FYP JC2104

Presentation

Term 2

Imsong Jeon 1155087995

25 April 2022

1. Introduction
2. Recommendation System
3. Implementation
4. Experiments and Results
5. Conclusion

Introduction

Recommendation System

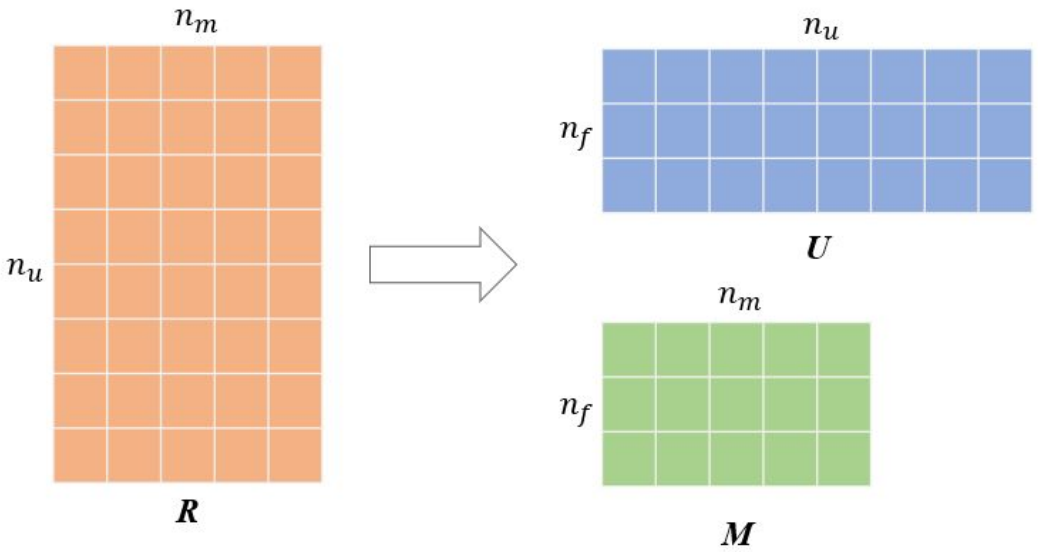
Recommendation System

- Collaborative filtering

user id \ item id	1	2	3	4	5
1	3	?	1	1	?
2	?	?	?	?	4
3	1	?	5	?	?
4	?	?	?	?	?
5	?	2	?	?	5
6	5	?	?	?	?
7	?	?	?	?	4
8	?	?	?	?	?

