Study for ML Exam

Category	Machine Learning
Date Created	@Mar 28, 2020 8:25 PM
Due Date	@Apr 01, 2020 3:00 PM
Priority	High 🔥
Status	Next Up

ML Cheat Sheet

Topics

- [x] ~~**Classification**~~
  - [x] ~~Binary Logistic Regression~~
  - [x] ~~Multinomial Logistic Regression~~
- [x] ~~**Important Concepts**~~
  - [x] ~~SGD~~
  - [x] ~~Regularization~~
  - [x] ~~Feature Engineering~~
- [x] ~~**Feature Learning**~~
  - [x] ~~Neural Networks~~
  - [x] ~~Basic NN Architectures~~
  - [x] ~~Backpropogation~~
- [x] ~~**Learning Theory**~~
  - [x] ~~Pac Learning~~
- [x] ~~**Generative Models**~~

- [x] ~~Generative vs. Discriminative~~
- [x] ~~MLE / MAP~~
- [x] ~~Naïve Bayes~~

Logistic Regression Fit Function

```
# trainX --> training data
# weights --> vector for each feature
# trainY --> output in [0, 1] for each xi
def fit():
  for i in range(num_epochs):
    for j in range(trainX.shape[0]):
      xi = trainX[j]
      dotProduct = np.dot(xi, weights)
      p = sigmoid(dotProduct)

      weights = weights + learning_rate * (trainY[j] - p) # update rule for SGD
```

Neural Network Fit Function

```
def train():
  for i in range(num_epochs):
    for j, xi in enumerate(trainX):
      # begin forward propogation
      a = xi.dot(alpha) # alpha is first set of weights
      z = sigmoid(a)
      z_ = np.append([1], z) # appending the bias in hidden layer
      b = z_.dot(beta) # beta is second set of weights
      y_prime = softmax(b)
      # end of forward propogation
      db = np.copy(y_prime)
      db[y[j]] = db[y[j]] - 1 # y[j] gives index of correct label

      dbeta = np.asmatrix(db).T.dot(np.asmatrix(z_)) #calculating backprop for beta
      dz = db.T.dot(beta[:, 1:]).T # omit bias in calculation of dz
      da = dz * z * (1-z) # element-wise multiplication to find da
      dalpha = np.asmatrix(da).T.dot(np.asmatrix(xi)) # calculating backprop for alpha

      # end of backpropogation
      # updates for stochastic gradient descent
```

```
        beta += learning_rate * dbeta
        alpha += learning_rate * dalpha
```