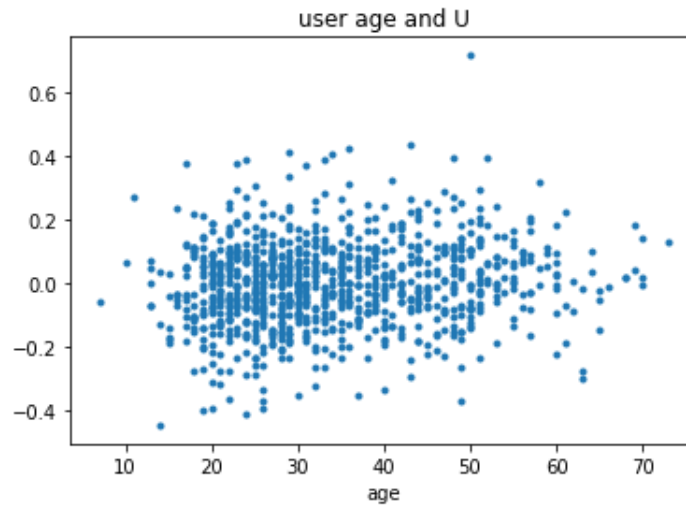


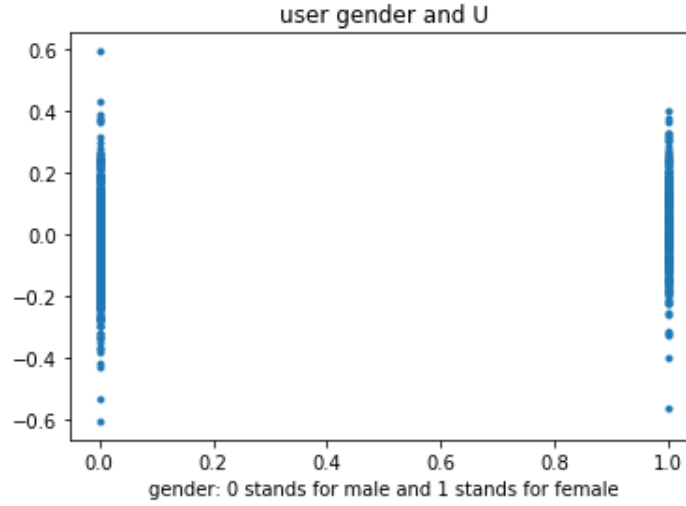
Discussion

1. Run collaborative filtering to make recommendations. Use SVD decomposition of the incomplete matrix of ratings to find vector representations of users and items. Run grid search to find best hyperparameters of my model. λ stands for the regularization term for all parameters, K is the number of factors. Set K to be 5, 10, 25, 50 and λ is 0.02, 0.4, 1. From calculate the root-mean-square error score of each combination of values of hyperparameters, the best score appears when $K = 25, \lambda = 0.02$.
2. User vector U and item vector V are from the result of my SVD decomposition. Each column of U can be seen as a 'learned' feature of users.

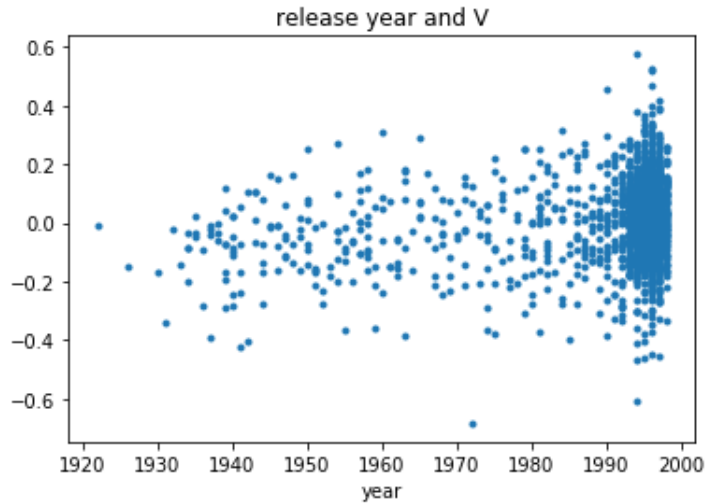
Calculating correlation coefficient of user vector and user age and select the column with the largest correlation coefficient which is 0.1287 in my result. Plot the values in that column against user ages. The plot shows as follow. I calculated the Pearsonr correlation coefficient. Since the largest correlation coefficient is still small. There almost no relation. In other words, user vector almost learnt nothing from the user age.



Similar to user age, the largest correlation coefficient is 0.1463. Uncorrelated. I used 0 to replace male and 1 for female. Plot of my result is as follows.



Largest correlation coefficient of item vector and release year is 0.1853. Uncorrelated.



3. User information and movie information can be used to build the user profile or movie profile, which include some basic information of user and movie. This will be used to calculate the user's or movie's similarity according to the profile. Then we can see if user A is similar to user C. If they are similar, then they are called 'neighbor' in the recommendation model. Some items are recommended to the current user based on the preferences of the "neighbor" user group, and the user's favorite item. We can recommend the similar movie to the similar user according to these information.