DATA FOLKZ
CATAPULT DATA LEADERS

Professional Certificate in **Artificial Intelligence**

Programme Cirruculum

9 Terms 5 Projects 1 Elective

Professional Certificate in **Artificial Intelligence**

DATA FOLKZ
CATAPULT DATA LEADERS

Preface

Term 1
Foundation of Statistics

Term 2
Introduction to Python

Term 3
Data Visualization & EDA

Capstone Project

Term 4
Supervised Learning

Capstone Project

Term 5
Unsupervised Learning

Term 6
Natural Programming Language (BASIC)

Capstone Project

Advanced TABLEAU

Term 7
Natural Programming Language (ADVANCED)

Term 8
Deep Learning

Capstone Project

Term 9
Dive Deep Learning

Capstone Project

Professional Certificate in **Artificial Intelligence**

DATA FOLKZ
CATAPULT DATA LEADERS

Programme Curriculum

9 Terms
5 Projects
1 Elective

Term 1
Foundation of Statistics

Term Duration : 1 Week

Software Skill : N/A

Assgnments: 2

Module 1
Statistics

Topic 1
What is Data Science?

What is Data Science?

Life cycle of data science

Skills required for data science

Applications of data science in different industries

Topic 2
What is Data Science?

Statistics in Data science

What is Statistics?

How is Statistics used in Data Science?

Population and Sample

Parameters and Statistics

Module 2
Statistics for Data Science

Topic 3
What is Data Science?

Data types

Variable and it's types

Sampling Techniques:

Convenience Sampling

Simple Random Sampling

Stratified Sampling

Systematic Sampling

Cluster Sampling

Term 1

Foundation of Statistics

DATA FOLKZ
CATAPULT DATA LEADERS

Module 2
Statistics for Data Science

Topic 4
Descriptive Statistics

What is Univariate and Bi Variate Analysis?

Measures of Central Tendencies

Measures of Dispersion

-Normal Distribution

-Standard Normal Distribution

Skewness and Kurtosis

Box Plots and Outliers detection

Covariance and Correlation

Case Study

DATA FOLKZ
CATAPULT DATA LEADERS

Term 2
Introduction to Python

Term Duration : 2 Weeks

Software Skill : Python

Assgnments: 4

Module 1
Core Python

Topic 1
Python Introduction

What is Python?

Why Data Science requires Python?

Installation of Anaconda

Understanding Jupyter Notebook

Basic commands in Jupyter Notebook

Understanding Python Syntax

Topic 2
Data Types & Data Structures

Variables

Strings

Lists

Sets

Tuples

Dictionaries

Topic 3
Control Flow & Conditional Statements

Conditional Operators, Arithmetic Operators & Logical Operators

If, Else if and Else Statements

While Loops

For Loops

Nested Loops

List and Dictionary Comprehensions

Term 2

Introduction to Python

DATA FOLKZ
CATAPULT DATA LEADERS

Topic 4

Functions

Code Optimization

Scope

Lambda Functions

Map, Filter and Reduce

Modules and Packages

Module 2

Advanced Python

Topic 5

File Handling

Create, Read, Write files

Operations in File Handling

Errors and Exception Handling

Topic 6

Miscellaneous Python

Date and Time

OOPS Concepts

Topic 7

Regular Expressions

Structured Data and Unstructured Data

Literals and Meta Characters

How to Regular Expressions using Pandas?

Inbuilt Methods

Pattern Matching

Case Study

DATA FOLKZ
CATAPULT DATA LEADERS

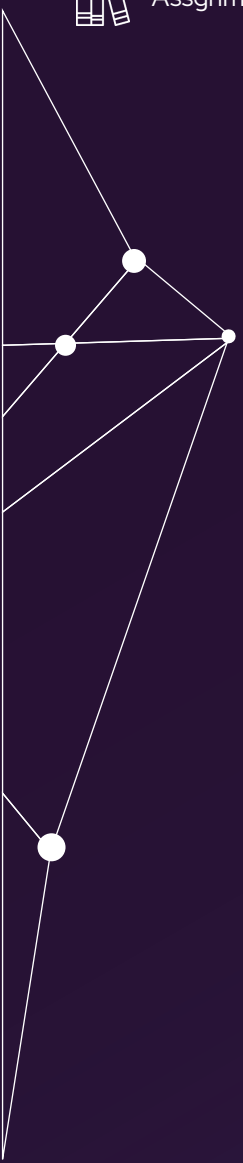
Term 3

Data Visualization & EDA

Term Duration : 2 Weeks

Software Skill : Python

Assgnments: 4



Industry Project

Module 1
Number Analytics

Topic 1
Numpy

Arrays
Basic Operations in Numpy
Indexing
Array Processing

Case Study

Module 2
Working with Data Frames

Topic 1
Pandas

Series
DataFrames
Indexing and slicing
Groupby
Concatenating
Merging Joining
Missing Values
Operations
Data Input and Output
Pivot
Cross tab

Case Study

Capstone Project

DATA FOLKZ
CATAPULT DATA LEADERS

Term 4

Supervised Learning

Term Duration : 2 Weeks

Software Skill : Python

Assgnments: 4

Module 1
Regression

Topic 1
Introduction to Supervised Learning

What Is Machine Learning?

