

Advance Machine Learning

Quiz #1

Feb 7th 2017

This is a closed-book and closed-notes quiz. You have 20 minutes to solve the following problems.

NAME: _____

1. (4 pts) Given the following low rank matrix factorization (7 users and 5 movies) for a collaborative filtering problem. Answer the following questions:

$$\begin{bmatrix} 5 & 1 & 4 & 5 & 1 \\ & 5 & 2 & 1 & 4 \\ 1 & 4 & 1 & 1 & 2 \\ 4 & 1 & 5 & 5 & 4 \\ 5 & 3 & 3 & & 4 \\ 1 & 5 & 1 & 1 & 1 \\ 5 & 1 & 5 & 5 & 4 \end{bmatrix} \approx \begin{bmatrix} 0.2 & 3.4 \\ 3.6 & 1.0 \\ 2.6 & 0.6 \\ 0.9 & 3.7 \\ 2.0 & 3.4 \\ 2.9 & 0.5 \\ 0.8 & 3.9 \end{bmatrix} \times \begin{bmatrix} 0.0 & 1.5 & 0.1 & 0.0 & 0.7 \\ 1.3 & 0.0 & 1.2 & 1.4 & 0.7 \end{bmatrix}$$

- (a) Compute the predicted value for \hat{y}_{21}

$$\hat{y}_{21} = 3.6 \cdot 0.0 + 1.0 \cdot 1.3 = 1.3$$

- (b) From the set of 5 movies, which movie would you recommend to a user that liked movie 1.

Movie 4. If you look at the item profile movie 4 has the closest profile to movie 1.

- (c) Given $y_{21} = 1$ and $y_{54} = 5$, compute the test error for this example. I accepted properly computed MSR, RMSR and ASR

$$RMSR = \sqrt{\frac{(1.0 - 1.3)^2 + (5 - 4.76)^2}{2}}$$

Here you had to compute $\hat{y}_{54} = 2.0 \cdot 0 + 3.4 \cdot 1.4 = 4.76$

2. (1 pts) Describe at least two features that go into creating personalized rank at Quora (as explained in the document “Machine Learning at Quora” by Xavier Amatriain) I accepted many answers in here including:

- Quality of the questions/answers
 - Topics the user is interested on
 - Other users the user is following
 - What is trending/popular
3. **(2 pts)** In which of the following situations will a collaborative filtering system be the most appropriate learning algorithm (compared to linear or logistic regression)?
 Answer: (a) and (d)
 For each of these questions, ask yourself are they collecting the “utility matrix” (multiple ratings per users, many users). Then ask yourself, can we use CF for the given task?
- (a) You work for a clothing store that sells many styles and brands of jeans. You have collected reviews of the different styles and brands from frequent shoppers, and you want to use these reviews to offer those shoppers discounts on the jeans you think they are most likely to purchase.
 - (b) You are a photographer that takes portraits of your clients. Each client gets a different portrait (of themselves or their babies) and gives you 1-5 star rating feedback, and each client purchases at most 1 photograph. You want to predict what rating your next customer will give you.
 - (c) You manage an online bookstore and you have the book ratings from many users. You want to learn to predict the expected sales volume (number of books sold) as a function of the average rating of a book.
 - (d) You run an online bookstore and collect the ratings of many users. You want to use this to identify what books are “similar” to each other.
4. **(3 pts)** Given training set $\{x_i, y_i\}_{i=1}^N$ and $x_i, y_i \in \mathbb{R}$. Compute the gradient descent equations for the following regression model. (Use the square error / loss).

$$y = a + b \cdot x + c \cdot x^2$$

Answer: In this model the parameters are a, b, c, d so we are solving this problem

$$\min_{a,b,c,d} \sum_{i=1}^N (y_i - a - b \cdot x_i - c \cdot x_i^2)^2$$

You needed to write the equations with respect to a, b, c, d . Many people lost 2 points for writing the wrong equations.