**Python Course Content for Data Science**

**Python Essentials**

* Data types and objects
* Loading packages, namespaces
* Reading and writing data
* Simple plotting
* Control flow
* Debugging
* Code profiling

**Learning Numpy**

* Creating arrays
* Using arrays and scalars
* Indexing Arrays
* Array Transposition
* Universal Array Function
* Array Processing

**Intro to Pandas**

* Series
* DataFrames
* Index objects
* Reindex
* Drop Entry
* Selecting Entries
* Data Alignment
* Rank and Sort
* Summary Statistics
* Missing Data
* Index Hierarchy

**Working with Data: Part 1**

* Reading and Writing Text Files
* JSON with Python
* HTML with Python
* Microsoft Excel files with Python

**Working with Data: Part 2**

* Merge
* Merge on Index
* Concatenate
* Combining DataFrames
* Reshaping
* Pivoting
* Duplicates in DataFrames
* Mapping
* Replace
* Rename Index
* Binning
* Outliers
* Permutation

**Working with Data: Part 3**

* GroupBy on DataFrames
* GroupBy on Dict and Series
* Splitting Applying and Combining
* Cross Tabulation

**Data Visualization**

* Installing Seaborn
* Histograms
* Combining Plot Styles
* Box and Violin Plots
* Regression Plots
* Heatmaps and Clustered Matrices

**Appendix: SQL and Python**

* introduction to SQL with Python
* SQL - SELECT,DISTINCT,WHERE,AND & OR
* SQL WILDCARDS, ORDER BY, GROUP BY and Aggregate Functions

**Machine Learning Course Content**

**01: Introduction** - Introduction to the course - What is machine learning? - Supervised learning - introduction - Unsupervised learning - introduction

**02: Regression Analysis and Gradient Descent** - Linear Regression - Linear regression - implementation (cost function) - A deeper insight into the cost function - simplified cost function - Gradient descent algorithm - So no need to change alpha over time - Linear regression with gradient descent

**03: Linear Algebra - review** - Matrices - overview - Vectors - overview - Matrix manipulation - Implementation/use - Matrix multiplication properties - Inverse and transpose operations

**04: Linear Regression with Multiple Variables** - Linear regression with multiple features - Gradient descent for multiple variables - Gradient Decent in practice: 1 Feature Scaling - Learning Rate a - Features and polynomial regression - Normal equation

**05: Logistic Regression** - Classification - Hypothesis representation - Decision boundary - Non-linear decision boundaries - Cost function for logistic regression - Simplified cost function and gradient descent - Advanced optimization - Multiclass classification problems

**06: Regularization** - The problem of overfitting - Cost function optimization for regularization - Regularized linear regression - Regularization with the normal equation - Advanced optimization of regularized linear regression

**07: Neural Networks - Representation** - Neural networks - Overview and summary - Model representation 1 - Model representation II - Neural network example - computing a complex, nonlinear function of the input - Multiclass classification

**08: Neural Networks - Learning** - Neural network cost functionx - Summary of what's about to go down - Back propagation algorithm - Back propagation intuition - Implementation notes - unrolling parameters (matrices) - Gradient checking - Random initialization - Putting it all together

**09: Advice for applying machine learning techniques** - Deciding what to try next - Evaluating a hypothesis - Model selection and training validation test sets - Diagnosis - bias vs. variance - Regularization and bias/variance - Learning curves

**10: Machine Learning System Design** - Machine learning systems design - Prioritizing what to work on - spam classification example - Error metrics for skewed analysis - Trading off precision and recall - Data for machine learning

**11: Support Vector Machines** - Support Vector Machine (SVM) - Optimization objective - Large margin intuition - Large margin classification mathematics (optional) - Kernels - 1: Adapting SVM to non-linear classifiers - Kernels II

**12: Clustering** - Unsupervised learning - introduction - K-means algorithm - K means optimization objective - How do we choose the number of clusters?

**13: Dimensionality Reduction** - Motivation 1: Data compression - Motivation 2: Visualization - Principle Component Analysis (PCA): Problem Formulation - PCA Algorithm - Reconstruction from Compressed Representation - Choosing the number of Principle Components - Advice for Applying PCA

**14: Anomaly Detection** - Anomaly detection - problem motivation - The Gaussian distribution (optional) - Anomaly detection algorithm - Developing and evaluating and anomaly detection system - Anomaly detection vs. supervised learning - Choosing features to use - Multivariate Gaussian distribution - Applying multivariate Gaussian distribution to anomaly detection

**15: Large Scale Machine Learning** - Learning with large datasets - Stochastic Gradient Descent - Mini Batch Gradient Descent - Stochastic gradient descent convergence - Online learning - Map reduce and data parallelism

**16: Application Example -**

**17: Course Summary**