Why Estimate f?

How Do We Estimate f?

The Trade-Off Between Prediction Accuracy & Model Interpretability

Supervised Versus Unsupervised Learning

Regression Versus Classification Problems Assessing Model Accuracy

Topic 2
Linear Regression

Simple Linear Regression:

Multiple Linear Regression:

· OLS Assumptions

· Residual Analysis

Non-linear Transformations of the Predictors

Polynomial Regression

Topic 3
Regularization Techniques

Lasso Regularization

Ridge Regularization

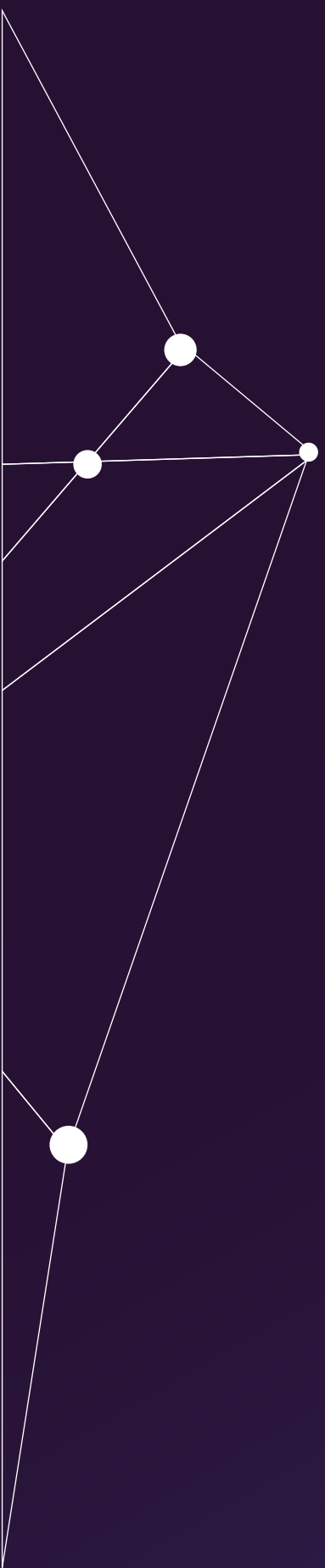
Elastic Net Regularization

Case Study

Term 4

Supervised Learning

DATA FOLKZ
CATAPULT DATA LEADERS



Topic 4

Classification Overview

An Overview of Classification

Why Not Linear Regression?

Topic 5

Logistic Regression

Logistic Regression:

· The Logistic Model

· Estimating the Regression Coefficients and Making Predictions

· Multiple Logistic Regression

· Logit and Sigmoid functions

· Setting the threshold and understanding decision boundary

Topic 6

Evaluation Techniques

Evaluation Metrics for Classification Models:

· Confusion Matrix

· Accuracy and Error rate

· TPR and FPR

· Precision and Recall

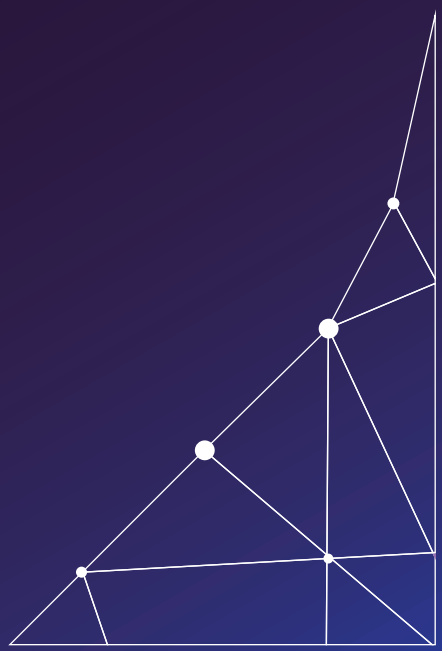
· F1 Score

· AUC – ROC

· Kappa Score

Concordant - Discordant Ratio

Case Study



Term 4

Supervised Learning

DATA FOLKZ
CATAPULT DATA LEADERS

Module 2
Tree Based Learning

Topic 7
Decision Tree

Decision Trees (Rule Based Learning):

