

Explanation Adaptation for Hybrid Multimedia Recommendation System

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Introduction

- History of Recommendation System
- Interaction Between People and Internet
- My Contributions



History of Recommendation System

- earliest days, information was scarce.
- people or companies have gathered kinds of information on some websites
- search through the category navigation.



History of Recommendation System

- increasing amount of information
- search engine

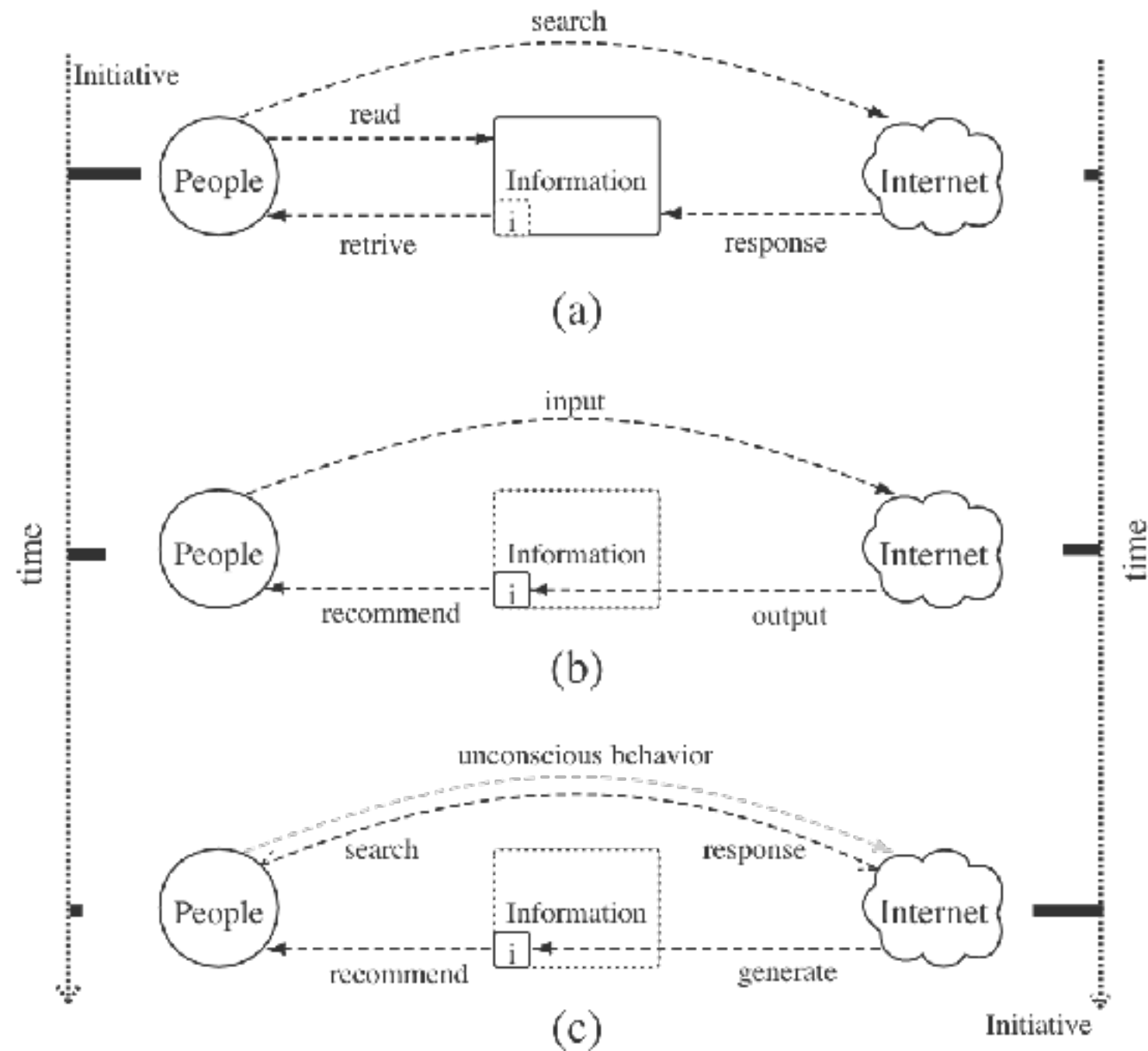


History of Recommendation System

- communication technology and data science
- Recommendation System



Interaction Between People and Internet



Explainable Recommendation

- When: time-aware recommendation
- What: application-aware recommendation
- Who: social recommendation
- Where: location-based recommendation
- Why: explainable recommendation



