COURSE OVERVIEW IT0006
Neural Networks & Deep Learning

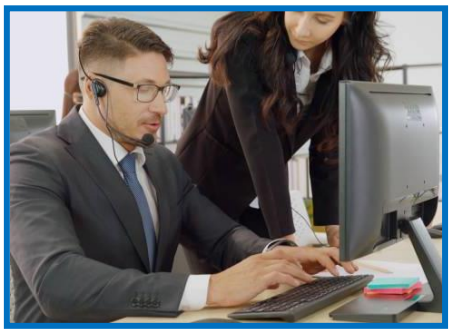
Course Title
Neural Networks & Deep Learning

Course Date/Venue
Session 1: April 06-10, 2025/Tamra Meeting Room, Al Bandar Rotana Creek, Dubai UAE
Session 2: December 08-12, 2025/Glasshouse Meeting Room, Grand Millennium Al Wahda Hotel, Abu Dhabi, UAE

Course Reference
IT0006

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

Course Objectives



This practical and highly-interactive course includes real-life case studies and exercises 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 Neural Networks and Deep Learning. It covers the AI, machine learning and deep learning; the basics of artificial neural networks (ANN); the fundamentals of deep learning, neural network architecture, cost function and optimization in neural networks; setting up deep learning environment; the backpropagation and gradient descent including hyperparameter tuning and regularization; the activation functions and their role and evaluating neural networks; and the data preprocessing for neural networks.

Further, the course will also discuss the implementation of first neural network with TensorFlow/PyTorch and convolutional neural networks (CNNs); the convolutional layers, pooling and fully connected layers; implementing CNNs with TensorFlow and PyTorch; how transfer learning speeds up training; using pre-trained models from TensorFlow/Keras; and the image data augmentation techniques.

During this interactive course, participants will learn the overfitting in CNNs and how to handle it and computational efficiency in deep networks; the batch normalization for stabilizing training and hardware acceleration (GPUs & TPUs); the recurrent neural networks (RNNs) and time-series data, long short-term memory (LSTM), gated recurrent units (GRU), word embeddings and Word2Vec; the natural language processing (NLP) with deep learning, attention mechanism and transformers; the natural language processing (NLP) applications; the generative adversarial networks (GANs); the autoencoders for anomaly detection, reinforcement learning and deep Q-networks (DQN); the distributed training with TensorFlow and model deployment using TensorFlow serving; the cloud-based deep learning and optimization techniques for large-scale networks; the ethical considerations in AI and deep learning; and building and deploying a deep learning model.

Course Objectives

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

- Apply and gain an in-depth knowledge on neural networks and deep learning
- Discuss AI, machine learning and deep learning and the basics of artificial neural networks (ANN)
- Explain the fundamentals of deep learning, neural network architecture, cost function and optimization in neural networks
- Set-up deep learning environment and describe backpropagation and gradient descent including hyperparameter tuning and regularization
- Identify activation functions and their role, evaluate neural networks and apply data preprocessing for neural networks
- Implement first neural network with TensorFlow/PyTorch and discuss convolutional neural networks (CNNs)
- Recognize convolutional layers and pooling and fully connected layers as well as implement CNNs with TensorFlow and PyTorch
- Discuss how transfer learning speeds up training, use pre-trained models from TensorFlow/Keras and apply Image data augmentation techniques
- Identify overfitting in CNNs and how to handle it, computational efficiency in deep networks, batch normalization for stabilizing training and hardware acceleration (GPUs & TPUs)
- Interpret recurrent neural networks (RNNs) and time-series data, long short-term memory (LSTM), gated recurrent units (GRU), word embeddings and Word2Vec
- Determine natural language processing (NLP) with deep learning, attention mechanism and transformers and implementing natural language processing (NLP) applications
- Recognize generative adversarial networks (GANs) and apply autoencoders for anomaly detection, reinforcement learning and deep Q-networks (DQN)

- Carryout distributed training with TensorFlow, model deployment using TensorFlow serving, cloud-based deep learning and optimization techniques for large-scale networks
- Discuss ethical considerations in AI and deep learning and build and deploy a deep learning model

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 neural networks and deep learning for data scientists and machine learning engineers, software engineers/developer, IT engineers, AI/ML researchers, business analysts and data analysts, product managers, linguists and other technical staff.

