IIT Guwahati

The IoT Academy
Connecting The Unconnected

Course Curriculum

Advanced Certification in

Applied Data Science and Machine Learning

By **The IoT Academy** in Collaboration with India's Top Institute

ABOUT THE
IIT GUWAHATI

Indian Institute of Technology Guwahati, the sixth member of the IIT fraternity, was established in 1994. The academic programme of IIT Guwahati commenced in 1995.At present the Institute has eleven departments and three inter-disciplinary academic centres covering all the major engineering, science and humanities disciplines, offering BTech, BDes, MA, MDes, MTech, MSc and PhD programmes. Within a short period of time, IIT Guwahati has been able to build up world class infrastructure and a reputation for itself.

ABOUT
E&ICT ACADEMY, IIT GUWAHATI

E&ICT Academy is joint venture between IIT Guwahati and MeiTY (The Ministry of Electronics and Information Technology, Government of India).

E&ICT Academy, IIT Guwahati conducts specialized customized training programmes and research promotion workshops for corporate sector & educational institutions

COURSE CURRICULUM

PYTHON FOR ML 01

Module-1: Python Basics

- What is Python
- Application of Python
- Why use Python for AI-ML
- Installation Anaconda/Other Idle
- Python Tokens
- Data Types in Python
- Conditional Statement
- Loops in Python
- Functions in Python
- Advance Functions
- File Handling

Module-2: Python NumPy & Pandas

- *Introduction to NumPy*
- *Exploring a NumPy Array*
- *Indexing & Slicing a NumPy Array*
- *Manipulating a NumPy Array*
- *Performing Mathematical & Statistical Functions using NumPy*
- *Performing Linear Algebra Operations using NumPy*
- *Introduction to Pandas*
- *Exploring Pandas Series*
- *Introduction to Pandas DataFrame*
- *Importing & Exporting Data*
- *Implementing basic DataFrame functionalities*
- *Exploring Descriptive Statistics with Pandas*

Modules -3: Data Processing and Manipulation

- *Data Types*
- *Dispersion & Skewness*
- *Data imputation*
- *Data Pre-processing*
- *Data Cleaning*
- *Data Manipulation*
- *Advanced Manipulation*

Module-4: Data Visualization

- *Why Data Visualization?*
- *Introduction to Data Visualization*
- *Libraries & Tools for Data Visualization in Python*
- *Static Data Visualization Using Seaborn*
- *Interactive Data Visualization Using Plotly Express*
- *Interactive Animations & Facet Plots*

Module-5: Tableau

- *Understanding Data*
- *Creating Your First visualization*
- *Tableau Calculations*
- *Formatting Visualizations*
- *Manipulating Data in Tableau*
- *Advanced Visualization Tools*
- *Creating Dashboards AND Stories*
- *Distributing & Publishing Your Visualization*

Maths and Applied Statistics 02

Module-1: Mathematics for Machine Learning

- *Linear Algebra*
- *Introduction to Calculus*
- *Multivariable Calculus*

Module-2: Statistical Foundations

- *Applications of Statistics*
- *Introduction to Statistics*
- *Categories of Data*
- *Basic Terminologies in Statistics*
- *Sampling techniques*
- *Descriptive Statistics*
- *Measure Used in Descriptive Statistics*
- *Z-Scores*

Module-3: Probability

- What is Probability?
- Rules of probability
- Types of Probability
- Random Variables
- Probability Distribution Functions

Module-4: Inferential Statistics

- *Introduction to Inferential Statistics*
- *Hypothesis Testing*
- *Normal Distribution*
- *P-value*
- *One-tailed and Two-tailed tests*
- *One Sample Z test*
- *One Sample T test*
- *Independent Sample T test*
- *Chi-square test*
- *ANOVA*

Machine Learning 03

Module-1: Introduction to Machine Learning

- *What is Machine Learning?*
- *Applications of Machine Learning*
- *Machine Learning in your daily life*
- *Machine Learning in Retail*
- *Steps Involved in Machine Learning*

Module-2: Regression

- *Introduction to Regression*
- *Linear Regression*
- *Evaluation Metrics in Regression Models*
- *Logistic Regression*

Module-3: Supervised Classification

- *Why Use Classification?*
- *Application of Classification Algorithms*
- *Introduction to Classification*
- *Types of Classification Algorithms*
- *Classification: Decision Tree*
- *Classification: Random Forest*
- *ML in Banking & Finance - Benefits*
- *Classification: SVM*
- *Classification: KNN*
- *Classification: Naïve Bayes*
- *Evaluating Classification Models*
- *Model Optimization Techniques*
- *Model Boosting Techniques*
- *Introduction to PyCaret*
- *Dealing with Unbalanced Datasets*

Capstone Project- 1

Module-4: Unsupervised Learning

- *What is Unsupervised Learning?*
- *Application of Unsupervised Learning*
- *Introduction to Clustering*
- *Types of Clustering*
- *Partitioning Methods: K-means, DBSCAN, Spectral*
- *Hierarchical Methods: Hierarchical*

Module 5 :- Dimension Reduction

- *PCA*
- *Factor Analysis*
- *LDA*

Module-6: Association Rules Mining

- *What are Association Rules?*
- *Association Rule Parameters*
- *A-priori Algorithm*
- *Market Basket Analysis*

Module-7: Recommendation System

- *What is a Recommendation System?*
- *Need for a Recommendation System*
- *Recommendation System Use Cases*
- *Applications of Recommendation System*
- *Types of Recommendation Systems*
- *Collaborative Filtering*
- *Content Based Filtering*
- *Matrix Factorization*
- *Pros and Cons of Collaborative Filtering*
- *Content Based filtering*
- *Hybrid Recommender System*