Task

Explanation Adaptation for Hybrid Multimedia Recommendation System



Task

Explanation Adaptation for Hybrid Multimedia **Recommendation System**



Task

Explanation Adaptation for Hybrid Multimedia Recommendation System



Task

Explanation Adaptation for Hybrid Multimedia Recommendation System



Task

Explanation Adaptation for Hybrid Multimedia Recommendation System

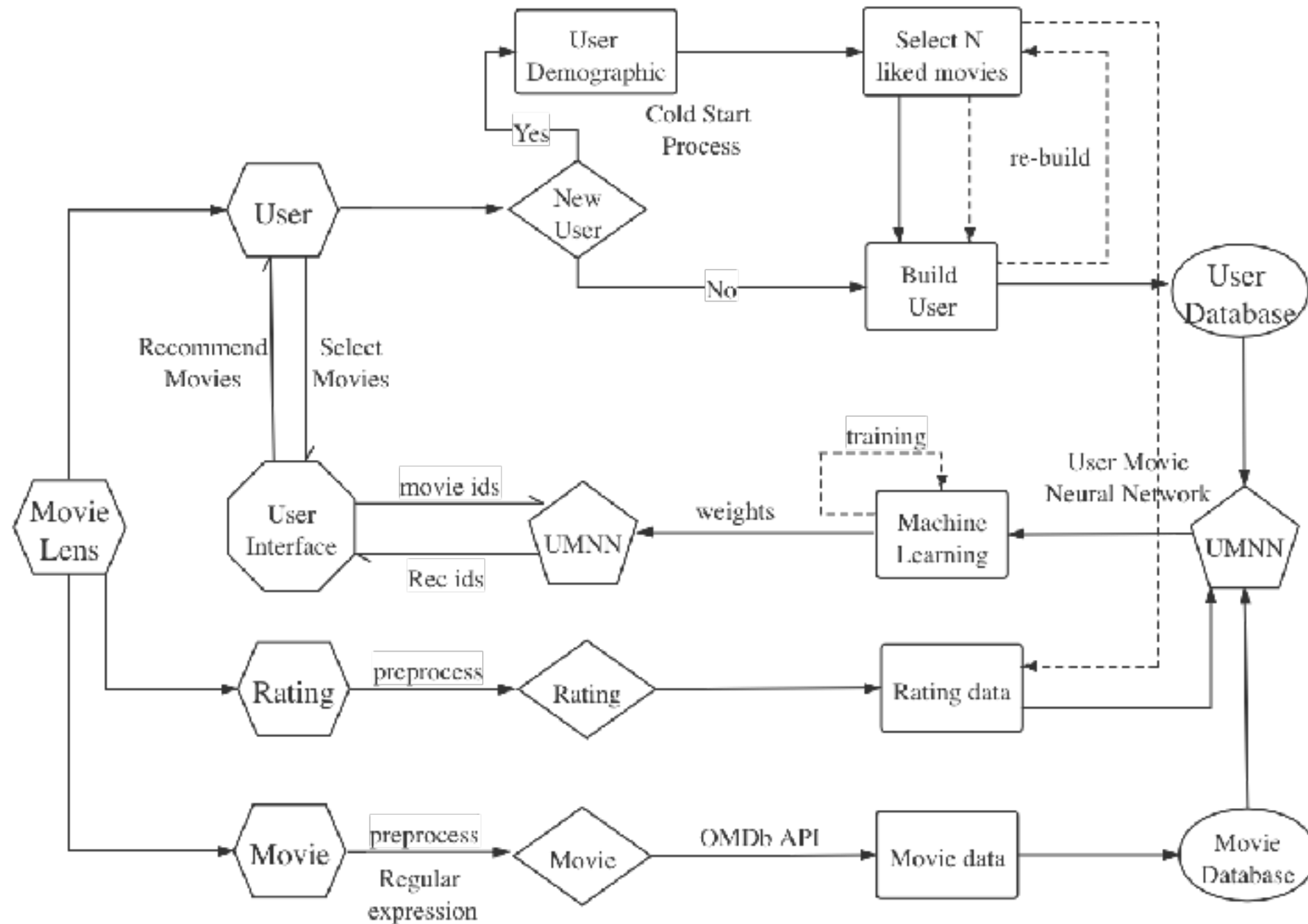


Steps

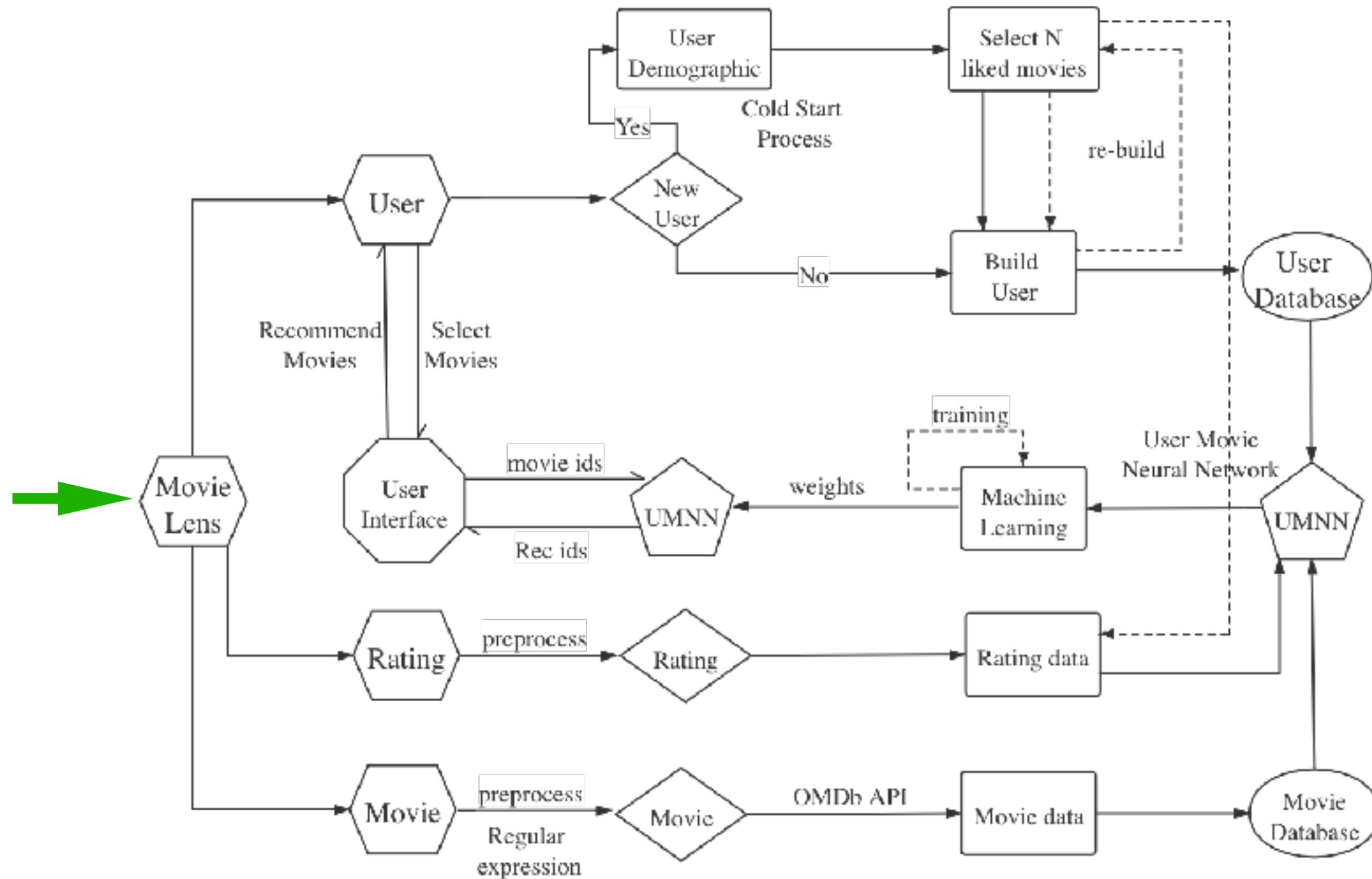
- build a recommendation system
- combined different recommendation methods
- make the recommend system explainable
- adapt the explanation



