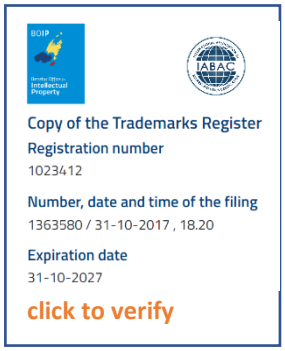
Certified Artificial Intelligence Expert (CAIE)

CODE: AI3050

Syllabus and Examination



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1 INTRODUCTION

This document is intended to provide information on Certified Artificial Intelligence Expert (CAIE-AI3050) certification for registered training providers to structure the course curriculum as per IABAC syllabus guidelines and for individuals, who are preparing for IABAC CAIE certification exam.

2 COURSE SYLLABUS

2.1 MACHINE LEARNING PRIMER

- Machine Learning Primer
- Machine Learning core concepts, scalable algorithms, project workflow.
- Objective Functions and Regularization
- Understanding Objective Function of ML Algorithms
- Metrics, Evaluation Methods and Optimizers
- Popular Metrics in Detail: R2 Score, RMSE, Cross Entropy, Precision, Recall, F1 Score, ROC-AUC, SGD, ADAM
- Artificial Neural Network
- ANN in detail, Forward Pass and Back Propagation
- Machine Learning Vs Deep Learning
- Core difference b/w ML and DL from implementation perspective

2.2 ADVANCED PYTHON FOR DEEP LEARNING

- Python Programming Primer
- Installing Python, Programming Basics, Native Data types
- Class, Inheritance and Magic Functions
- Python Classes, Inheritance Concepts, Magic Functions
- Special Functions in Python
- Overview, Array, selecting data, Slicing, Iterating, Array Manipulations, Stacking, Splitting arrays, Key functions
- Decorators and Special Functions
- Decorators implementation with class
- Context Manager 'with' in Python
- Context Manager Application
- Exception Handling
- Try and Catch block
- Python Package Management
- Bundling and export python packages

2.3 TENSORFLOW 2.0 AND KERAS FOR DEEP LEARNING

- TensorFlow 2.0 Basics
- TensorFlow core concepts, Tensors, core APIs

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- Concrete Functions, Datatypes, Control Statements
- Polymorphic Functions, Concrete Functions, Datatypes, Control Statements, NumPy, Pandas
- Autograph eager execution
- tf.function autograph implementation
- Sessions vs tf.function
- Keras (TensorFlow 2.0 Built-in API) Overview
- Sequential Models, configuring layers, loading data, train and test, complex models, call backs, save and restore Neural Network weights
- Building Neural Networks in Keras
- Building Neural networks from scratch in Keras
- Implementing RNN, CNN in Keras
- Building Recurrent Neural Networks for sequence data and Convolution Neural Networks for Image Classification

2.4 Mathematics for Deep Learning

- Linear Algebra
- Vectors, Matrices, Linear Transformation, Eigen Vectors, Matrix Operations, Special Matrices
- Calculus – Derivatives: Calculus essentials, Derivatives and Partial Derivatives, Chain Rule, Derivatives of special functions
- Probability Essentials: Probability basics and notations, Conditional probability, Essential Probability theorems for Machine Learning
- Special functions: Relu, Sigmoid, SoftMax, Popular Loss Functions – Cross Entropy, Quadratic Loss Functions

2.5 Deep Learning Foundation

- Deep Learning Network Concepts
- Core concepts of Deep Learning Networks
- Deep Dive into Activation Functions
- Relu, Sigmoid, Tanh, SoftMax, Linear
- Building simple Deep Learning Network
- Simple DL network from starch
- Tuning Deep Learning Network
- Tuning Deep Learning Network Parameters for optimal performance, Stopping Criteria
- Visualizing Training using TensorBoard
- Visualizing Deep Learning Network using TensorBoard

2.6 Advanced Deep Learning - CNN, RNN, LSTM RNN

- Deep Learning Architectures
- Popular Deep learning Architectures – CNN, RNN, LSTM RNN, GRU RNN Introduction
- Deep Dive into Convolutional Neural Network
- Core Concepts of Convolutional Neural Network, Feature Maps, Relu Activation, Max Pooling
- CNN Application – Image Classification
- Image Classification implementation with CNN TensorFlow 2.0 (Keras)
- Recurrent Neural Networks (RNN) Basics

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- RNN Architecture, BPTT Backprop through time, Mathematics of RNN
- RNN, LTSM RNN and GRU RNN
- Vanishing Gradient and exploding Gradient problem, LTSM architecture, GRU Architecture.
- LSTM RNN implementation in TensorFlow
- LSTM RNN project.

