Practical Machine Learning

Module 1:

Lecture 1: Introduction to Machine Learning

* What is Machine Learning
* Goals of Machine Learning
* Methods of Machine Learning
* Structure of Machine Learning
* Characteristics of Machine Learning algorithms
* Technologies for Machine Learning
* Examples of Machine Learning Projects
* Where to learn more about Machine Learning
* Recap of Linear Algebra

Lecture 2: Linear Regression

* What is Linear Regression
* Single variable linear regression
* Multiple variables linear regression
* Multivariate linear regression
* Cost Function
* Optimization
* Gradient descent
* Normal equation
* Feature engineering

Lecture 3: Overfitting and Regularization

* What is overfitting
* How to overcome overfitting
* Early stopping
* Drop-off
* Regularization
* L1 vs L2 regularization
* Train/CV/Test splitting
* Bias-variance tradeoff
* Learning curves

Module 2:

Lecture 1: Logistic Regression

* What is logistic regression
* Cost function
* Multivariate (multiclass) classification
* Logistic skewed output
* Precision and recall
* ROC curves
* Decision boundary

Lecture 2: Support vector machines

* What is support vector machines
* SVM with linear kernel
* SVM with nonlinear kernel

Lecture 3: Decision trees and random forests

* What is a Decision Tree
* Structure of Decision Tree
* How to train a Decision Tree
* Overfitting
* Degenerate split and gain ratio
* Continuous, Multi-class, Regression with Decision Trees
* Ensemble learning
* Random Forest
* How to optimize Random Forest
* Boosting

Module 3: Processing and analyzing data

Lecture 1: Patterns

* Methods to find patterns
* Clustering
* Cluster Dendrograms
* K-means clustering
* How to choose the number of clusters

Lecture 2: Principal Component Analysis

* What is PCA
* Methods to perform PCA
* Correlation matrix
* Singular value decomposition
* How to choose the number of principal components

Lecture 3: Machine Learning Pipeline

* What is Machine Learning Pipeline
* Approaches to design Machine Learning Systems
* Error analysis
* How much data you need
* Data augmentation

Module 4: Deep learning

Lecture 1: Deep learning and neural networks

* What is Deep Learning
* What is a Neural Networks
* Neural Networks representation
* Forward propagation
* Calculations of gradients
* Gradients by finite differences
* Gradients by backpropagation
* Random Initialization

Lecture 2: Convolutional Neural Networks

* What are CNNs
* Structure of CNNs
* Convolutional layer
* Stride and Padding
* Rectified Linear Unit Layer
* Pooling Layer
* Dropout layer
* Network in Network layer
* Fully connected layer
* Transfer Learning
* ImageNet competition
* Examples of CNNs
* Inception module

Lecture 3: Recurrent Neural Network

* What is RNN
* Why do we need RNNs
* Recurrent neuron
* Unrolling RNN into a feed-forward net
* Architecture of RNNs
* Training RNN
* Vanishing and exploding gradients
* How to deal with Exploding gradient
* How to deal with Vanishing gradient