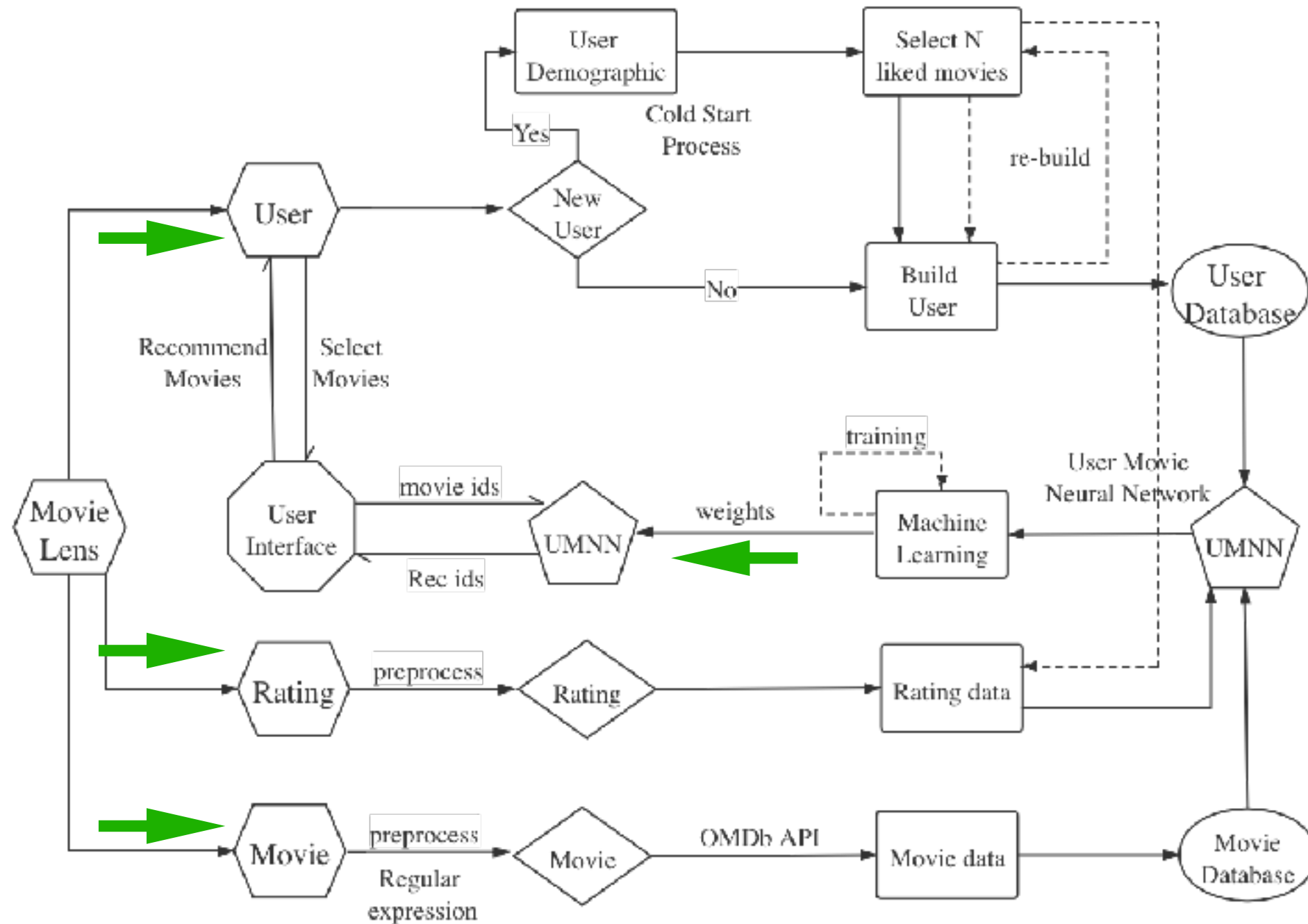
System Architecture Diagram



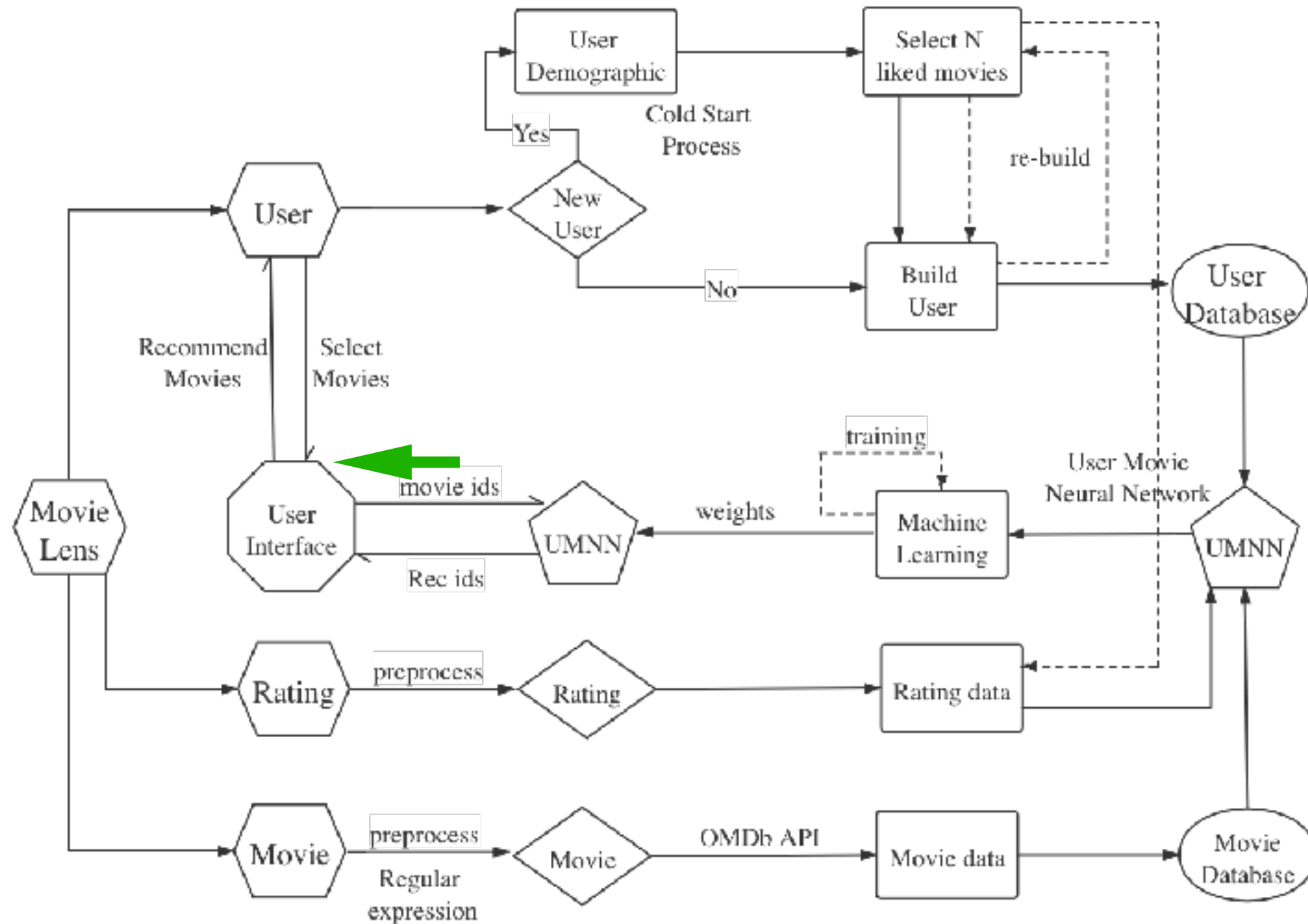
System Architecture Diagram



System Architecture Diagram