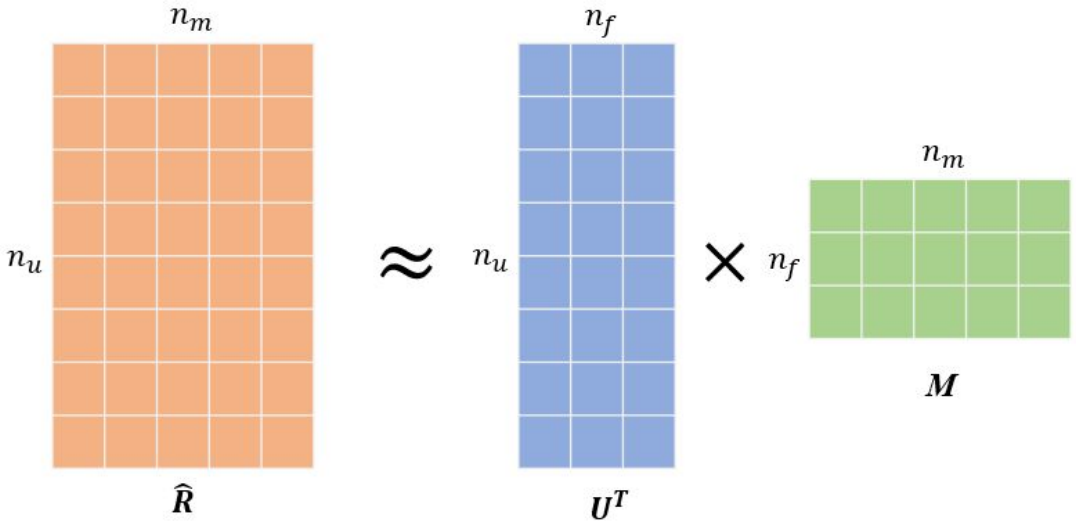
Recommendation System

- Latent factor model



Recommendation System

- Latent factor model



$$\hat{r}_{um} = p_u^T \cdot q_m$$

Recommendation System

- Loss function for Optimizing feature vectors *U* and *M*

$$f(U,M) = \min_{U,M} \sum_{r_{ui} \in R} (r_{um} - p_u^T q_m)^2$$

$$f(U,M) = \min_{U,M} \sum_{r_{ui} \in R} (r_{ui} - p_u q_i)^2 + \lambda \left(\sum_u n_{user_u} \|p_u\|^2 + \sum_i n_{movie_m} \|q_i\|^2 \right)$$

- Alternating Least Square

$$p_u = \left(\sum_{r_{um} \epsilon r_{u*}} q_m q_m^T + \lambda n_{user_u} \right)^{-1} \sum_{r_{um} \epsilon r_{u*}} q_m r_{um}^T = \left(M_u M_u^T + \lambda n_{user_u} I_{nf} \right)^{-1} \left(M_u R_{u_m} \right)$$

$$q_m = \left(\sum_{r_{um} \epsilon r_{*m}} p_u p_u^T + \lambda n_{movie_m} \right)^{-1} \sum_{r_{um} \epsilon r_{*m}} p_u r_{um} = \left(U_m U_m^T + \lambda n_{movies_m} I_{nf} \right)^{-1} \left(U_m R_{m_u} \right)$$