· Basic Terminology in Decision Tree
· Root Node and Terminal Node
· Regression Trees
· Classification Trees
· ID3 and C4.5 Decision Trees
· Trees Versus Linear Models
· Advantages and Disadvantages of Trees
· Gini Index, Information Gain/Entropy and Reduction in Variance
· Overfitting and Pruning
· Stopping Criteria
· Accuracy Estimation using Decision Trees

Case Study

Topic 8
Resampling Methods

Resampling Methods:

· Cross-Validation
· The Validation Set Approach Leave-One-Out Cross-Validation
· k-Fold Cross-Validation
· Bias-Variance Trade-Off for k-Fold Cross-Validation

Topic 10
Ensemble Learning

Ensemble Methods in Tree Based Models:

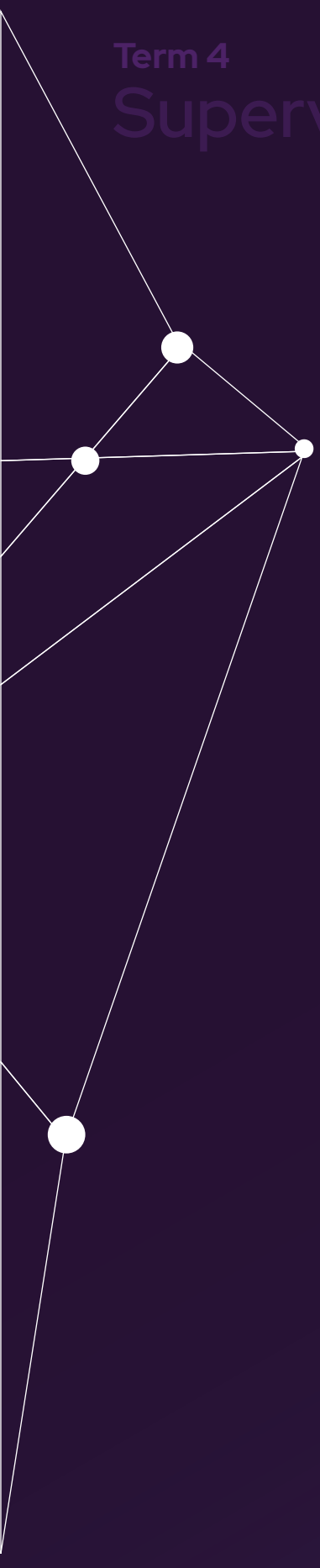
· What is Ensemble Learning?
· What is Bagging and how does it work?
· What is Random Forest and how does it work?
· The Bootstrap
· Variable selection using RandomForest
· What is Boosting and how does it work?
· Ada Boosting
· Gradient Boosting

Case Study

Term 4

Supervised Learning

DATA FOLKZ
CATAPULT DATA LEADERS



Module 3
Distance Based Learning

Topic 11
Support Vector Machines

Support Vector Machines:

· Hyperplane
· The Maximal Margin Classifier
· Support Vector Classifiers
· Support Vector Machines
· Hard and Soft Margin Classification
· Classification with Non-linear Decision Boundaries
· Kernel Trick
· Linear, Polynomial and Radial
· Tuning Hyperparameters for SVM
· Gamma, Cost and Epsilon
· SVMs with More than Two Classes

Case Study

Topic 12
K Nearest Neighbors

K Nearest Neighbors:

· K-Nearest Neighbor Algorithm
· Eager Vs Lazy learners
· How does the KNN algorithm work?
· How do you decide the number of neighbors in KNN?
· Curse of Dimensionality
· Pros and Cons of KNN
· How to improve KNN performance?

Case Study

Industry Project

Capstone Project

Professional Certificate in **Artificial Intelligence**

DATA FOLKZ
CATAPULT DATA LEADERS

Term 5

Unsupervised Learning

Term Duration : 2 Weeks

Software Skill : Python

Assgnments: 4

Module 1

Clustering & Dimensionality Reduction

Topic 1

Principal Component Analysis

Principal Components Analysis:

· Introduction to Dimensionality Reduction and it's necessity
· What Are Principal Components?
· Demonstration of 2D PCA and 3D PCA
· Eigen Values, Eigen Vectors and Orthogonality
· Transforming Eigen values into a new data set
· Proportion of variance explained in PCA

Case Study

Topic 2

Clustering

Clustering Methods:

