COURSE OVERVIEW AI0020
Artificial Intelligence (AI) and Machine Learning

Course Title
Artificial Intelligence (AI) and Machine Learning

Course Date/Venue
November 02-06, 2025/TBA Meeting Room, Elite Byblos Hotel Al Barsha, Sheikh Zayed Road, Dubai, UAE

Course Reference
AI0020

Course Duration/Credits
Five days/3.0 CEUs/30 PDHs

Course Description

This practical and highly-interactive course includes real-life case studies where participants will be engaged in a series of interactive small groups and class workshops.

This course is designed to provide participants with a detailed and up-to-date overview of Artificial Intelligence (AI) and Machine Learning. It covers the differences between AI, ML and deep learning and its applications in engineering fields; the machine learning fundamentals, mathematical foundations for ML, data preparation and engineering and AI tools and platforms; the AI use cases in mechanical engineering covering predictive maintenance in rotating machinery, fault detection in pumps, compressors and turbines, energy optimization in HVAC and manufacturing and smart robotics and automation; the regression techniques, classification algorithms, model training and evaluation and applications in mechanical systems; the clustering techniques and dimensionality reduction; and the anomaly detection methods.

During this interactive course, participants will learn the reinforcement learning basics comprising of RL concepts and agents, Q-learning fundamentals, deep Q networks (DQN) and applications in robotics and control systems; the neural networks basics, activation functions and backpropagation, overfitting and regularization in deep learning and applications in image and signal processing; the deep neural networks (DNNs), computer vision applications, natural language processing (NLP) basics and AI in simulation and digital twins; the AI ethics and safety in engineering and AI for process optimization; the IoT and AI integration, edge versus cloud AI in manufacturing, cyber-physical systems and AI-enabled production lines; the AI-powered materials discovery, AI in additive manufacturing (3D printing) and autonomous maintenance robots; and the AI for sustainable engineering.

Course Objectives

Upon the successful completion of this course, each participant will be able to:-

- Apply and gain an in-depth knowledge on artificial intelligence (AI) and machine learning
- Discuss the differences between AI, ML and deep learning and its applications in engineering fields
- Recognize machine learning fundamentals, mathematical foundations for ML, data preparation and engineering and AI tools and platforms
- Carryout AI use cases in mechanical engineering covering predictive maintenance in rotating machinery, fault detection in pumps, compressors and turbines, energy optimization in HVAC and manufacturing and smart robotics and automation
- Apply regression techniques, classification algorithms, model training and evaluation and applications in mechanical systems
- Carryout clustering techniques, dimensionality reduction and anomaly detection methods
- Discuss reinforcement learning basics comprising of RL concepts and agents, Q-learning fundamentals, deep Q networks (DQN) and applications in robotics and control systems
- Explain neural networks basics, activation functions and backpropagation, overfitting and regularization in deep learning and applications in image and signal processing
- Describe deep neural networks (DNNs), computer vision applications, natural language processing (NLP) basics and AI in simulation and digital twins
- Apply AI ethics and safety in engineering and AI for process optimization as well as discuss IoT and AI integration, edge versus cloud AI in manufacturing, cyber-physical systems and AI-enabled production lines
- Explain AI-powered materials discovery, AI in additive manufacturing (3D printing), autonomous maintenance robots and AI for sustainable engineering

Exclusive Smart Training Kit - H-STK®

*Participants of this course will receive the exclusive "Haward Smart Training Kit" (**H-STK®**). The **H-STK®** consists of a comprehensive set of technical content which includes **electronic version** of the course materials conveniently saved in a **Tablet PC**.*

Who Should Attend

This course provides an overview of all significant aspects and considerations of artificial intelligence (AI) and machine learning for senior mechanical engineers, IT professionals and software developers, data scientists and analysts, engineers and technical specialists, business analysts and strategists, project managers and consultants and other technical staff.