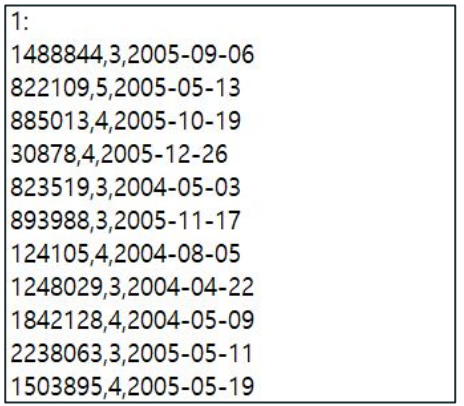
Recommendation System

- Netflix Prize Dataset

  100,480,507 ratings (1 - 5); 1.2%

  480,189 users

  17,770 movies

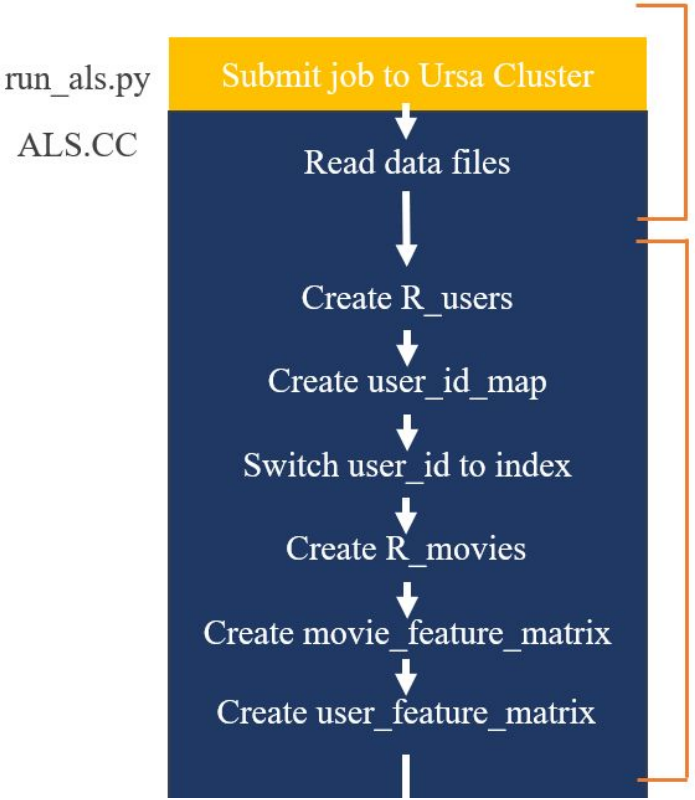


Implementation

- Data Reading
- Data Transformation
- Optimization
- Prediction and Recommendation

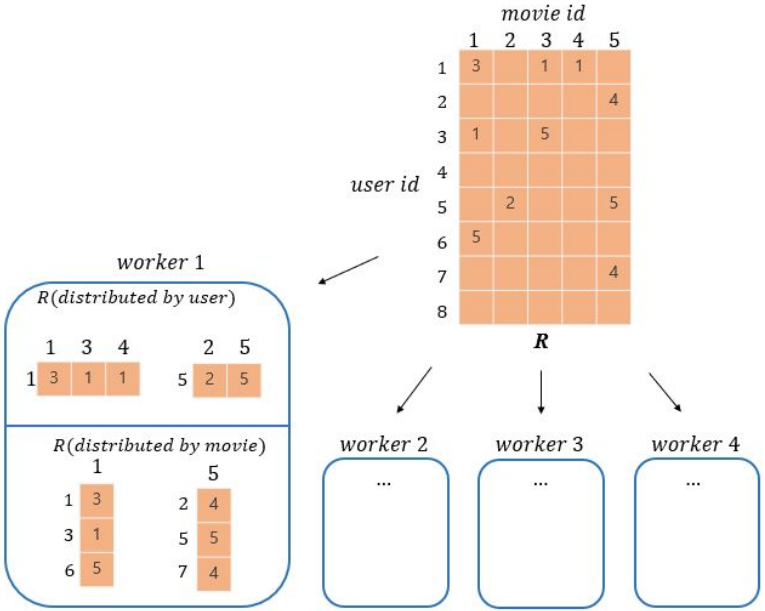
Implementation

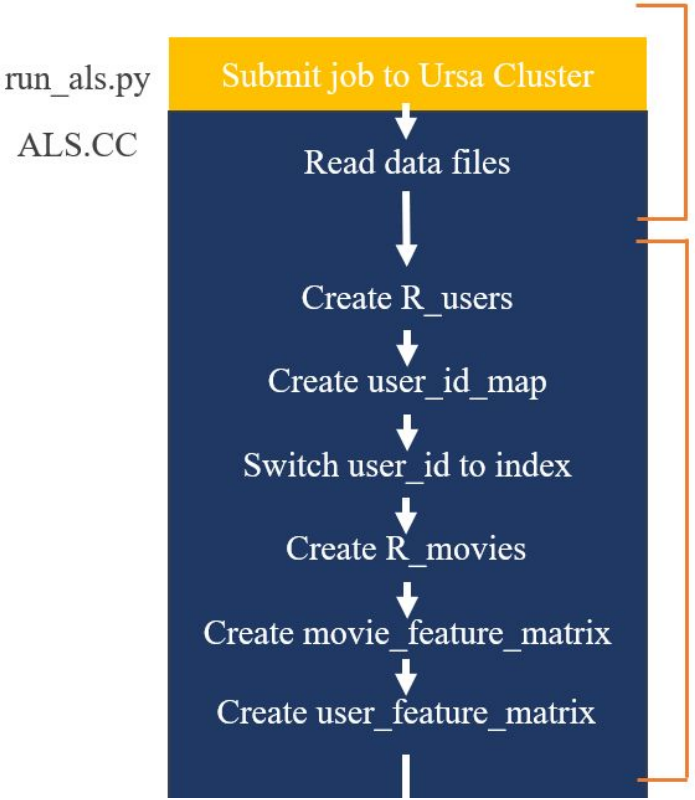
- Data Reading
  - n_job_processes, parallelism, nf, lambda, iterations, seed, and data file path



