**Machine Learning speclization**

I.Supervised Machine Learning: Regression and Classification

1. Introduction to machinea learning

a. Overview of machine learning

b.supervised and unsupervised learning

-What is ML

-What is supervised learning

-What is unsupervised learning

c. Regression Model

-Linear Regression

-Cost function

d. Traning model with gradient descent

-Gradient descent

-Learning rate

-Gradient descent for linear regression

2.Regression with multiple input

a.Multi linear regression

-multiple features

-vectorization

-vectorization in gradient descent

-Normal equation for linear regression

b.Gradient descent in practice

-feature scaling

-check gradient for convergence

-choose learning rate

-choose of featuree: feature engineering ,polymial regression

3.Classification

a.Classification with logistic regression

-Classification

-Logisstic regression

-Decision boundary

b.Cost function for logistic regression:

-Cost function for logistic regression

-Simplify cost function

c. Gradient descent for logistic regression

d.The problem of overfitting:

-The problem of overfitting

-Address overfitting

-Cost function with regularization

-Regularized linear regression

-Regularized logistic regression

II. Advance Learning Algorithm

1.Neuron network

a. Neuron network

b.Neuron network model

-Layer of neuron

-Neuron network

-Forward propagation

c.Tensorflow implementation

-Inference in code

-Data in tensorflow

-Building neuron network

d. Implementation in python

2.Neuron network training

a.Neuron network training: model traing step

b.Activation function

-Types of activation

-Choose activation function

c.Multi class Classification

-Multiclass

-Softmax

-Neuron network with softmax

-Improve implementation (Numerical round error)

-Classfication with multiple output(multilabels)

d.Advanced concept

-Adam optimizer

-Types of layer: convolutional

e. Backpropagation

3. Advice for apply machine learning

a. Advice apply ML

-what to try next?

-Evaluate model (test set)

-Model selection(cross-validation set)

b.Bias and variance

-diagosing bias and variance

-Regularization and bias/variance

-Baseline level of performance

-Learning curve and size of dataset

-Bias and variance-what to do next

-Bias and variance-Neuron network

c.Machine learning development process

-Iterative loop of ML development

-Error analysis

-Adding data: by error analysic, data augmentation ,data synthetic

-Full cycle of machine learning project

-Fariness , bias ,ethics

d.Skewed dataset

-Metrics for skewed dataset

-Trading off precision and recall

4.Decision Tree

a.Decision tree

-decision tree model

-Decision tree learning

b.Decision tree learning

-Measuring purity

-Chose split: Information Gain

-Decision tree algorithm

-Categorical feature,continous feature

-Regression Tree

c.Tree ensemble

-Sampling with replacement

-Random forest algorithm

-Gradient boosting ,Xgboost algorithm

-When to use decision tree

III.Unsupervised Learning ,Recommender,Reinforement Learing

1.Unsupervised Learing

a.Clustering-Kmeans

-What is clustering

-Kmeans

-Kmeans clustering algorihm

-Optimization objective

-Initialize K-means

-Chose K(number of cluster)

*##More clustering algorithm: DBSCAN, Gaussian mixture, Mean shift,Hierachical clustering,…*

b.Anomaly detection

-Anomaly detection

-Gaussian distribution

-Anomaly detection algorithm

-Develop and evaluating anomaly detection

-Anomaly detection vs supervised learing

-Chose feature to use

*###More anomaly detection: iForest , local outlier factor ,autoencoder , one-class SVM , DBSCAN ,K-mean,Gaussian mixure model*

*### Unsupervised Algorithm: Clustering , Anomaly detection , Dimension redution , Association rule learing, Representation learning: -word2vec , Deep belief network( Restricted Boltmann Machine)*