Course Certificate(s)

Internationally recognized certificates will be issued to all participants of the course who completed a minimum of 80% of the total tuition hours

Certificate Accreditations

Haward's certificates are accredited by the following international accreditation organizations:

- British Accreditation Council (BAC)

  Haward Technology is accredited by the **British Accreditation Council** for **Independent Further and Higher Education** as an **International Centre**. Haward's certificates are internationally recognized and accredited by the British Accreditation Council (BAC). BAC is the British accrediting body responsible for setting standards within independent further and higher education sector in the UK and overseas. As a BAC-accredited international centre, Haward Technology meets all of the international higher education criteria and standards set by BAC.

- The International Accreditors for Continuing Education and Training (IACET - USA)

  Haward Technology is an Authorized Training Provider by the International Accreditors for Continuing Education and Training (IACET), 2201 Cooperative Way, Suite 600, Herndon, VA 20171, USA. In obtaining this authority, Haward Technology has demonstrated that it complies with the **ANSI/IACET 2018-1 Standard** which is widely recognized as the standard of good practice internationally. As a result of our Authorized Provider membership status, Haward Technology is authorized to offer IACET CEUs for its programs that qualify under the **ANSI/IACET 2018-1 Standard**.

  Haward Technology's courses meet the professional certification and continuing education requirements for participants seeking **Continuing Education Units** (CEUs) in accordance with the rules & regulations of the International Accreditors for Continuing Education & Training (IACET). IACET is an international authority that evaluates programs according to strict, research-based criteria and guidelines. The CEU is an internationally accepted uniform unit of measurement in qualified courses of continuing education.

  Haward Technology Middle East will award **3.0 CEUs** (Continuing Education Units) or **30 PDHs** (Professional Development Hours) for participants who completed the total tuition hours of this program. One CEU is equivalent to ten Professional Development Hours (PDHs) or ten contact hours of the participation in and completion of Haward Technology programs. A permanent record of a participant's involvement and awarding of CEU will be maintained by Haward Technology. Haward Technology will provide a copy of the participant's CEU and PDH Transcript of Records upon request.

Course Instructor(s)

This course will be conducted by the following instructor(s). However, we have the right to change the course instructor(s) prior to the course date and inform participants accordingly:

