Recommendation System

Group 6

CONTENTS

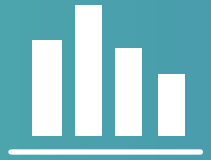
Dataset

Algorithm: ALS

Regularization:
Temporal
Dynamic

Post-processing:
KNN VS Kernel
Ridge
Regression

Result&Evaluation



Dataset

Data

- ✓ Data used: rating.csv
- ✓ Subset: select the number of movies greater than 5
- ✓ Data description: 610 users 3268 movies
- ✓ Add time-bins: 15 bins
- ✓ Split data
  - Train: each user, movie and time-bin appears at least once
  - Test

Algorithm

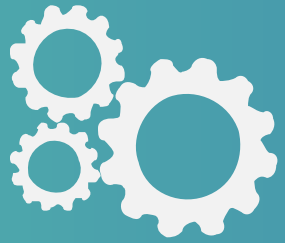
Alternating Least Square

Alternating Least Square

- Basic ALS objective function:

$$min \sum_{(u,i)\in\kappa} (r_{ui} - p_u^T q_i)^2 + \lambda(\|p_u\|^2 + \|q_i\|^2)$$

q: movie matrix p: user matrix



Regularization

Temporal Dynamic

Add Temporal Dynamic

- Objective function:

$$\min_{u,i,t} \sum_{(u,i)\in\kappa} (r_{ui}(t) - \mu - b_u - b_i - b_{i,Bin(t)} - p_u^T q_i)^2 + \lambda(b_u^2 + b_i^2 + b_{i,Bin(t)}^2 + \|p_u\|^2 + \|q_i\|^2)$$

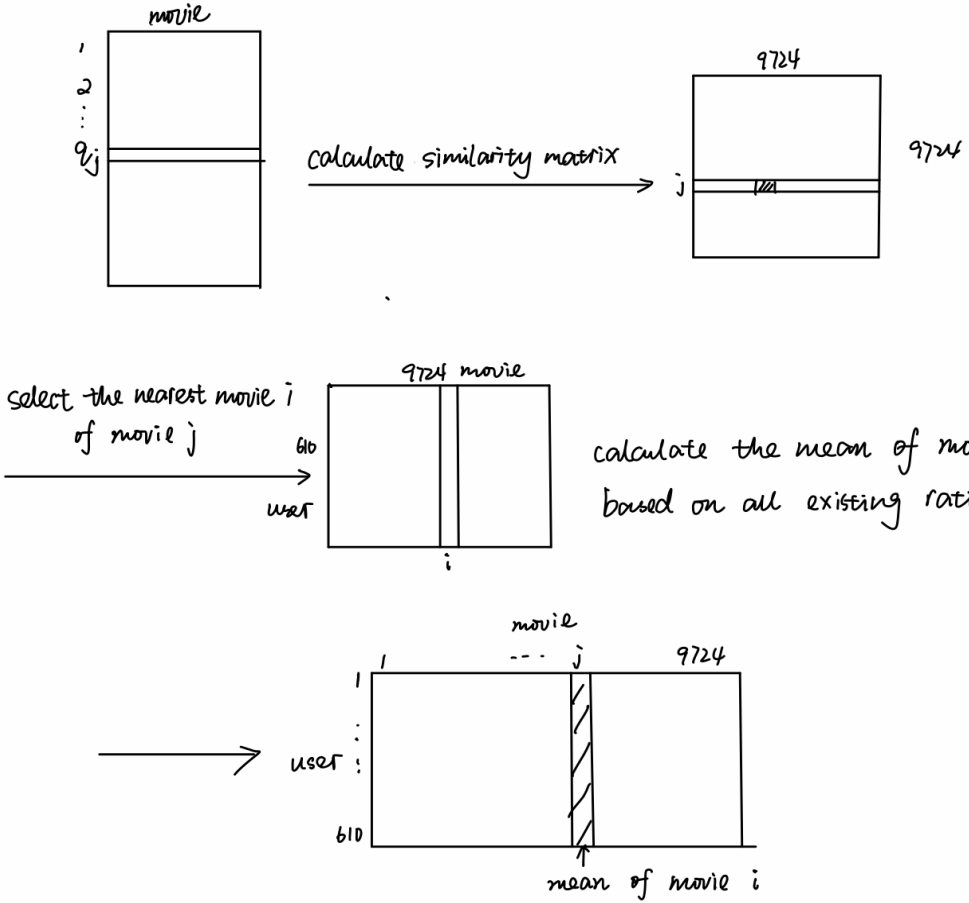
- stationary part: b_i dynamic part: $b_{i,Bin(t)}$
- Use ALS method to minimize the objective function
- parameters: b_u b_i $b_{i,Bin(t)}$ p q
- $\hat{r}_{ui}(t) = \mu + b_u + b_i + b_{i,Bin(t)} + p_u^T q_i$