2.7 Natural Language Processing

- Introduction to Natural Language Processing
- Language modelling
- Sequence to Sequence Models
- Transformers and BERT

2.8 Computer vision

- Introduction to Computer Vision
- Image Representation and Analysis
- Convolutional Neural Network
- Features and Object Recognition
- Image Segmentation
- Advanced CNN Architectures
- Recurrent Neural Networks
- Attention Mechanisms

2.9 Reinforcement Learning Introduction

- Reinforcement learning framework
- Dynamic programming algorithms
- Monte Carlo Methods
- Temporal Difference Methods
- Gym - OpenAI Framework Introduction
- Deep Q-Learning
- Introduction to Multi-Agent RL

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3 EXAMINATION

3.1 PRE-REQUISITE QUALIFICATIONS

1. Certified Machine Learning Associate Course (CMLA) or Demonstrable competence at CMLA level
2. Recommended essential knowledge in
    a. Mathematics: Calculus, Statistics, Linear Algebra, Probability
    b. Machine Learning and Python/R Programming
3. Training: Though formal training is not mandatory; it is recommended to attend IABAC® registered course through Registered Education Partners

3.2 MATERIAL **PERMITTED**

1. The examination is an 'open book'
2. Candidates can refer to any material

3.3 EXAM DURATION AND **FORMAT**

1. Exam format is the project submission
2. The assessment duration is 10 days
3. The project is graded for AI model conceptual coding standards and performance

3.4 **EXAM** MODE

1. Project needs to be submitted at IABAC project submit page, as per exam guidelines
2. Any copied work, ideas, concepts or a piece of text need to be marked with reference as per IABAC project plagiarism guidelines

3.5 PASS **CRITERIA**

1. The candidate needs to score assessment grade A+, A, B+, B, C+, C as a PASS Criteria
2. The candidate will be awarded grade F in case of failing to meet the pass criteria
3. The results will be declared after validation of the project as per guidelines

3.6 RESULTS **TIMELINE**

1. The preliminary results are usually released within **9 days** of the exam date
2. The official results are usually released within **15 days** from the exam date

3.7 CERTIFICATE **ISSUANCE**

1. IABAC® e-certificate will be issued through the candidate's registered email
2. The e-certificate is digital verifiable at https://www.iabac.org/verify-certificate
3. The candidate has license to share digital certificate validation in professional networking portals such as www.linkedin.com
4. The candidate has a license to print physical copy (hardcopy) of the certificate

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4 IABAC® KNOWLEDGE AREAS MAPPING

Knowledge Area	Syllabus Details	Bloom's Index
KAG1-DSDA: Data Analytics group including Machine Learning, Statistical Methods, and Business Analytics	• Case Study on Statistical Analysis • Curating the Data and performing, Discrete Mathematics, Probabilistic Reasoning • Statistical Methods, including Descriptive Statistics, Exploratory Data Analysis (EDA) and Confirmatory Data Analysis (CDA) • Case Study & Creating Machine Learning Model • With detailed implementation of algorithms: Artificial Intelligence, Natural Language Processing • Knowledge Representation and Reasoning • Data Mining and knowledge discovery • Text analysis, Data Mining, Text Analytics including Statistical, Linguistic, and Structural Techniques to analyse Structured and Unstructured data • Creating Predictive Forecasting Models • Decision Analysis and Decision Support Systems • Data Mining	6
KAG2-DSENG: Data Science Engineering group including Software and Infrastructure Engineering	• Set Up Infrastructure and Big Data Applications • Computer Networks for high-performance computing and Big Data Infrastructure • Cloud Enabled Applications development • Modelling and Simulation • Modelling and Simulation Theory and Techniques (general and domain oriented) • Large Scale Modelling and Simulation Systems • Set up Big Data (Data Science) Applications Design • Programming Languages for Big Data Analytics: R, Python, others • Models and Languages for complex interlinked Data Presentation and Visualisation	5
KAG3-DSDM: Data Management group including Data Curation, Preservation and Data Infrastructure	• Creating Database Models and Data Curation • Data Modelling, Databases and Database Management Systems, Data Models and Query Languages, Database Administration • Set up Data Management and Enterprise Data Infrastructure • Data management, including Reference and Master Data, Data Warehousing and Business Intelligence, Data storage and Operations	4

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	• Data Archives/Storage Compliance and Certification Metadata, Linked data, Provenance • Data Infrastructure, Data Management and Organisation Research Data Infrastructure, Open Science, Open Data, Open Access, Data Infrastructure Compliance and Certification, Ethical Principle and Data Privacy	
KAG4-DSRM: Scientific and Research Methods group	• Scientific/Research Methods • Research Methodology, Paradigms and Research Cycle, Modelling and Experiment Planning • Data Selection and Quality Evaluation • Use Case Analysis: Research Infrastructures and Projects Research Data Management plan and Ethical Issues	6
KAG5-DSBPM: Business Process Management group	• Business Process Management • Business Processes and Operations, Project Scope and Risk Management • Business Analysis - Organisation and Management • Business Analysis - Planning and Monitoring • Requirements Analysis and Design Definition • Requirements Life Cycle Management (from inception to retirement) Solution Evaluation and Improvements Recommendation • Business analysis and Enterprise Organisation • Agile Data Driven Methodologies, Processes and Enterprises • Use Case Analysis: Business and Industry	4
KAG6-DSDK: Data Science Domain Knowledge group includes domain specific knowledge	• Applied Data Science use cases in Domains, HR, Retail, Fraud Analytics, Finance Trends, Health Care, Infrastructure Management	2

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5 BLOOM'S TAXONOMY REFERENCE

Bloom's Learning Index	Description
1	Remembering: Recall or retrieve previous learned information.
2	Understanding: Comprehending the meaning, translation, interpolation, and interpretation of instructions and problems. State a problem in one's own words.
3	Applying: Use a concept in a new situation or unprompted use of an abstraction. Applies what was learned in the classroom into novel situations in the workplace.
4	Analysing: Separates material or concepts into component parts so that its organizational structure may be understood. Distinguishes between facts and inferences.
5	Evaluating: Make judgments about the value of ideas or materials.
6	Creating: Builds a structure or pattern from diverse elements. Put parts together to form a whole, with emphasis on creating a new meaning or structure.

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