Mr. Dimitry Rovas, CEng, MSc, PMI-PMP, SMRP-CMRP is a **Senior Mechanical & Maintenance Engineer** with extensive industrial experience in **Oil**, **Gas**, **Power** and **Utilities** industries. His expertise includes **Artificial Intelligence (AI) & Machine Learning**, **Machine Learning & Data Analytics, AI, ML & Deep Learning**, **AI Tools & Platforms**, **Boiler** Inspection & Maintenance, **Boiler** Systems, **Boiler** instrumentation & Controls, **Boiler** Start-up & Shutdown, **Boiler** Operation & Steam System Management, **Boiler** Efficiency & Waste Heat Recovery, **Boiler** Inspection & Testing, **Combustion** Analysis & Tuning Procedures, **Water Treatment** Technology, Heat Recovery Steam Generating (**HRSG**), **Impulse Tube** Installation & Inspection, **Parker Compression Fittings**, **Pipes & Fittings**, **PSV Inspection**, **Root Cause Failure Analysis**, **Tank** Design & Engineering, **Tank Shell**, **Tanks & Tank Farms**, **Vacuum Tanks**, **Gas Turbine** Operating & Maintenance, **Diesel Engine**, **Engine Cycles**, **Governors & Maintenance**, **Crankshafts** & Maintenance, **Lubrication** System Troubleshooting & Maintenance, **Engines/Drivers**, **Motor** Failure Analysis & Testing, **Motor** Predictive Maintenance, **Engine** Construction & Maintenance, **HP Fuel Pumps & Maintenance**, **Fired Equipment** Maintenance, Combustion **Techniques**, **Process Heaters**, **Mechanical Pipe Fittings**, **Flange Joint Assembly**, Adhesive Bond Lamination, **Butt Jointing**, **Joint & Spool Production**, **Isometric Drawings**, **Flange Assembly** Method, **Fabrication & Jointing**, Jointing & Spool Fabrication, **CAESAR**, **Pipe Stress Analysis**, **Pipe Cuttings**, **Flange Bolt Tightening** Sequence, **Hydro Testing**, **Pump** Technology, Fundamentals of **Pumps**, **Pump** Selection & Installation, **Centrifugal Pumps & Troubleshooting**, **Reciprocating & Centrifugal Compressors**, **Screw Compressor**, **Compressor** Control & Protection, **Gas & Steam Turbines**, **Turbine** Operations, **Gas Turbine** Technology, **Valves**, **Process Control Valves**, **Bearings & Lubrication**, **Heat Transfer**, **Vulcanization Methods**, **Process Plant Shutdown & Turnaround**, **Professional Maintenance Planner**, Advanced **Maintenance Management**, **Maintenance Optimization & Best Practices**, **Maintenance Auditing & Benchmarking**, **Material Cataloguing**, **Reliability** Management, **Rotating Equipment**, **Energy Conservation**, **Energy Loss Management** in Electricity Distribution Systems, **Energy Saving**, **Thermal Power Plant** Management, **Thermal Power Plant** Operation & Maintenance, **Heat Transfer**, **Machine Design**, **Fluid Mechanics**, **Heating & Cooling Systems**, **Heat Insulation Systems**, **Heat Exchanger & Cooling Towers**, **Mechanical Erection**, **Heavy Rotating Equipment**, Material Unloading & Storage, Commissioning & Start-Up. He is currently the **Project Manager** wherein he is managing, directing and controlling all activities and functions associated with the domestic heating/cooling facilities projects.

During his life career, Mr. Rovas has gained his practical and field experience through his various significant positions and dedication as the **EPC Project Manager**, **Maintenance Manager**, **Mechanical Engineer**, **Field Engineer**, **Preventive Maintenance Engineer**, **Lead Rotating Equipment Commissioning Engineer**, **Construction Commissioning Engineer**, **Offshore Lead Maintenance Engineer**, **Researcher**, **Instructor/Trainer**, **Telecom Consultant** and **Consultant** from various companies such as the Mytilineos Aluminium Group, Podaras Engineering Studies, Metka and Diadikasia, S.A., **Hellenic Petroleum Oil Refinery** and COSMOTE.

Mr. Rovas has **Master's** degrees in **Energy Production & Management** and **Mechanical Engineering** from the **National Technical University of Athens** (**NTUA**), **Greece**. Further, he is a **Certified Instructor/Trainer**, a **Certified Maintenance and Reliability Professional** (**CMRP**) from the Society of Maintenance & Reliability Professionals (**SMRP**), **Certified Project Management Professional** (**PMI-PMP**), **Certified Six Sigma Black Belt**, **Certified Internal Verifier/Assessor/Trainer** by the **Institute of Leadership & Management** (**ILM**), **Certified Construction Projects Contractor**, **Certified Energy Auditor** and a **Chartered Engineer**. Moreover, he is an active member of **American Society for Quality**, Project Management Institute (**PMI**), **Body of Certified Energy Auditors** and **Technical Chamber of Greece**. He has further received various recognition and awards and delivered numerous trainings, seminars, courses, workshops and conferences internationally.

Training Methodology

All our Courses are including **Hands-on Practical Sessions** using equipment, State-of-the-Art Simulators, Drawings, Case Studies, Videos and Exercises. The courses include the following training methodologies as a percentage of the total tuition hours:-

30% Lectures
20% Practical Workshops & Work Presentations
30% Hands-on Practical Exercises & Case Studies
20% Simulators (Hardware & Software) & Videos

In an unlikely event, the course instructor may modify the above training methodology before or during the course for technical reasons.