Implementation

- Data Transformation





Implementation

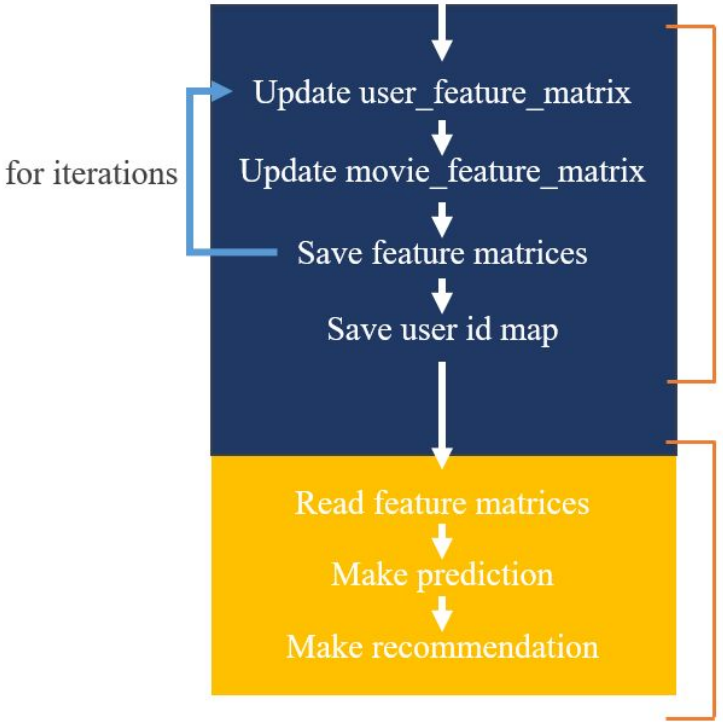
- Optimization

$$p_u = \left(M_u M_u^T + \lambda n_{user_u} I_{nf}\right)^{-1} \left(M_u R_{u_m}\right)$$

$$q_m = \left(U_m U_m^T + \lambda n_{movies_m} I_{nf}\right)^{-1} \left(U_m R_{m_u}\right)$$