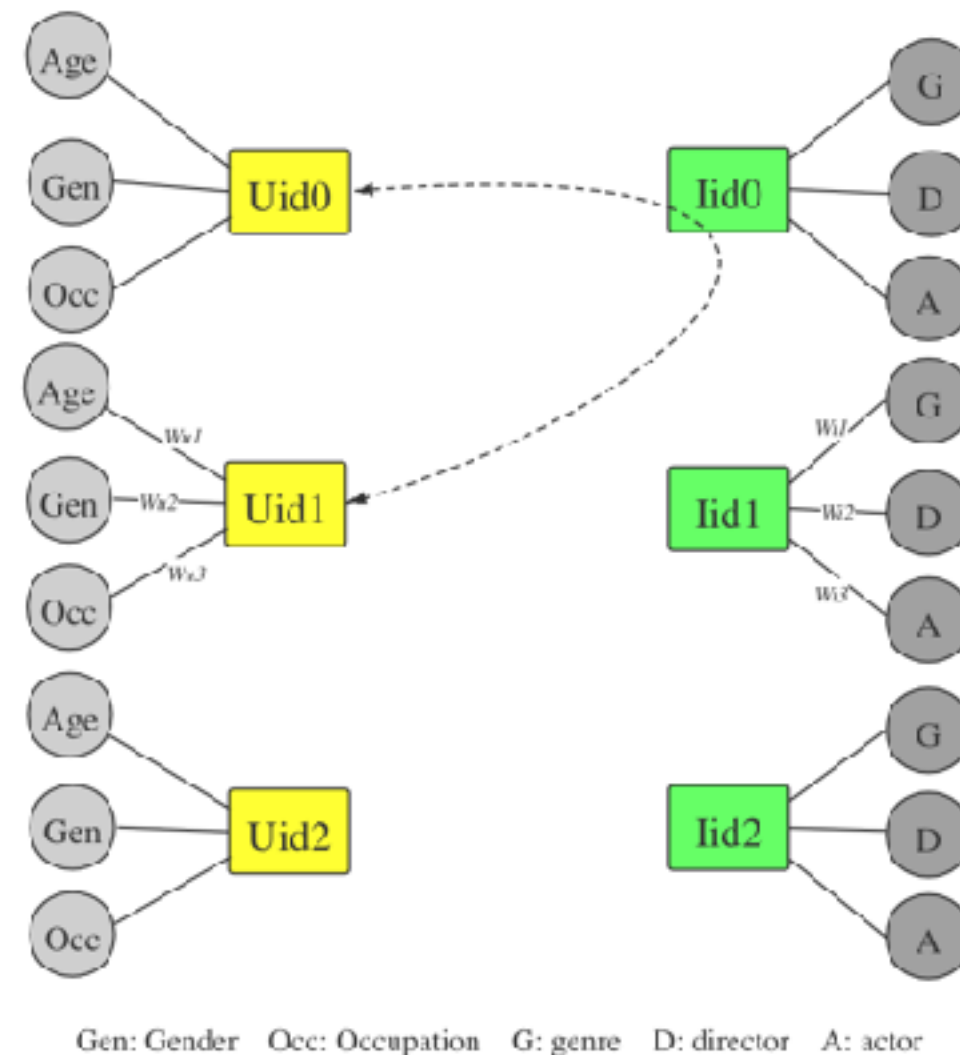


System Architecture Diagram



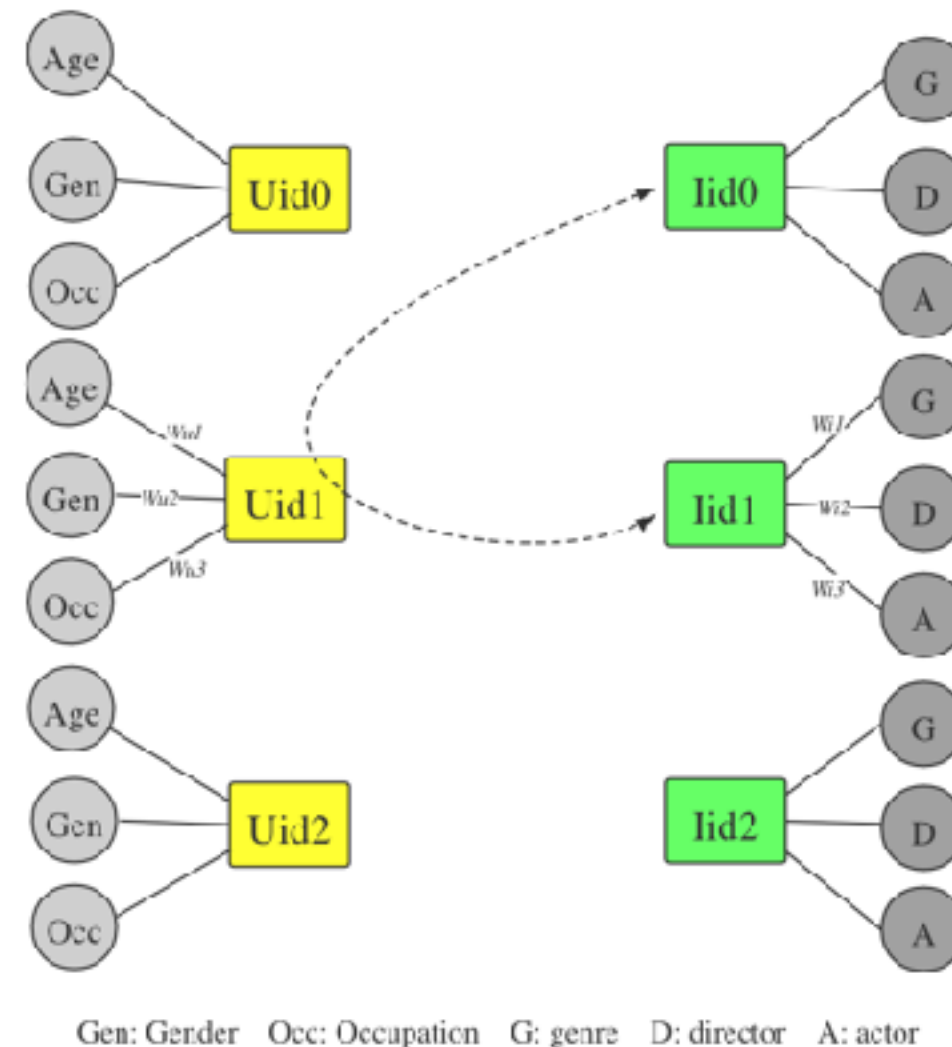
Recommendation Style

- Popularity-Based
- User-Based
- Item-Based
- Demographic-Based