Accommodation

Accommodation is not included in the course fees. However, any accommodation required can be arranged at the time of booking.

Course Fee

US$ 5,500 per Delegate + **VAT**. This rate includes H-STK® (Haward Smart Training Kit), buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

Course Program

The following program is planned for this course. However, the course instructor(s) may modify this program before or during the workshop for technical reasons with no prior notice to participants. Nevertheless, the course objectives will always be met:

Day 1: ***Sunday, 02nd of November 2025***

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Introduction to Artificial Intelligence*** *History & Evolution of AI • Differences Between AI, ML & Deep Learning • Applications in Engineering Fields • AI Challenges & Opportunities for Mechanical Engineers*
0930 – 0945	*Break*
0945 – 1030	***Machine Learning Fundamentals*** *Types of Learning (Supervised, Unsupervised, Reinforcement) • Data-Driven Decision Making • Training, Validation & Testing Concepts • Bias, Variance & Generalization*
1030 – 1130	***Mathematical Foundations for ML*** *Linear Algebra Basics for AI Models • Probability & Statistics in ML • Optimization Concepts (Gradient Descent) • Cost Functions & Evaluation Metrics*
1130 – 1215	***Data Preparation & Engineering*** *Data Collection in Mechanical Systems (Sensors, IoT) • Data Cleaning & Preprocessing • Feature Extraction & Scaling • Handling Missing & Noisy Data*
1215 – 1230	*Break*

1230 – 1330	***AI Tools & Platforms Overview*** *Python for AI & ML • Popular ML Libraries (TensorFlow, PyTorch, Scikit-Learn) • AI Simulation Tools for Engineers (MATLAB, Ansys, COMSOL With AI Extensions) • Cloud-Based AI Services (AWS, Azure, Google AI)*
1330 – 1420	***AI Use Cases in Mechanical Engineering*** *Predictive Maintenance in Rotating Machinery • Fault Detection in Pumps, Compressors, Turbines • Energy Optimization in HVAC & Manufacturing • Smart Robotics & Automation*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day One*

Day 2: ***Monday, 03rd of November 2025***

0730 – 0830	***Regression Techniques*** *Linear Regression Fundamentals • Polynomial & Multivariate Regression • Regularization (Ridge, Lasso) • Applications in Mechanical System Modeling*
0830 – 0930	***Classification Algorithms*** *Decision Trees & Random Forests • Support Vector Machines (SVM) • K-Nearest Neighbors (KNN) • Applications in Defect Classification*
0930 – 0945	*Break*
0945 – 1100	***Model Training & Evaluation*** *Cross-Validation & K-Folds • Confusion Matrix & Accuracy Metrics • Precision, Recall & F1-Score • ROC Curves & AUC*
1100 – 1215	***Applications in Mechanical Systems*** *Predicting Equipment Failures • Quality Inspection in Manufacturing • Remaining Useful Life (RUL) Estimation • Vibration & Thermal Analysis with ML*
1215 – 1230	*Break*
1230 – 1330	***Case Study: Predictive Maintenance*** *Data Acquisition from Sensors • Feature Engineering for Time-Series Data • ML Model Development & Evaluation • Deployment in Industrial Systems*
1330 – 1420	***Hands-on Practical Session*** *Build Regression & Classification Models in Python • Train with Real-World Engineering Datasets • Visualize Predictions & Error Metrics • Group Exercise: Fault Detection Modeling*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Two*

Day 3: ***Tuesday, 04th of November 2025***

0730 – 0830	***Clustering Techniques*** *K-Means Clustering • Hierarchical Clustering • Density-Based Clustering (DBSCAN) • Applications in Fault Grouping & Anomaly Detection*
0830 – 0930	***Dimensionality Reduction*** *Principal Component Analysis (PCA) • t-SNE & LDA • Feature Selection vs Feature Extraction • Use in Mechanical Test Data Visualization*
0930 – 0945	*Break*

