computing Center at KAUST, Asymptotic Gird shells, Gestalt, and design studio

Day 2

Architectural Geometry
role of geometry in architecture and engineering, Modern geometric computing, and design studio.

Day 3

Simulation
Climate Resilient Habitats, Detailed representations of the underlying geometric structures, Complex environments, and design studio.

Day 4

Machine Learning
Machine Learning for Smart Cities, Use of digital fabrication and rapid prototyping to build physical models, and design studio.

Day 5

Wrap-up and project presentations
Review of key concepts learned during the course, participants present their projects to the group and invited guests.