- Content-Based



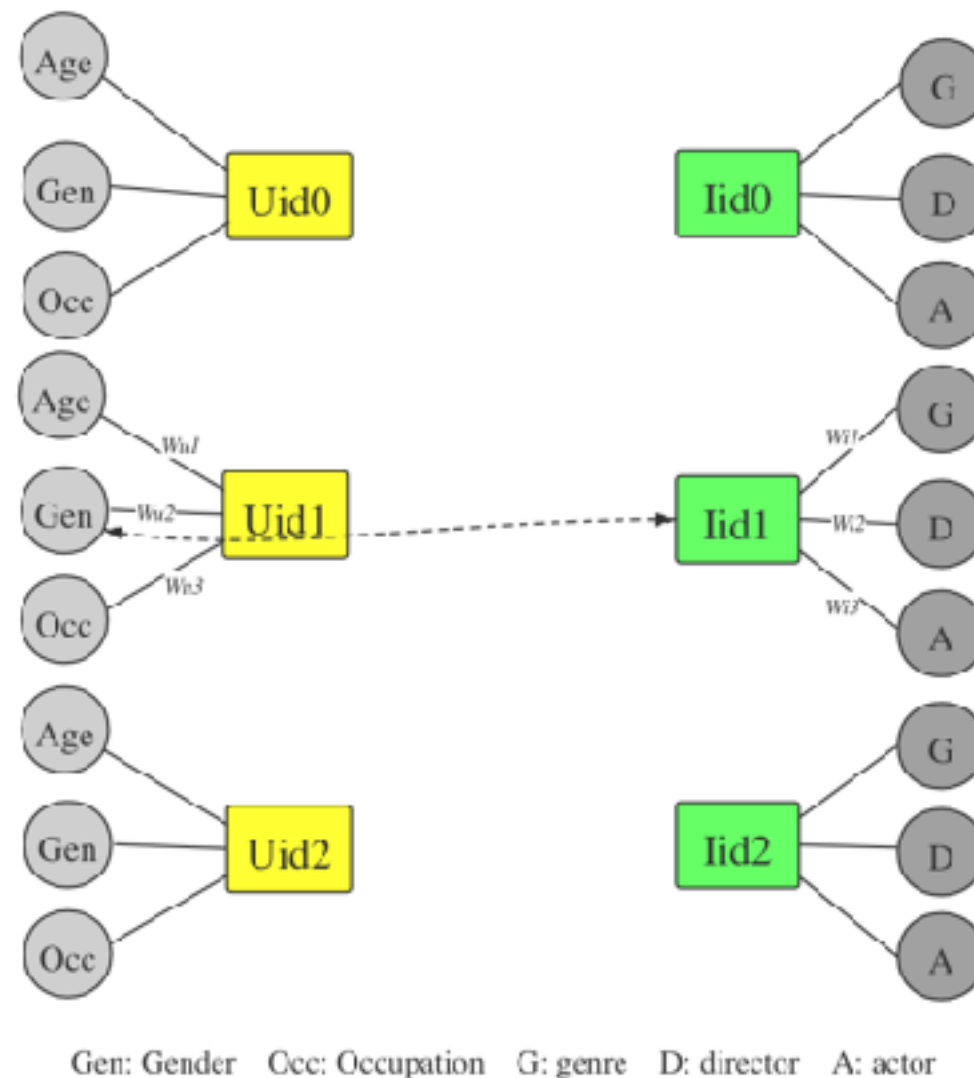
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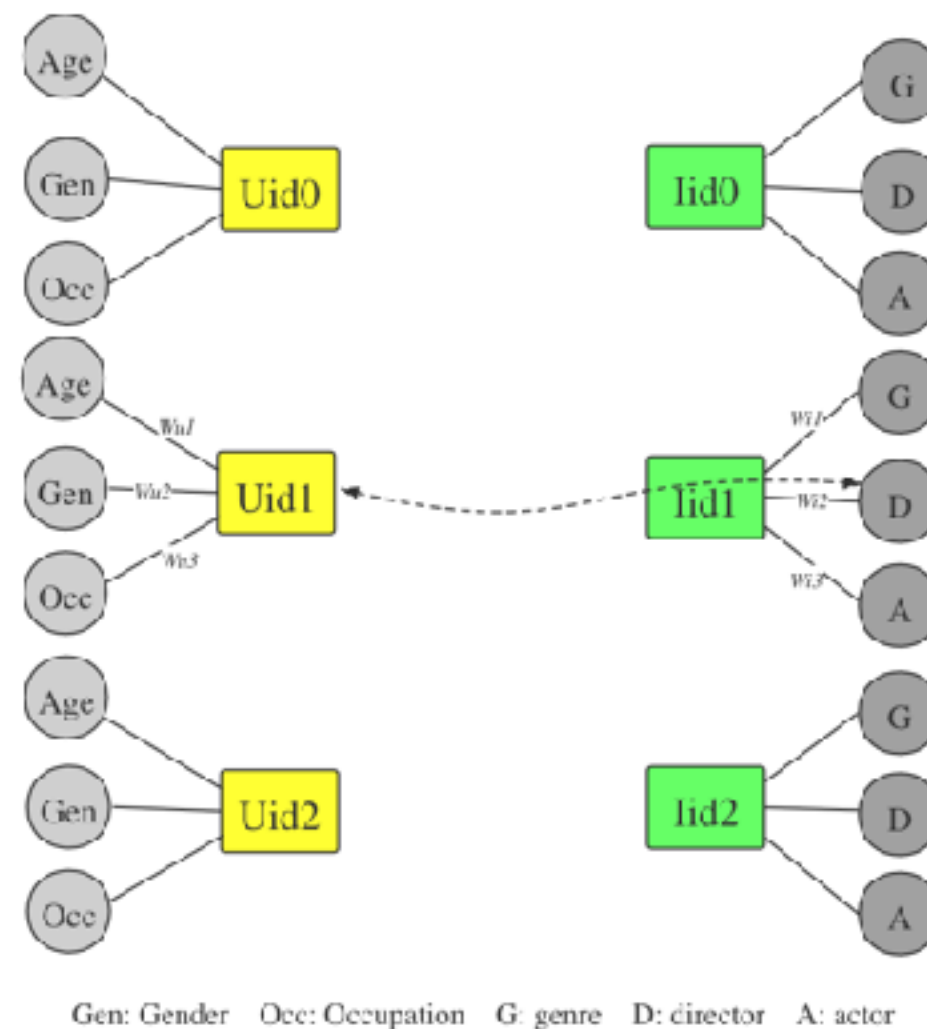
