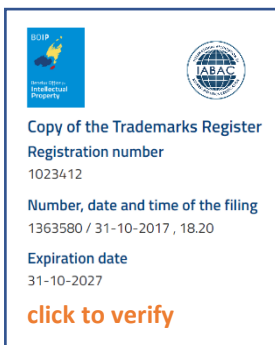




# Certified Deep Learning Expert (CDLE)

## CODE: AI3060

## Syllabus and Examination



*The International Association for Data Science Certification (IABAC®) is a globally recognized professional association dedicated to growing and enhancing the field of applied Data Science and Business Analytics.*

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# 1 INTRODUCTION

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This document is intended to provide information on Certified Deep learning Expert (CDLE-AI3060) certification for registered training providers to structure the course curriculum as per IABAC syllabus guidelines and for individuals, who are preparing for IABAC CDLE certification exam.

## 2 COURSE SYLLABUS

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### 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 ADV 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, LSTM RNN and GRU RNN
- Vanishing Gradient and exploding Gradient problem, LSTM architecture, GRU Architecture.
- LSTM RNN implementation in TensorFlow
- LSTM RNN project.

## 2.7 BIG DATA FOUNDATION

- Big Data Platforms
- Importing Big Data
- PySpark functions for importing data from various sources and other big data frameworks.
- Machine Learning with PySpark
- Implementing scalable ML models with PySpark.

## 2.8 DEEP LEARNING PROJECTS

- Image Classification
- Image Classification with CIFAR-10 Dataset
- Human Face Detection
- Traffic Sign Detection
- Human Activity Detection
- 20BN-something-something Dataset V2
- Image Caption Generation

## 3 EXAMINATION

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### 3.1 PRE-REQUISITE QUALIFICATIONS

1. Certified Machine Learning Expert Course (CMLE) or Demonstrable competence at CMLE level
2. Programming Knowledge
3. Essential Knowledge in
  - i. Calculus, Derivative, core concepts and theorems.
  - ii. Statistics
  - iii. Linear Algebra
  - iv. Probability
- b. Machine Learning
4. Training: Though formal training is not mandatory; it is recommended to attend IABAC® registered course for Certified Data Scientist 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 8 hours
3. The project is graded for Deep Learning 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](http://www.linkedin.com)
4. The candidate has a license to print physical copy (hardcopy) of the certificate

## 4 IABAC® KNOWLEDGE AREAS MAPPING

Knowledge Area	Syllabus Details	Bloom's Index
<p><b>KAG1-DSDA:</b> Data Analytics group including Machine Learning, Statistical Methods, and Business Analytics</p>	<ul style="list-style-type: none"> <li>● Case Study on Statistical Analysis</li> <li>● Curating the Data and performing, Discrete Mathematics, Probabilistic Reasoning</li> <li>● Statistical Methods, including Descriptive Statistics, Exploratory Data Analysis (EDA) and Confirmatory Data Analysis (CDA)</li> <li>● Case Study &amp; Creating Machine Learning Model</li> <li>● With detailed implementation of algorithms: Artificial Intelligence, Natural Language Processing</li> <li>● Knowledge Representation and Reasoning</li> <li>● Data Mining and knowledge discovery</li> <li>● Text analysis, Data Mining, Text Analytics including Statistical, Linguistic, and Structural Techniques to analyse Structured and Unstructured data</li> <li>● Creating Predictive Forecasting Models</li> <li>● Decision Analysis and Decision Support Systems</li> <li>● Data Mining</li> </ul>	6
<p><b>KAG2-DSENG:</b> Data Science Engineering group including Software and Infrastructure Engineering</p>	<ul style="list-style-type: none"> <li>● Set Up Infrastructure and Big Data Applications</li> <li>● Computer Networks for high-performance computing and Big Data Infrastructure</li> <li>● Cloud Enabled Applications development</li> <li>● Modelling and Simulation</li> <li>● Modelling and Simulation Theory and Techniques (general and domain oriented)</li> <li>● Large Scale Modelling and Simulation Systems</li> <li>● Set up Big Data (Data Science) Applications Design</li> <li>● Programming Languages for Big Data Analytics: R, Python, others</li> <li>● Models and Languages for complex interlinked Data Presentation and Visualisation</li> </ul>	5
<p><b>KAG3-DSDM:</b> Data Management group including Data Curation, Preservation and Data Infrastructure</p>	<ul style="list-style-type: none"> <li>● Creating Database Models and Data Curation</li> <li>● Data Modelling, Databases and Database Management Systems, Data Models and Query Languages, Database Administration</li> <li>● Set up Data Management and Enterprise Data Infrastructure</li> <li>● Data management, including Reference and Master Data, Data Warehousing and Business Intelligence, Data storage and Operations</li> </ul>	4

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	<ul style="list-style-type: none"> <li>● Data Archives/Storage Compliance and Certification Metadata, Linked data, Provenance</li> <li>● 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</li> </ul>	
<b>KAG4-DSRM:</b> Scientific and Research Methods group	<ul style="list-style-type: none"> <li>● Scientific/Research Methods</li> <li>● Research Methodology, Paradigms and Research Cycle, Modelling and Experiment Planning</li> <li>● Data Selection and Quality Evaluation</li> <li>● Use Case Analysis: Research Infrastructures and Projects Research Data Management plan and Ethical Issues</li> </ul>	6
<b>KAG5-DSBPM:</b> Business Process Management group	<ul style="list-style-type: none"> <li>● Business Process Management</li> <li>● Business Processes and Operations, Project Scope and Risk Management</li> <li>● Business Analysis - Organisation and Management</li> <li>● Business Analysis - Planning and Monitoring</li> <li>● Requirements Analysis and Design Definition</li> <li>● Requirements Life Cycle Management (from inception to retirement) Solution Evaluation and Improvements Recommendation</li> <li>● Business analysis and Enterprise Organisation</li> <li>● Agile Data Driven Methodologies, Processes and Enterprises</li> <li>● Use Case Analysis: Business and Industry</li> </ul>	4
<b>KAG6-DSDK:</b> Data Science Domain Knowledge group includes domain specific knowledge	<ul style="list-style-type: none"> <li>● Applied Data Science use cases in Domains, HR, Retail, Fraud Analytics, Finance Trends, Health Care, Infrastructure Management</li> </ul>	2



## 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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