Module-8: Time-series Forecasting

- *Introduction to forecasting data*
- *Properties of Time Series data*
- *Features of Time Series data*
- *Markov Processes - Overview and Terminologies*
- *Naive, Average and Moving Average Forecasting*
- *Exponential Smoothing*
- *ARIMA Approach*

Module-1: Introduction to Deep Learning

- *What is Deep Learning*
- *Curse of Dimensionality*
- *Machine Learning vs. Deep Learning*
- *Use Cases of Deep Learning*
- *Human Brain vs. Neural Network*
- *What is Perceptron?*
- *Learning Rate*
- *Epoch*
- *Batch Size*

Module-2: Tensorflow 2.0 with Tensor Board

- *Introduction to Tensorflow 2.x*
- *Installing Tensorflow 2.x*
- *Introduction to TensorBoard*
- *Defining Sequence model layers*
- *Activation Function*
- *Layer Types*
- *Model Compilation*
- *Model Optimizer*
- *Model Loss Function*
- *Model Training*
- *Digit Classification using Simple Neural Network in Tensorflow 2.x*

Module-3: Computer Vision

- *Introduction to Convolutional Neural Networks*
- *Introduction to images*
- *Convolution, Pooling, Padding & its mechanisms*
- *Forward Propagation & Backpropagation for CNNs*
- *CNN architectures*
- *AlexNet, VGGNet, InceptionNet & ResNet*
- *Transfer Learning*
- *Object Detection*

Module-4: Introduction to NLP

- *Introduction to NLP*
- *Libraries & Tools for NLP in Python*
- *NLTK vs Spacy*
- *Applications of NLP:*
- *Chatbot*
- *Search, Autocorrect and Autocomplete*
- *Grammar Checker*

Module-5: Text Processing Methods

- *Bag of Words*
- *Countvectorizer*
- *Term Frequency (TF)*
- *Inverse Document Frequency (IDF)*
- *Converting text to features and labels*
- *Multinomial Naive Bayes Classifier*
- *Leveraging Confusion Matrix Assignment*
- *Word Embeddings*
- *Word2Vec*

Module-6: Introduction to Sequence Learning

- *What is Sequence Learning*
- *Application of Sequence Learning*
- *What is Sequence Model*
- *Bayesian Network*
- *Markov Model*
- *Markov Chain*
- *Hidden Markov Model*
- *Viterbi Algorithm*

Module-7: RNN vs LSTM

- *Recurrent Neural Network*
- *Architecture of RNN*
- *Calculation in RNN*
- *Backpropagation and Loss calculation*
- *Applications of RNN*
- *What is LSTM?*
- *Structure of LSTM*
- *LSTM architecture*

Capstone Project- 2

Module-8: TensorFlow Hub for Object Detection using Faster RCNN

- *Introduction to TensorFlow Hub*
- *Use cases of TensorFlow Hub*
- *Limitations of CNN in object detection*
- *Architecture of RCNN*
- *Applications of RCNN*
- *Types of RCNN*
- *Step by step implementation of Faster RCNN*

Module-9: Sentiment Analysis

- *Sentiment Analysis*
- *Subjectivity Analysis*
- *Topic Extraction*
- *Product Reviews*
- *Opinion Retrieval and Spam*
- *Opinion Summarization*
- *Implementing Sentiment Analysis in Python*

Module-10: Reinforcement Learning

- *Understanding Reinforcement Learning*
- *Algorithms associated with RL*
- *Q-Learning Model*

Module-11: *Introduction to GANs (Generative adversarial networks)*

- *Introduction to GANs*
- *Generative Networks*
- *Adversarial Networks*
- *How do GANs work?*
- *DCGANs - Deep Convolution GANs*
- *Applications of GANs*

Module 1: IoT Architecture, Protocols and ML

- *IoT Architecture*
- *Signal Acquisition*
- *Data filtering and Pre-processing*
- *Inference handling*
- *Edge vs Cloud functional partitioning*
- *IoT Protocols*
- *HTTP*
- *MQTT*
- *CoAP*
- *6LoWPAN*

Module 2: Introduction of Cloud Computing and Edge System Architecture

- *Processor Architecture*
- *Compiler*
- *DSP*
- *FPGA*
- *ASIC*
- *Hardware Accelerators*
- *System Architecture*
- *Memory architecture*
- *Instruction set*
- *GPU*
- *TPU*

Hands-on:

- *Data Acquisition*
- *Data filtering and Pre-processing*
- *Node red installation and designing a flow for MQTT*
- *Data Visualization and Dashboard*

Module 3: ML Optimization Techniques

- *Performance parameters*
- *Generic Optimization techniques*
- *Quantized NNs, and its Case Study: 8-bit Fixed Point Training*
- *Compression vis Early Exiting, Prediction, and its Case Studies*
- *Tensorflow Lite*

Hands-on:

- *Tensorflow Lite*
- *8-bit Fixed Point Training*

Module 4: IoT Cloud Platforms supporting ML

- *Why Use Machine Learning (ML) in the Cloud?*
- *ML Cloud Platforms*
- *Amazon ML vs Google Cloud AutoML vs IBM Watson*
- *Overview of AWS SageMaker*
- *Machine Learning with AWS SageMaker*
- *Creating an account on AWS*
- *AWS- IOT Core*
- *Google Collab*
- *Build, Train, and Deploy a ML Model*

Industry Grade Capstone Project Assessment

CONTACT DETAILS

Program Information:

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