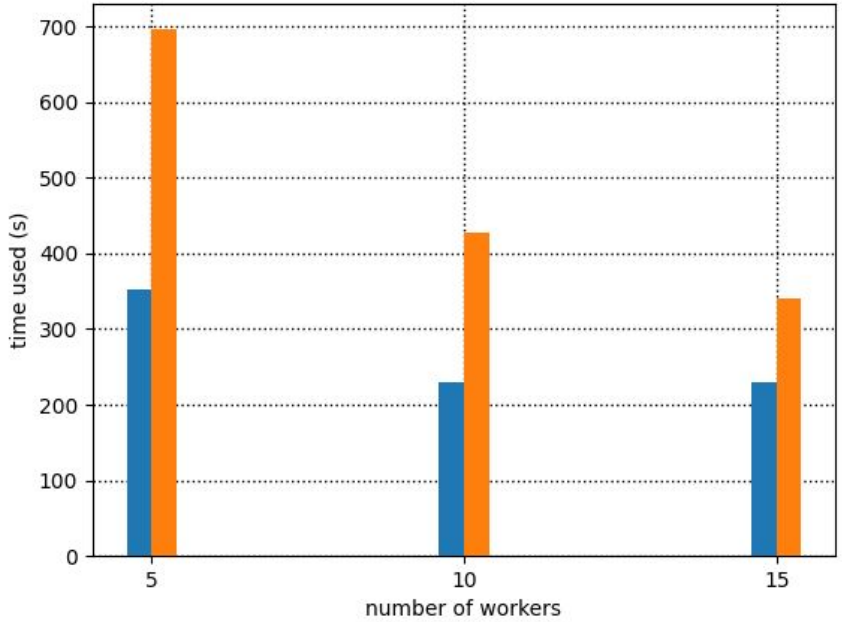
- Prediction and Recommendation

$$\hat{r}_{um} = p_u^T \cdot q_m$$



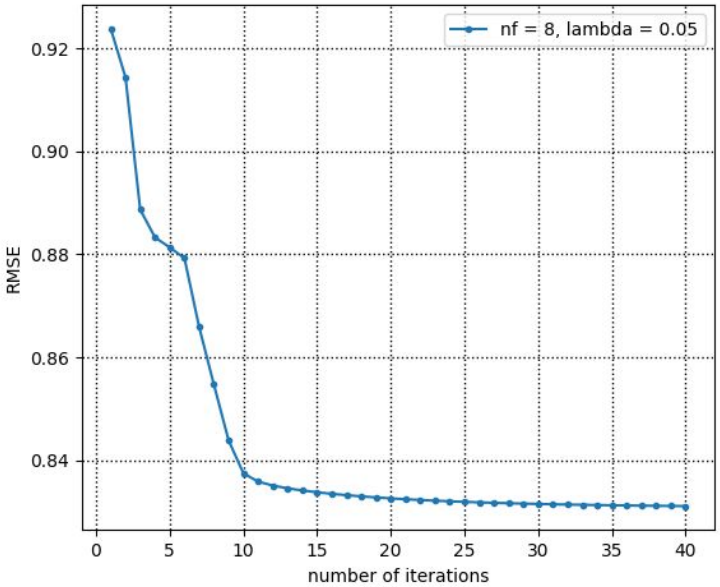
Experiments and Results

- Number of workers(lambda=0.05,iterations=20)



