← Go Back to Recommendation Systems

Course Content

Matrix Estimation Meets Content-Based Filtering

In this lecture, we will be learning how to make a recommendation system taking time and some measurements into consideration. **The lecture is divided into 3 modules - Matrix Estimation meets Content-based, Matrix Estimation across time, and Everything together.** Let's first go by getting an overview of the first part, Matrix Estimation meets Content-based filtering.

In the last couple of lectures, we have learned about multiple solutions of recommendation systems, like Averaging, Content-based, Matrix Estimation, etc. where we have used ratings given by users or user-item observed features or latent features. But all the algorithms are using only one specific type of data, for example, we have either used observed features for the content-based approach or latent features for the matrix estimation approach. What if we can combine these two approaches to get more accurate predictions? Let's see how we can do that:

Step 1: Content-based supervised learning

Recalling from previous lectures, in the content-based model, we use the observed features of users and items. The prediction problem of estimating is reduced to learning a model which is a function of x_i and y_j. The learned model can be a simple regression model or classification model depending on the target values. The equation of the model can be given as:

$$L_{ij}^{obs} = f_{obs}\ (x_i,\ y_i)$$

Where, L_{ij}^{obs} is the predicted value, f_{obs} is the hypothesis function (the regression or classification model equation), and ($x_i,\ y_j$) are the observed values of the matrix.

Step 2: Matrix estimation

In the Matrix estimation step, we will try to capture the information not captured in step 1. First, we will find the error matrix L_{ij}^{diff}, also known as the "difference matrix", by finding the difference between the true and the predicted values, as shown below:

$$L_{ij}^{diff} = L_{ij} - L_{ij}^{obs}$$

Then, we estimate the difference matrix using matrix estimation.

Step 3: Combine estimates

Finally, we can combine the estimates from steps 1 and 2 to make the final prediction.

$$\hat{L}_{ij} = L_{ij}^{obs} + L_{ij}^{ME}$$

Here, L_{ij}^{ME} is the matrix estimation part of the equation. Hence, this is how the matrix estimation part meets with the content-based filtering.

Previous Next

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