· K-Means Clustering
· Centroids and Medoids
· Deciding optimal value of 'k' using Elbow Method
· Linkage Methods
· Hierarchical Clustering
· Divisive and Agglomerative Clustering
· Dendrograms and their interpretation
· Applications of Clustering
· Practical Issues in Clustering
· Improving Supervised Learning algorithms with clustering

Case Study

Term 5

Unsupervised Learning

DATA FOLKZ
CATAPULT DATA LEADERS

Module 2
Association Mining

Topic 3
Association Rules

Association Rules Mining:

· Association Rules
· Market Basket Analysis
· Apriori/Support/Confidence/Lift

Case Study

Topic 4
Naive Bayes Algorithm

ü Naive Bayes:

· Principle of Naive Bayes Classifier
· Bayes Theorem
· Terminology in Naive Bayes
§ Posterior probability
§ Prior probability of class
§ Likelihood
· Types of Naive Bayes Classifier
· Multinomial Naive Bayes
· Bernoulli Naive Bayes
· Gaussian Naive Bayes

Case Study

Term 6
Natural Language Processing (BASIC)

DATA FOLKZ
CATAPULT DATA LEADERS

Term 6
Natural Language Processing (BASIC)

Term Duration : 2 Weeks

Software Skill : Python

Assgnments: 4

Module 1
Time Series Analysis

Topic 1
Time Series (Forecasting)

What is Times Series Data?
Stationarity in Time Series Data and
Augmented Dickey Fuller Test
The Box-Jenkins Approach
The AR Process
The MA Process What is ARIMA?
SARIMA
ACF, PACF and IACF plots
Decomposition of Times Series Trend, Seasonality and Cyclic
Exponential Smoothing
EWMA

Module 2
Natural Language Processing (I)

Topic 2
Intro to NLP

What is NLP?
- Why NLP?
- Applications of NLP
- Unstructured data
- Life cycle of NLP
- Tools for NLP
- Libraries for NLP

o NLTK
o Spacy
o TextBlob

Term 6

Natural Language Processing (BASIC)

DATA FOLKZ
CATAPULT DATA LEADERS

Topic 3

Extracting the Data

Potential data sources

- Reading a pdf file
- Reading a HTML file
- Reading a JSON file
- Data extraction through API and Intro to Webscraping
- Regular expressions
- Handling string

Module 2

Nuts & Bolts of NLP

Topic 4

Text Preprocessing

Text normalizing

- Spelling correction
- Stop words removal
- Stemming
- Lemmatization
- Tokenization
- Text standardization and exploratory data analysis

Topic 5

Text Indexing

Inverted Indexes
Boolean query processing
Handling phrase queries, proximity queries
Latent Sematic Analysis

Topic 6

Feature Engineering

One hot encoding

- N gram
- Feature hashing
- Count vectorizer
- TFIDF
- Co occurance matrix

Word embeddings - word2vec, fasttext etc

Term 6

Natural Language Processing (BASIC)

DATA FOLKZ
CATAPULT DATA LEADERS

Case Study

Text Mining
Sentiment Analysis
Spam Detection
Dialogue Prediction

Industry Project

Capstone Project

Elective

Advanced TABLEAU

DATA FOLKZ
CATAPULT DATA LEADERS

Term 7
Natural Language Processing (ADVANCED)

Term Duration : 2 Weeks

Software Skill : Python

Assgnments: 4

Module 1
Natural Language Processing (II)

Topic 1
Advanced NLP & ML

Noun phrase extraction
- POS tagging
- NER
- Topic modeling
- Text classification
- Sentiment analysis
- Text similarity
- Support Vector Machine: Classification
- Word sense disambiguation
- Speech recognition and speech to text
- Text to speech
- Language detection and translation

Module 2
Applications of NLP

Topic 2
Implementing Industrial Applications

Consumer complaint classification
Customer reviews sentiment prediction
Data stitching using text similarity and record linkage
Text summarization for subject notes
Document clustering
Architectural details of Chatbot and Search Engine along with Learning to rank

Term 7

Natural Language Processing (ADVANCED)

DATA FOLKZ
CATAPULT DATA LEADERS

Module 2
Applications of NLP

Topic 3
Deep Learning for NLP

What is a sequence-based model?
Vanishing Gradient
Exploding Gradient
The Idea behind Recurrent Neural Networks
LSTM (Long Short-Term Memory)
GRU (Gated Recurrent Unit)
Batching Sequence Models
Information retrieval using word embedding's
Text classification using deep learning approaches (CNN, RNN, LSTM, Bi-directional LSTM)
Natural language generation – prediction next word/ sequence of words using LSTM.
Text summarization using LSTM encoder and decoder.