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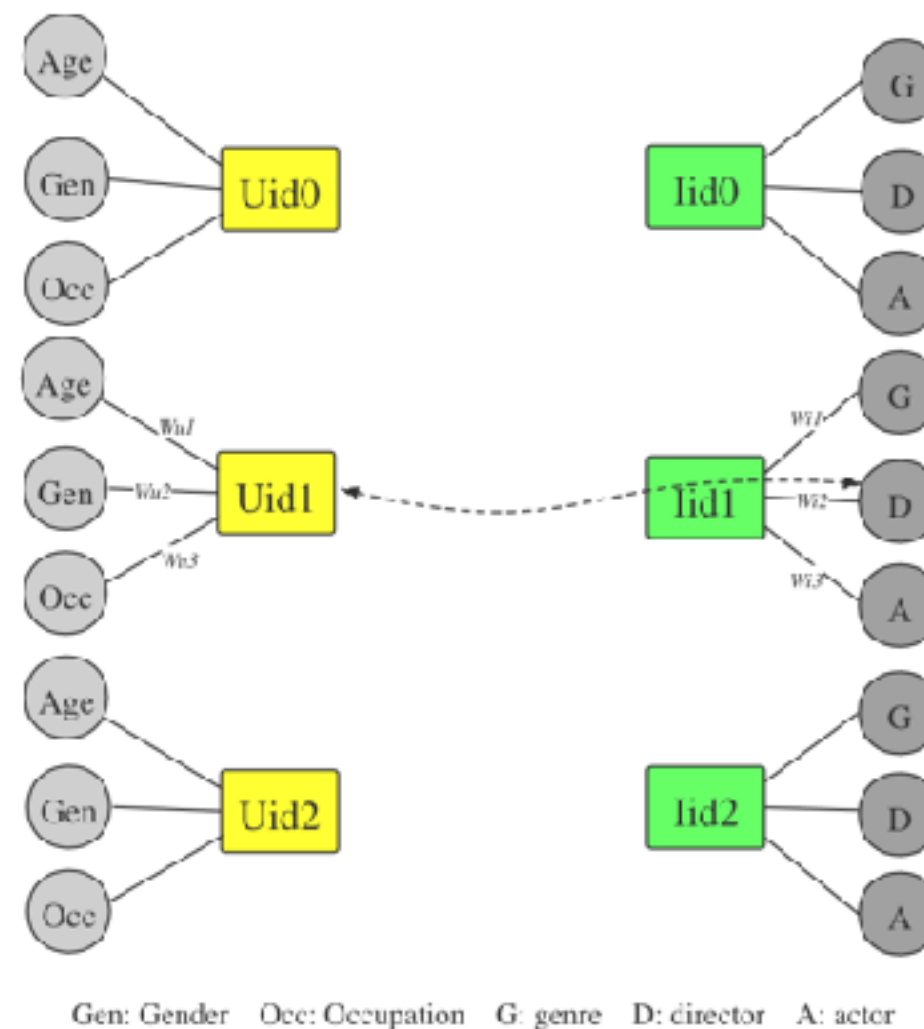
Recommendation Style

- Popularity-Based
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- Content-Based