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.

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.

Accommodation

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

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

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**. 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:

Dr. George Chel, PhD, MSc, BSc, Prince2, CISCO-CCNA, CISCO-CCENT, is a **Senior Communication & Telecommunications Engineer** with over **20 years** of extensive experience within the **Petrochemical**, **Oil & Gas** and **Power** industries specializing in **Fiber Optics** Technology, **Access Network** Planning, **Fiber Optics Transmission**, **Fiber Optic Cables** Construction, **Optical Drivers & Detectors**, **Fiber Optic** Termination, **Fiber Optic Cables** Installation, **Fiber Optics** System Design, **Media Converters**, **Fiber Optic** Systems Testing, **Optical Fibers** Technologies, **Opto-Electronics**, **Data Networking**, **Access Networks**, **Optical Networks**, DWDM, DSL, FTTH, GPON, **Wireless & Mobile Networks**, **Telecom** Technologies, **Core Network** Technologies, Broadband Architectures & Services, **Analogue & Digital Communications**, **IP Networking**, **Network Automation**, Software Defined Networking (**SDN**), Network Function Virtualization (**NFV**), Internet of Things (**IoT**), Converged Connectivity & Hybrid Access, RF Electronics & Digital Communications, **Communications Systems** Analysis, **Network Security**, **Computer Networks** Modelling & Simulation, **Data Networks & Communications**, **Networking Technology**, Networking Concepts, I**CT Systems** Management & Strategy, Strategic Information Systems, Wireless Access Points, Analogue & Digital Electronics, **Circuit Analysis**, **Circuit Design**, Electromagnetics, WiMAX Broadband Wireless System, Networking Design & Configurations, Practical **Industrial Data Communications & Telecommunications**, **Industrial Data Communication** Systems, Effective **Telecoms Strategies**, Integrated Electro-Optic Devices & Systems, **Telecom**, **Datacom & Network**, **EtherNet** Maintenance and Troubleshooting, Synchronous Digital Hierarchy (**SDH**), IP Telephony Design (**IPTD**) and LTE Technology (**WiMax**) Skills. He is currently the **Core Technologies Section Manager** of Hellenic Telecommunications Organization wherein he is responsible for managing, carrying, conducting, leading and participating in projects relating to the design, evaluation and trial of new aggregation/core network services & systems projects.

During his career, Dr. Chel has gained his practical and field experience through his various significant positions and dedication as the **Deputy Manager**, **Project Manager**, **Lab Section Head**, **Deputy Section Head**, **Program Leader**, **Access Technologies Senior Expert**, **Access Network Development Engineer**, **Telecom Engineer**, **Technical Engineer**, **Senior Expert**, **Senior Technical Instructor/Lecturer**, **Part-Time Lecturer**, **Development Engineer**, **R&D Engineer** and **Research Programmes Engineer**, **Post-Doctoral Research Associate** and **Teaching & Laboratory Assistant** from the Hellenic Telecommunication Organization – Deutsche Telekom Group, Fixed Access Shared Service Center – Deutsche Telekom Technology, OTE Academy, Athens Metropolitan College and Imperial College London.

Dr. Chel has a **PhD** in **Photonics**, **Optical Communications & Opto-Electronics** from the **Imperial College London**, **UK**, a **Master** degree in **Medical Physics & Clinical Engineering** from the **University of Sheffield**, **UK**, a **Bachelor** degree in **Physics** from the **University of Crete**, **Greece** and a **Graduate Diploma** in **Management** from the **University of London**, **UK**. Further, he is a **Certified Instructor/Trainer**, a **Registered PRINCE2 Project Management Practitioner**, a **Cisco Certified Network Associate Routing** and **Switching** (**CCNA**) and a **Cisco Certified Entry Networking Technician** (**CCENT**). Moreover, he is an author of many books, technical publication at high-profile scientific journals and conferences and deliver numerous trainings, courses, workshops, seminars and conferences internationally.