0945 – 1100	***Anomaly Detection Methods*** *Statistical Anomaly Detection • Isolation Forests • Autoencoders for Anomaly Detection • Applications in Machinery Monitoring*
1100 – 1215	***Reinforcement Learning Basics*** *RL Concepts & Agents • Q-Learning Fundamentals • Deep Q Networks (DQN) • Applications in Robotics & Control Systems*
1215 – 1230	*Break*
1230 – 1330	***Deep Learning Fundamentals*** *Neural Networks Basics • Activation Functions & Backpropagation • Overfitting & Regularization in Deep Learning • Applications in Image & Signal Processing*
1330 – 1420	***Engineering Case Studies*** *AI-Driven Process Optimization • Robotics in Assembly & Welding • Predictive Quality Assurance • Autonomous System Control*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Three*

Day 4: ***Wednesday, 05th of November 2025***

0730 – 0830	***Deep Neural Networks (DNNs)*** *Network Layers & Architectures • Convolutional Neural Networks (CNNs) • Recurrent Neural Networks (RNNs) • Applications in Mechanical Imaging*
0830 – 0930	***Computer Vision Applications*** *Object Detection in Manufacturing • Defect Identification in Welding & Casting • Surface Quality Inspection • Thermal Imaging with CNNs*
0930 – 0945	*Break*
0945 – 1100	***Natural Language Processing (NLP) Basics*** *Text Preprocessing & Embeddings • Sentiment & Classification Models • Applications in Engineering Reports Analysis • Voice-to-Command Interfaces in Robotics*
1100 – 1215	***AI in Simulation & Digital Twins*** *Concept of Digital Twins in Engineering • AI-Based Predictive Simulations • Integration with CAD/CAE Tools • Energy & Cost Optimization*
1215 – 1230	*Break*
1230 – 1330	***Hands-On Deep Learning Workshop*** *Build a CNN for Defect Detection • Train with Mechanical System Image Dataset • Model Evaluation & Deployment • Transfer Learning for Engineering Tasks*
1330 – 1420	***AI Ethics & Safety in Engineering*** *Ethical Considerations in AI Adoption • Reliability & Robustness of AI Models • Cybersecurity & AI in Control Systems • Human-AI Collaboration in Engineering*
1420 – 1430	***Recap*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Topics that were Discussed Today and Advise Them of the Topics to be Discussed Tomorrow*
1430	*Lunch & End of Day Four*

Day 5:	***Thursday, 06th of November 2025***
0730 – 0830	***AI for Process Optimization*** *Lean Manufacturing & AI Integration • Predictive Scheduling & Resource Allocation • Energy Efficiency Optimization • AI in Supply Chain & Logistics*
0830 – 0930	***Mechanical System Case Studies*** *Turbomachinery Fault Detection • Smart HVAC Optimization • Automotive Predictive Systems • Robotics & Autonomous Maintenance*
0930 – 0945	*Break*
0945 – 1100	***AI in Industry 4.0 & Smart Factories*** *IoT & AI Integration • Edge versus Cloud AI in Manufacturing • Cyber-Physical Systems • AI-Enabled Production Lines*
1100 – 1215	***Future of AI in Mechanical Engineering*** *AI-Powered Materials Discovery • AI in Additive Manufacturing (3D Printing) • Autonomous Maintenance Robots • AI for Sustainable Engineering*
1215 – 1230	*Break*
1230 – 1345	***Group Project & Presentation*** *Define Engineering Problem with AI Solution • Select Appropriate ML/AI Approach • Develop Prototype Solution • Present Results & Recommendations*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about t Topics that were Covered During the Course*
1400 – 1415	***POST-TEST***
1415 – 1430	*Presentation of Course Certificates*
1430	*Lunch & End of Course*

Practical Sessions

This practical and highly-interactive course includes real-life case studies and exercises:-

Course Coordinator

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