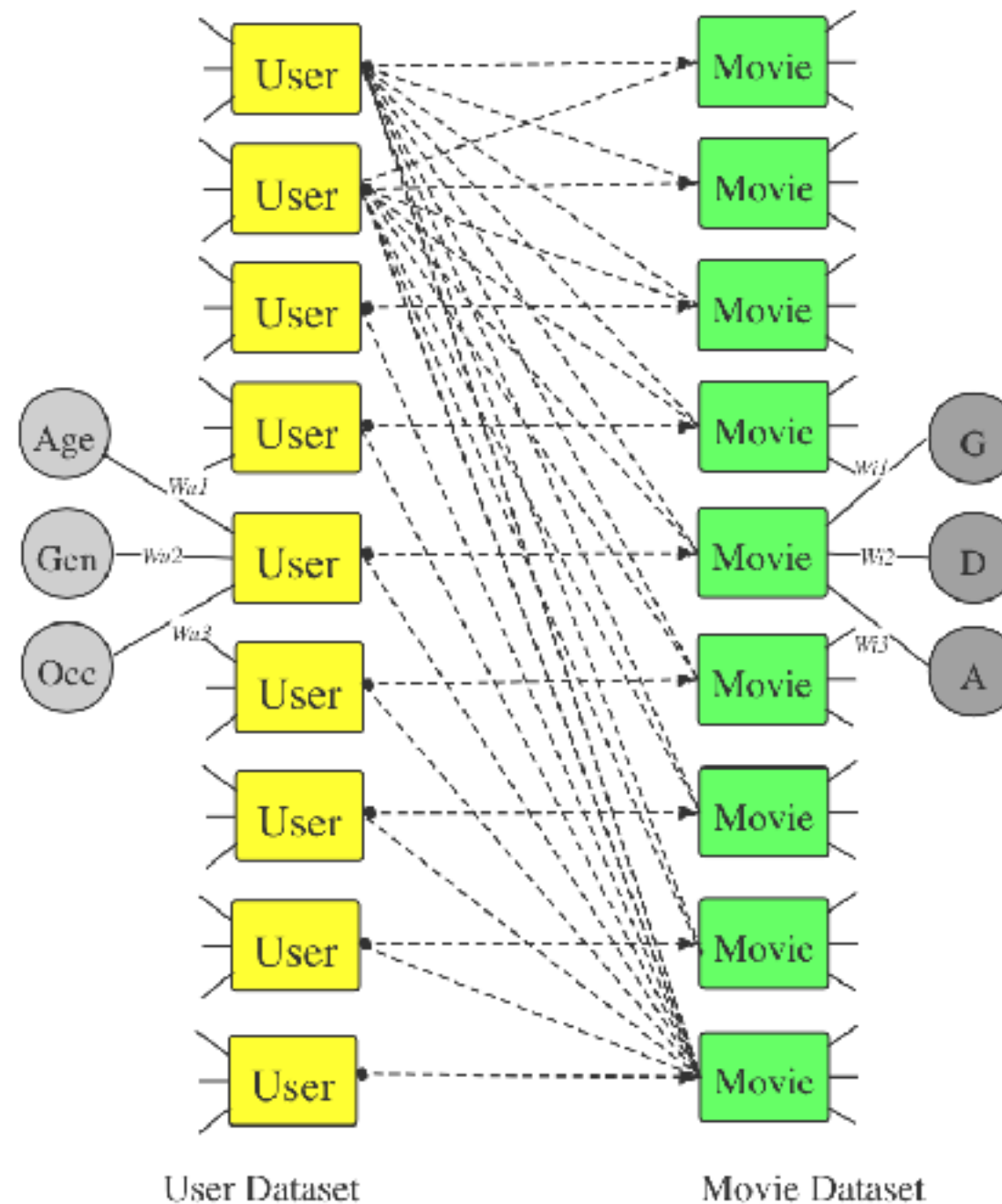
Hybrid Recommendation

- Popularity-Based
- User-Based
- Item-Based
- Demographic-Based
- Content-Based



Hybrid Recommendation

- Path-aware Attention Graph Neural Network



Hybrid Recommendation

- Path-aware Attention Graph Neural Network

Algorithm 3: Path Generated Algorithm

Result:

$$P_{v_1} = \begin{bmatrix} \text{genre} & \text{actor} & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots \\ I_1 & I_2 & I_k & \dots & \dots \\ V_1 & V_1 & V_1 & V_1 & \dots \end{bmatrix} \quad L_P \times N_P$$

L_P : Length of Path

N_P : Count of Path

$$\begin{cases} p_1 = f_{\text{path-encoder}}(V_{\text{genres}}, V_{I_1}, V_1) \\ \dots \\ \dots \\ p_{N_P} = f_{\text{path-encoder}}(V_{\text{director}}, V_{I_N}, V_1) \end{cases}$$

$$att_{p_i} = \frac{e^{P_i \cdot A^T}}{e^{\sigma(p_1 A^T)} + e^{\sigma(p_2 A^T)} + \dots + e^{\sigma(p_{N_P} A^T)}}$$

$$\mathbf{h}_{v_1} = \sum_{i=1}^{N_P} att_i \cdot P_i$$

$$\hat{r} = \mathbf{h}_{\text{user}} \cdot \mathbf{h}_{\text{att}}^T$$



Hybrid Recommendation

- Path-aware Attention Graph Neural Network

UserNode–MovieNode–UserNode
MovieNode–UserNode–MovieNode
DemographicFeature–UserNode–MovieNode
UserNode–MovieNode–ContentFeature

Table 3.1: Four connection methods

- find a way to represent connection methods



Recommendation Style	Explanation Template	Data Template	Example
user-based	(uid_1) is recommended with (iid_1) because (uid_2) is similar with (uid_1) and (uid_2) likes (iid_1).	Uid{uid-1}-Iid{iid1}- Uid{uid2}	You are recommended with "Resurrection Man (1998)" because user 5183 is similar with you and user 5183 likes this movie.
item-based	(iid_1) is recommended to (uid_1) because (iid_1) that is similar with (iid_2) which (uid_1) liked before.	Iid{iid1}-Uid{uid-1}- Iid{iid2}	"Woo (1998)" is recommended to you because that is similar with "Ice Storm (1997)" which you liked before.
demographic-based	(iid_1) is recommended to (uid_1) because (uid_1)'s (DemographicFeature-Type) is (DemographicFeatureValue).	Iid{iid1}-Uid{uid-1}- DFTType{type}- DFValue{value}	"12 Monkeys (1995)" is recommended to you because your occupation is academic/educator.
content-based	content-based: (uid_1) is recommend with (iid_1) because (iid_1)'s (Content-FeatureType) is (Content-FeatureValue)	Uid{uid-1}-Iid{iid}- CFTType{type}- CFValue{value}	You are recommended with "Resurrection Man (1998)" because the genre of the movie is Crime.