Course Program

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

Day 1

0730 – 0800	*Registration & Coffee*
0800 – 0815	*Welcome & Introduction*
0815 – 0830	***PRE-TEST***
0830 – 0930	***Overview of AI, Machine Learning & Deep Learning*** *History & Evolution of AI & Deep Learning • Differences Between AI, ML & DL • Real-World Applications of Deep Learning • Introduction to Common Deep Learning Frameworks (TensorFlow, PyTorch)*
0930 – 0945	*Break*
0945 – 1030	***Basics of Artificial Neural Networks (ANN)*** *Biological Inspiration: How the Human Brain Works • Structure of an Artificial Neuron • Activation Functions (Sigmoid, ReLU, Tanh, Softmax) • Forward Propagation & Weighted Sum*
1030 – 1130	***Fundamentals of Deep Learning*** *Why Deep Learning is Effective • Difference Between Shallow & Deep Networks • Training Deep Neural Networks • Overview of Gradient Descent*
1130 – 1215	***Neural Network Architecture*** *Input Layer, Hidden Layers & Output Layer • Fully Connected Layers (Dense Layers) • How Neurons Interact in a Layer • Parameters & Hyperparameters in Networks*
1215 – 1230	*Break*
1230 – 1330	***Cost Function & Optimization in Neural Networks*** *Loss Function & Its Importance (MSE, Cross-Entropy) • Gradient Descent & Backpropagation • Challenges in Optimization (Vanishing & Exploding Gradients) • Learning Rate & its Impact on Convergence*
1330 – 1420	***Setting Up Your Deep Learning Environment*** *Installing Python, TensorFlow & PyTorch • Jupyter Notebook Setup for Deep Learning • Using Google Colab for Training Models • Basic Commands & Structure of a Deep Learning Project*
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

0730 – 0830	***Backpropagation & Gradient Descent*** *Mathematical Intuition Behind Backpropagation • Role of Chain Rule in Backpropagation • Types of Gradient Descent (Batch, Stochastic, Mini-Batch) • Avoiding Local Minima in Optimization*
0830 – 0930	***Hyperparameter Tuning & Regularization*** *Learning Rate Selection Strategies • Dropout Regularization to Prevent Overfitting • L1 & L2 Regularization (Ridge & Lasso Regression) • Early Stopping & Batch Normalization*

0930 – 0945	*Break*
0945 – 1100	***Activation Functions & Their Role*** *Choosing the Right Activation Function for Different Tasks • Vanishing Gradient Problem & How ReLU Mitigates It • Custom Activation Functions for Specific Applications • Gradient Clipping for Better Performance*
1100 – 1215	***Evaluating Neural Networks*** *Training, Validation & Test Datasets • Metrics for Classification (Accuracy, Precision, Recall, F1-Score) • Metrics for Regression (MSE, RMSE, R^2 Score) • Confusion Matrix & ROC Curves*
1215 – 1230	*Break*
1230 – 1330	***Data Preprocessing for Neural Networks*** *Importance of Normalizing & Standardizing Input Data • Data Augmentation Techniques • Handling Missing Values & Outliers • Feature Engineering & Selection for Better Performance*
1330 – 1420	***Implementing First Neural Network with TensorFlow/PyTorch*** *Creating a Simple ANN Using TensorFlow • Writing a Neural Network in PyTorch • Training & Evaluating a Model on a Dataset • Saving & Loading Trained Models*
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

0730 – 0830	***Convolutional Neural Networks (CNNs)*** *Why CNNs Are Better for Image Tasks • Layers of a CNN (Convolution, Pooling, Fully Connected) • Feature Extraction in CNNs • Types of Convolutions (1x1, 3x3, 5x5 Filters)*
0830 – 0930	***Understanding Convolutional Layers*** *Kernel & Filter Operations • Stride & Padding in Convolution Layers • Feature Maps & Receptive Fields • Activation Functions in CNNs*
0930 – 0945	*Break*
0945 – 1100	***Pooling & Fully Connected Layers*** *Max Pooling versus Average Pooling • Global Pooling & Its Advantages • Flattening Layers for Fully Connected Networks • Softmax Layer for Multi-Class Classification*
1100 – 1215	***Implementing CNNs with TensorFlow & PyTorch*** *Building a CNN from Scratch Using TensorFlow • Using Pre-Trained Models (VGG16, ResNet, Inception) • Fine-Tuning CNN Models for Specific Tasks • Optimizing CNN Performance*
1215 – 1230	*Break*
1230 – 1330	***Transfer Learning & Data Augmentation*** *How Transfer Learning Speeds Up Training • Using Pre-Trained Models from TensorFlow/Keras • Image Data Augmentation Techniques • Practical Case Study: Classifying Handwritten Digits (MNIST)*