Case Study

DATA FOLKZ
CATAPULT DATA LEADERS

Term 8
Deep Learning

Term Duration : 2 Weeks

Software Skill : Python

Assgnments: 4

Module 1
All About Neural Networks

Topic 1
Introduction to Neural Networks

Introduction to Neural Network
Introduction to Neuron and Perceptron
· Primitive Neuron
· Sigmoid Neuron
Types of Activation functions used in deep learning networks
Cost Functions
Gradient Decent
Stochastic Gradient Descent
The feedforward model of neural network
Disadvantages of feedforward model
Applying weights to the feedforward model
Backpropagation algorithm

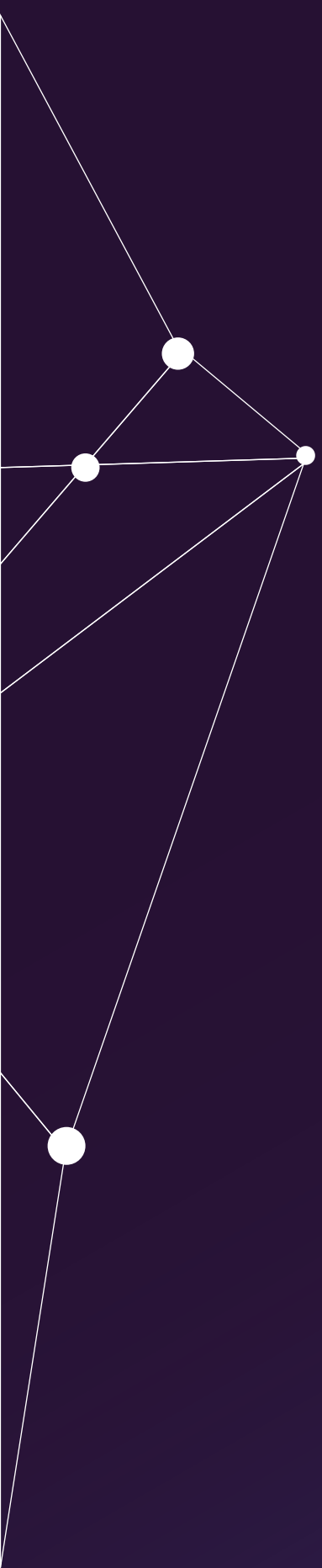
Topic 2
Artificial Neural Network

Understanding Neural Networks
The Biological Inspiration
Perceptron Learning & Binary Classification
Back propagation Learning & Object Recognition

Term 8

Deep Learning

DATA FOLKZ
CATAPULT DATA LEADERS



Topic 3

Tensorflow & Keras

- Introducing Tensorflow
- Neural Networks using Tensorflow
- Debugging and Monitoring
- Keras for Classification and Regression in TypicalData Science Problems
- Setting up KERAS
- Different Layers in KERAS
- Creating a Neural Network
- Training Models and Monitoring & Artificial Neural Networks

Case Study

Module 2

Types of Neural Networks

Topic 4

Recurrent Neural Network

- Introduction to RNN
- RNN Network Structure
- Different Types of RNNs
- Bidirectional RNN
- Limitations of RNN
- Training a RNN with a use case
- GRU's
- Introduction to LSTM
- LSTM Architecture Variants on LSTM
- Time Series Forecasting or Sequential Modelling using LSTM

Term 8

Deep Learning

DATA FOLKZ
CATAPULT DATA LEADERS

Topic 5

Convolutional Neural Network

- Intro to CNN
- Convolutional operations and Image Features
- ReLu
- Pooling
- Fully Connected Layer
- Training a CNN & Image Classification

Case Study

Capstone Project

Term 9
Dive Deep Learning

DATA FOLKZ
CATAPULT DATA LEADERS

Term 9
Dive Deep Learning

Term Duration : 2 Weeks

Software Skill : Python

Assgnments: 4

Module 1
Computer Vision

Topic 1
Open CV

- Introduction to Computer Vision
- OpenCV to work with image files
- image manipulation including smoothing, blurring
- Translation, rotation,cropping
- thresholding, and morphological operations.
- Open and Stream video with OpenCV
- Create Color Histograms with OpenCV
- Corner, edge, and grid detection techniques with OpenCV
- Face Recognition
- Template matching

Topic 2
Advanced CV

Transfer Learning Using Keras
VGG
RESNET
Object Detection
Drawing bounding boxes
Yolo

Module 2
Deploy

Topic 1
Deployment

Creating pickle and frozen files
Cloud Deploying Machine Learning &
Deep Learning model for production

Case Study

Industry Project

Capstone Project