**Introduction to Data Science Deep Learning & Artificial Intelligence**

**Introduction to Deep Learning & AI**

**Deep Learning: A revolution in Artificial Intelligence**

* Limitations of Machine Learning

**What is Deep Learning?**

* Need for Data Scientists
* Foundation of Data Science
* What is Business Intelligence
* What is Data Analysis
* What is Data Mining

**What is Machine Learning?  
Analytics vs Data Science**

* Value Chain
* Types of Analytics
* Lifecycle Probability
* Analytics Project Lifecycle
* Advantage of Deep Learning over Machine learning
* Reasons for Deep Learning
* Real-Life use cases of Deep Learning
* Review of Machine Learning

**Data**

* Basis of Data Categorization
* Types of Data
* Data Collection Types
* Forms of Data & Sources
* Data Quality & Changes
* Data Quality Issues
* Data Quality Story
* What is Data Architecture
* Components of Data Architecture
* OLTP vs OLAP
* How is Data Stored?

**Big Data**

* What is Big Data?
* 5 Vs of Big Data
* Big Data Architecture
* Big Data Technologies
* Big Data Challenge
* Big Data Requirements
* Big Data Distributed Computing & Complexity
* Hadoop
* Map Reduce Framework
* Hadoop Ecosystem

**Data Science Deep Dive**

* What Data Science is
* Why Data Scientists are in demand
* What is a Data Product
* The growing need for Data Science
* Large Scale Analysis Cost vs Storage
* Data Science Skills
* Data Science Use Cases
* Data Science Project Life Cycle & Stages
* Data Acuqisition
* Where to source data
* Techniques
* Evaluating input data
* Data formats
* Data Quantity
* Data Quality
* Resolution Techniques
* Data Transformation
* File format Conversions
* Annonymization

**Python**

* Python Overview
* About Interpreted Languages
* Advantages/Disadvantages of Python pydoc.
* Starting Python
* Interpreter PATH
* Using the Interpreter
* Running a Python Script
* Using Variables
* Keywords
* Built-in Functions
* StringsDifferent Literals
* Math Operators and Expressions
* Writing to the Screen
* String Formatting
* Command Line Parameters and Flow Control.
* Lists
* Tuples
* Indexing and Slicing
* Iterating through a Sequence
* Functions for all Sequences

**Operators and Keywords for Sequences**

* The xrange() function
* List Comprehensions
* Generator Expressions
* Dictionaries and Sets.

**Numpy & Pandas**

* Learning NumPy
* Introduction to Pandas
* Creating Data Frames
* GroupingSorting
* Plotting Data
* Creating Functions
* Slicing/Dicing Operations.

**Deep Dive – Functions & Classes & Oops**

* Functions
* Function Parameters
* Global Variables
* Variable Scope and Returning Values. Sorting
* Alternate Keys
* Lambda Functions
* Sorting Collections of Collections
* Classes & OOPs

**Statistics**

* What is Statistics
* Descriptive Statistics
* Central Tendency Measures
* The Story of Average
* Dispersion Measures
* Data Distributions
* Central Limit Theorem
* What is Sampling
* Why Sampling
* Sampling Methods
* Inferential Statistics
* What is Hypothesis testing
* Confidence Level
* Degrees of freedom
* what is pValue
* Chi-Square test
* What is ANOVA
* Correlation vs Regression
* Uses of Correlation & Regression

**Machine Learning, Deep Learning & AI using Python**

**Introduction**

* ML Fundamentals
* ML Common Use Cases
* Understanding Supervised and Unsupervised Learning Techniques

**Clustering**

* Similarity Metrics
* Distance Measure Types: Euclidean, Cosine Measures
* Creating predictive models
* Understanding K-Means Clustering
* Understanding TF-IDF, Cosine Similarity and their application to Vector Space Model
* Case study

**Implementing Association rule mining**

* What is Association Rules & its use cases?
* What is Recommendation Engine & it’s working?
* Recommendation Use-case
* Case study

**Understanding Process flow of Supervised Learning Techniques**

**Decision Tree Classifier**

* How to build Decision trees
* What is Classification and its use cases?
* What is Decision Tree?
* Algorithm for Decision Tree Induction
* Creating a Decision Tree
* Confusion Matrix
* Case study

**Random Forest Classifier**

* What is Random Forests
* Features of Random Forest
* Out of Box Error Estimate and Variable Importance
* Case study

**Naive Bayes Classifier.**

* Case study

**Project Discussion**

**Problem Statement and Analysis**

* Various approaches to solve a Data Science Problem
* Pros and Cons of different approaches and algorithms.