1330 – 1420	***CNN Challenges & Solutions*** *Overfitting in CNNs & How to Handle It • Computational Efficiency in Deep Networks • Batch Normalization for Stabilizing Training • Hardware Acceleration (GPUs & TPUs)*
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

0730 – 0830	***Recurrent Neural Networks (RNNs) & Time-Series Data*** *Why RNNs Are Needed for Sequential Data • Structure & Working of RNNs • Challenges with RNNs (Vanishing Gradient Problem) • Applications of RNNs in Natural Language Processing (NLP) & Time-Series Forecasting*
0830 – 0930	***Long Short-Term Memory (LSTM) & Gated Recurrent Units (GRU)*** *Why LSTMs Solve the Vanishing Gradient Problem • Working of Memory Cells in LSTMs • GRU versus LSTM: Differences & Applications • Implementing LSTMs in TensorFlow/PyTorch*
0930 – 0945	*Break*
0945 – 1100	***Word Embeddings & Word2Vec*** *Understanding Word Representations • One-Hot Encoding versus Word2Vec • Using Pre-Trained Embeddings (GloVe, FastText) • Implementing Word Embeddings in Deep Learning Models*
1100 – 1215	***Natural language processing (NLP) with Deep Learning*** *Tokenization & Preprocessing Textual Data • Named Entity Recognition (NER) • Sentiment Analysis with LSTMs • Text Classification with RNNs*
1215 – 1230	*Break*
1230 – 1330	***Attention Mechanism & Transformers*** *Introduction to Self-Attention • How Transformers Outperform RNNs • Basics of BERT & GPT Models • Using Hugging Face Transformers for NLP Tasks*
1330 – 1420	***Implementing Natural Language Processing (NLP) Applications*** *Building a Chatbot with Deep Learning • Speech-To-Text with RNNs • Text Summarization with Transformers • Real-World NLP Case Study*
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

0730 – 0830	***Generative Adversarial Networks (GANs)*** *Introduction to GANs & How They Work • Generator versus Discriminator Networks • Applications of GANs (Image Synthesis, Deepfake) • Implementing a Simple GAN in TensorFlow*
0830 – 0930	***Autoencoders for Anomaly Detection*** *How Autoencoders Compress Data • Variational Autoencoders (VAE) versus Traditional Autoencoders • Applications in Anomaly Detection • Implementing Autoencoders in Deep Learning Frameworks*

0930 – 0945	*Break*
0945 – 1030	***Reinforcement Learning & Deep Q-Networks (DQN)*** *Basics of Reinforcement Learning • How Deep Q-Networks (DQN) Work • Implementing Q-Learning in Python • Applications in Robotics & Gaming*
1030 – 1130	***Scaling Deep Learning Models*** *Distributed Training with TensorFlow • Model Deployment Using TensorFlow Serving • Cloud-Based Deep Learning (Google AI, AWS SageMaker) • Optimization Techniques for Large-Scale Networks*
1130 – 1230	***Ethical Considerations in AI & Deep Learning*** *Bias in AI Models & How to Mitigate It • Explainability in Deep Learning Models • AI Safety & Regulations • The Future of AI & Deep Learning*
1230 – 1245	*Break*
1245 – 1345	***Final Project: Building & Deploying a Deep Learning Model*** *Selecting a Project (Image Classification, NLP, etc.) • Data Preprocessing & Model Selection • Training & Evaluating the Model • Deploying the Model As an API*
1345 – 1400	***Course Conclusion*** *Using this Course Overview, the Instructor(s) will Brief Participants about the Course 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

Mari Nakintu, Tel: +971 2 30 91 714, Email: mari1@haward.org