Post-processing

KNN VS Kernel Ridge Regression

KNN

Goal: Improve accuracy



Kernel Ridge Regression

Goal: Improve accuracy

Ridge Regression

$$\hat{\beta}_i = (X^T X + \lambda I)^{-1} X^T y_i$$
$$\hat{y}_i = \hat{\beta}_i \mathrm{X}$$

Kernel Ridge Regression

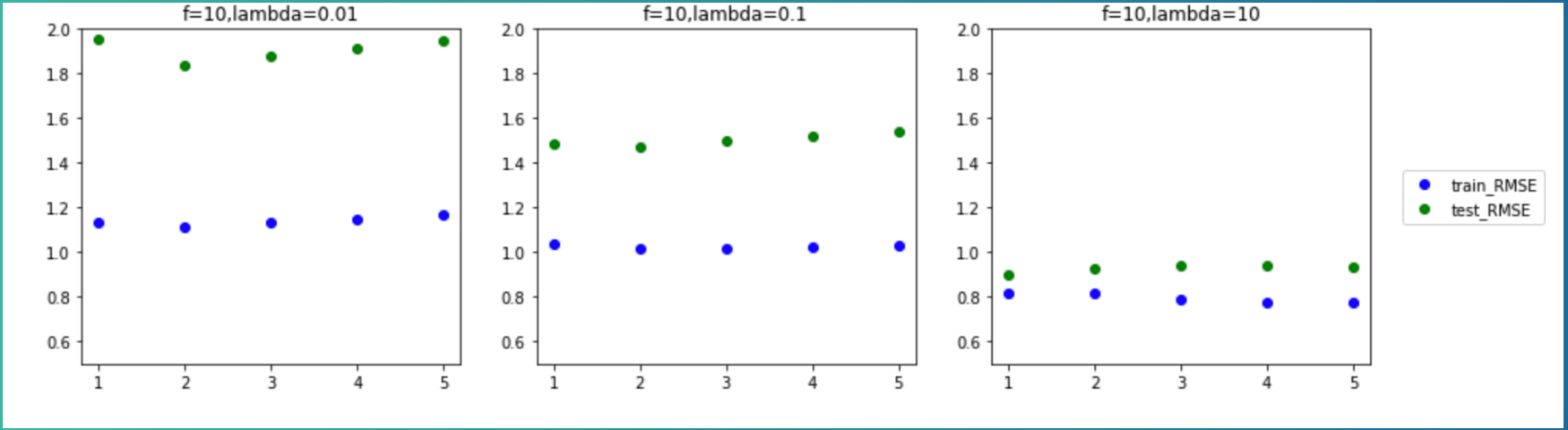
$$\hat{y}_i = K(x_i^{\mathrm{T}}, X)(K(X, X) + \lambda I)^{-1} y$$

Tune parameters using cross validation

Result&Evaluation

Result&Evaluation

RMSE for ALS+temporal dynamic



Result&Evaluation

Evaluation: RMSE

$$Regression\ fucntion\ for\ KNN: y - 3.542 = -0.038 + 6.564pq + 1.265b_i + b_{i,bint(t)} + 1.003b_u - 0.00034KNN$$

$$Regression\ fucntion\ for\ KRR: y - 3.542 = -0.04 + 6.565pq + 1.264b_i + b_{i,bint(t)} + 1.0038b_u - 0.000314KRR$$

RMSE	Train	test
KNN	0.9000936	0.921986
KRR	0.9000965	0.921987

Thank You

Team Members:

Thomson Batidzirai

Sen Dai

Jie Jin

Jiyuan Liu

Qiuyu Ruan

Xiyi Yan