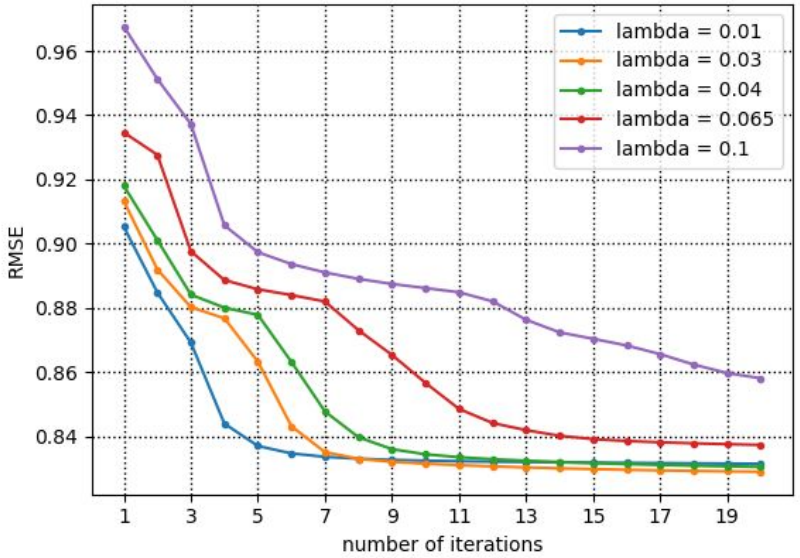
Experiments and Results

- Number of iterations



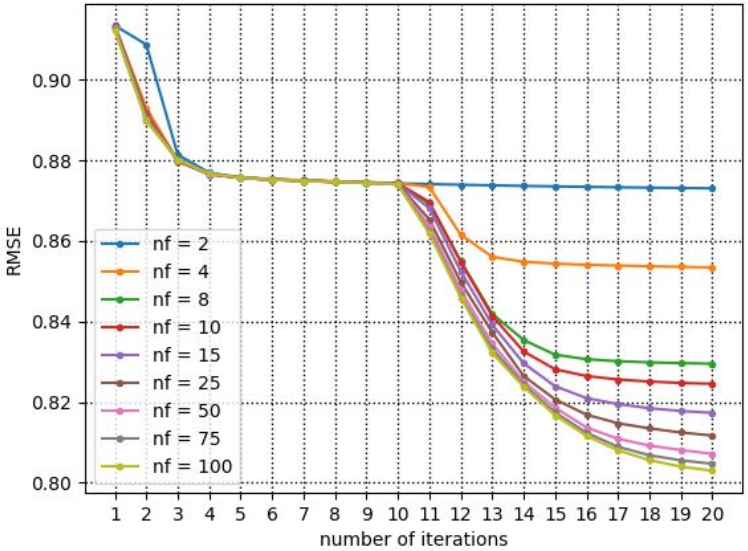
Experiments and Results

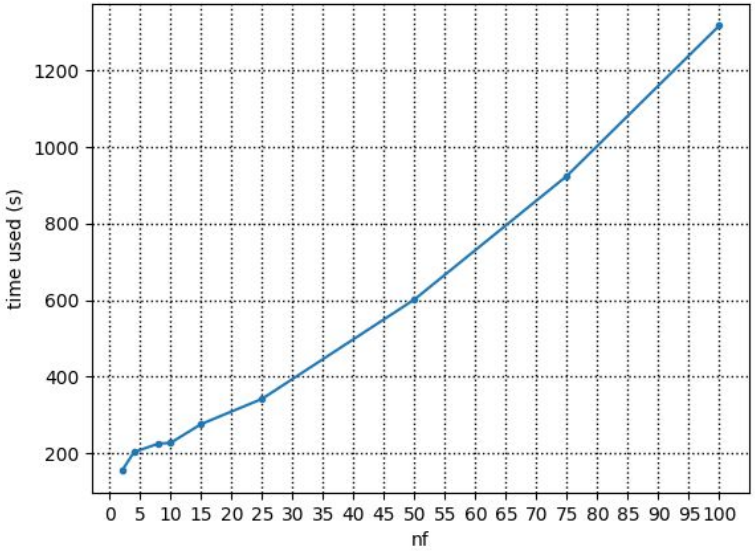
- Lambda (nf=8, iterations=20)



Experiments and Results

- nf (lambda=0.03,iterations=20)





Experiments and Results

- nf =200,lambda=0.03,iterations=25
  - RMSE: 0.794831436337
  - time used: 5426531ms (about 1.5 hour)

Experiments and Results

- User ID: 1583391

- 10 5-Rated Watched of Movies
  - Independence Day(Action, Adventure, Science Fiction)
  - Jurassic Park(Adventure, Science Fiction)
  - Spider-Man(Fantasy, Action)
  - The Bourne Identity(Thriller, Action, Drama)
  - The Italian Job(Action, Crime)
  - The Matrix(Action, Science Fiction)
  - The Patriot(Action, Thriller)
  - Stargate SG-1: Season 5, 6, 7(Sci-Fi & Fantasy, Action & Adventure, Mystery)
  - Saving Private Ryan(Drama, History, War)
  - Band of Brothers(Drama, War & Politics)

- Top 7 Recommended Movies
  1. Braveheart(Action, Drama, History, War)
  2. Lord of the Rings: The Return of the King: Extended Edition(Adventure, Fantasy, Action)
  3. The Lord of the Rings: The Fellowship of the Ring: Extended Edition(Adventure, Fantasy, Action)
  4. Lord of the Rings: The Two Towers: Extended Edition(Adventure, Fantasy, Action)
  5. Gladiator: Extended Edition(Action, Drama, Adventure)
  6. Lord of the Rings: The Fellowship of the Ring(Adventure, Fantasy, Action)
  7. Stargate SG-1: Season 4(Sci-Fi & Fantasy, Action & Adventure, Mystery)

Conclusion

Thank you!