**Linear Regression**

* Case study
* Introduction to Predictive Modeling
* Linear Regression Overview
* Simple Linear Regression
* Multiple Linear Regression

**Logistic Regression**

* Case study
* Logistic Regression Overview
* Data Partitioning
* Univariate Analysis
* Bivariate Analysis
* Multicollinearity Analysis
* Model Building
* Model Validation
* Model Performance Assessment AUC & ROC curves
* Scorecard

**Support Vector Machines**

* Case Study
* Introduction to SVMs
* SVM History
* Vectors Overview
* Decision Surfaces
* Linear SVMs
* The Kernel Trick
* Non-Linear SVMs
* The Kernel SVM

**Time Series Analysis**

* Describe Time Series data
* Format your Time Series data
* List the different components of Time Series data
* Discuss different kind of Time Series scenarios
* Choose the model according to the Time series scenario
* Implement the model for forecasting
* Explain working and implementation of ARIMA model
* Illustrate the working and implementation of different ETS models
* Forecast the data using the respective model
* What is Time Series data?
* Time Series variables
* Different components of Time Series data
* Visualize the data to identify Time Series Components
* Implement ARIMA model for forecasting
* Exponential smoothing models
* Identifying different time series scenario based on which different Exponential Smoothing model can be applied
* Implement respective model for forecasting
* Visualizing and formatting Time Series data
* Plotting decomposed Time Series data plot
* Applying ARIMA and ETS model for Time Series forecasting
* Forecasting for given Time period
* Case Study

**Machine Learning Project**

**Machine learning algorithms Python**

* Various machine learning algorithms in Python
* Apply machine learning algorithms in Python

**Feature Selection and Pre-processing**

* How to select the right data
* Which are the best features to use
* Additional feature selection techniques
* A feature selection case study
* Preprocessing
* Preprocessing Scaling Techniques
* How to preprocess your data
* How to scale your data
* Feature Scaling Final Project

**Which Algorithms perform best**

* Highly efficient machine learning algorithms
* Bagging Decision Trees
* The power of ensembles
* Random Forest Ensemble technique
* Boosting – Adaboost
* Boosting ensemble stochastic gradient boosting
* A final ensemble technique

**Model selection cross validation score**

* Introduction Model Tuning
* Parameter Tuning GridSearchCV
* A second method to tune your algorithm
* How to automate machine learning
* Which ML algo should you choose
* How to compare machine learning algorithms in practice

**Text Mining& NLP**

* Sentimental Analysis
* Case study

**PySpark and MLLib**

* Introduction to Spark Core
* Spark Architecture
* Working with RDDs
* Introduction to PySpark
* Machine learning with PySpark – Mllib

**Deep Learning & AI using Python**

**Deep Learning & AI**

* Case Study
* Deep Learning Overview
* The Brain vs Neuron
* Introduction to Deep Learning

**Introduction to Artificial Neural Networks**

* The Detailed ANN
* The Activation Functions
* How do ANNs work & learn
* Gradient Descent
* Stochastic Gradient Descent
* Backpropogation
* Understand limitations of a Single Perceptron
* Understand Neural Networks in Detail
* Illustrate Multi-Layer Perceptron
* Backpropagation – Learning Algorithm
* Understand Backpropagation – Using Neural Network Example
* MLP Digit-Classifier using TensorFlow
* Building a multi-layered perceptron for classification
* Why Deep Networks
* Why Deep Networks give better accuracy?
* Use-Case Implementation
* Understand How Deep Network Works?
* How Backpropagation Works?
* Illustrate Forward pass, Backward pass
* Different variants of Gradient Descent

**Convolutional Neural Networks**

* Convolutional Operation
* Relu Layers
* What is Pooling vs Flattening
* Full Connection
* Softmax vs Cross Entropy
* ” Building a real world convolutional neural network
* for image classification”

**What are RNNs – Introduction to RNNs**

* Recurrent neural networks rnn
* LSTMs understanding LSTMs
* long short term memory neural networks lstm in python

**Restricted Boltzmann Machine (RBM) and Autoencoders**

* Restricted Boltzmann Machine
* Applications of RBM
* Introduction to Autoencoders
* Autoencoders applications
* Understanding Autoencoders
* Building a Autoencoder model

**Tensorflow with Python**

* Introducing Tensorflow
* Introducing Tensorflow
* Why Tensorflow?
* What is tensorflow?
* Tensorflow as an Interface
* Tensorflow as an environment
* Tensors
* Computation Graph
* Installing Tensorflow
* Tensorflow training
* Prepare Data
* Tensor types
* Loss and Optimization
* Running tensorflow programs

**Building Neural Networks using**

**Tensorflow**

* Tensors
* Tensorflow data types
* CPU vs GPU vs TPU
* Tensorflow methods
* Introduction to Neural Networks
* Neural Network Architecture
* Linear Regression example revisited
* The Neuron
* Neural Network Layers
* The MNIST Dataset
* Coding MNIST NN

**Deep Learning using**

**Tensorflow**

* Deepening the network
* Images and Pixels
* How humans recognise images
* Convolutional Neural Networks
* ConvNet Architecture
* Overfitting and Regularization
* Max Pooling and ReLU activations
* Dropout
* Strides and Zero Padding
* Coding Deep ConvNets demo
* Debugging Neural Networks
* Visualising NN using Tensorflow
* Tensorboard

**Transfer Learning using**

**Keras and TFLearn**

* Transfer Learning Introduction
* Google Inception Model
* Retraining Google Inception with our own data demo
* Predicting new images
* Transfer Learning Summary
* Extending Tensorflow
* Keras
* TFLearn
* Keras vs TFLearn Comparison