Table 3.2: Explanation Template



Recommendation Explanation Adaptation Strategy

- graphical adaptation
- proportion adaptation



Recommendation Explanation Adaptation Strategy

- graphical adaptation
- proportion adaptation



Recommendation Explanation Adaptation Strategy

- graphical adaptation
- proportion adaptation



Algorithm 2: Adaptation Rule Algorithm

Result: propotion

$$score(Sum) = \frac{\sum_{i=0}^n rating_i}{n}$$

$$score(IUI) = \frac{\sum_{i \in IUI} rating_i}{|IUI|}$$

$$score(UIU) = \frac{\sum_{i \in UIU} rating_i}{|UIU|}$$

$$score(IUDD) = \frac{\sum_{i \in IUDD} rating_i}{|IUDD|}$$

$$score(UICC) = \frac{\sum_{i \in UICC} rating_i}{|UICC|}$$

while

$count_{sum} == 10$

do

$count_{IUI} += func_{propotion}(score(IUI) - score(sum))$

$count_{UIU} += func_{propotion}(score(UIU) - score(sum))$

$count_{IUDD} += func_{propotion}(score(IUDD) - score(sum))$

$count_{UICC} += func_{propotion}(score(UICC) - score(sum))$

if

$count_x < 0$

then

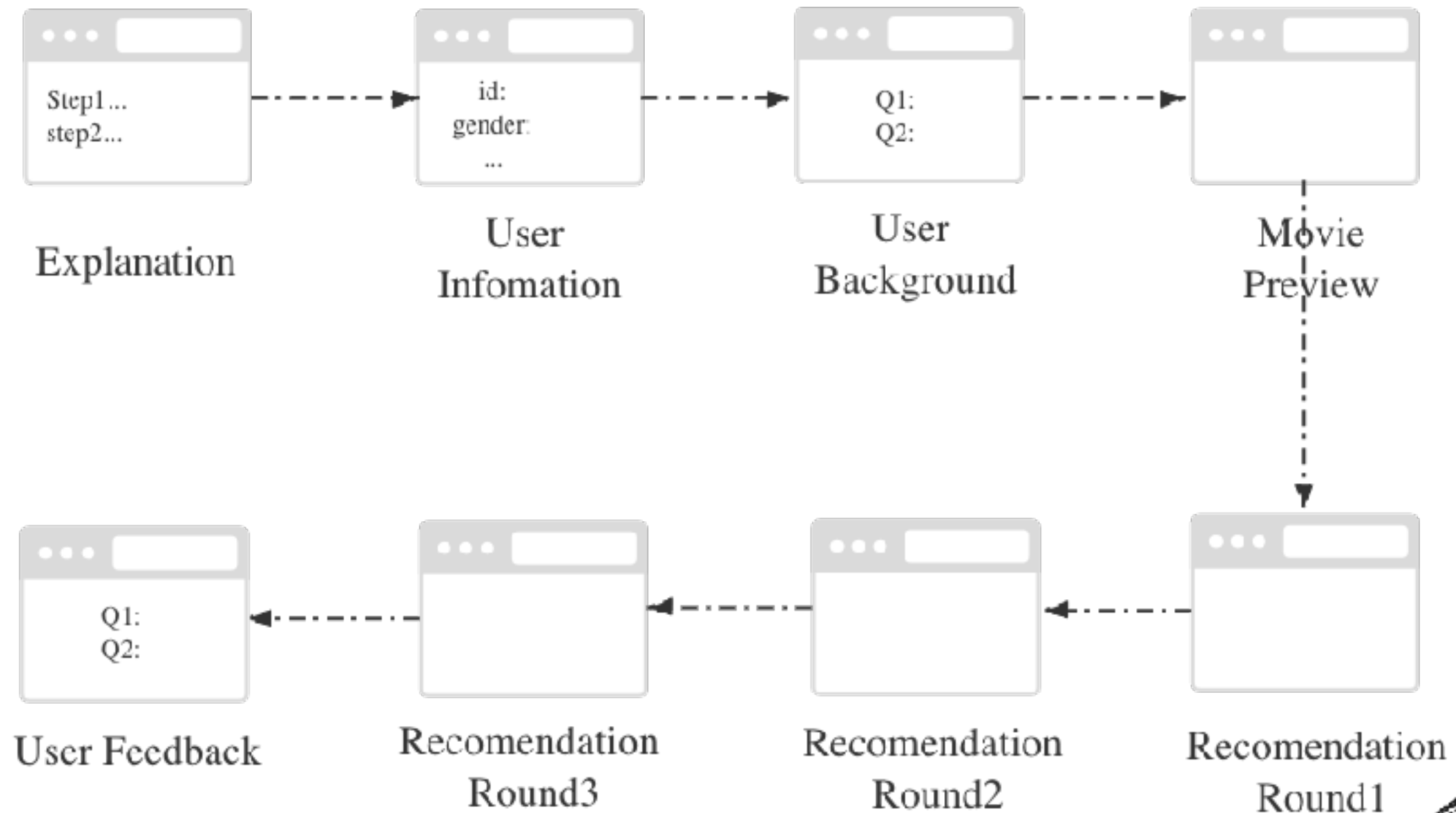
$count_x = 0$

end

end



System Prototype



System Prototype

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Some explanations about the User Study!

All your task is to use this movie recommendation system, just like using a simple software normally.

A simple process introduction:

1. **Building User Portraits:** We will give you a series of movie posters and names. You can click to select the movies you have watched from 6 options (selecting multiple, selecting none in 6 options and selecting all 6 options are allowed). Click the 'REFRESH' button to load the new 6 options. Repeat this selection process until you have selected a total of 10 movies.
2. **Recommendation Round One:** We will give you a series of recommendation movies and the explanations why they are recommended to you. You can click to select the movies you have watched and give a score for the explanations
4. **Recommendation Round Two:** Same with Recommendation Round One, but the new recommendation movies are based on your choices and scores in Recommendation Round One.
6. **Recommendation Round Three:** Same with Recommendation Round One and Two, but the new recommendation movies are based on your choices and scores in Recommendation Round Two.
8. **Feedback:** Your opinion about recommendation kind, number and ratio in the 3 test rounds (Confidence, Transparency, Satisfaction, Persuasiveness).



System Prototype

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Your ID:

Gender:

Age:

Occupation:



System Prototype

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1:Fully disagree, 2:Somewhat disagree, 3:Neutral, 4:Somewhat agree, 5:Fully Agree

I will watch one movie every ☐ 1 day ☐ 3 days ☐ 7 days ☐ 14 days ☐ 30 days

I will visit a movie recommendation website I think every ☐ 1 day ☐ 3 days ☐ 7 days ☐ 14 days ☐ 30 days

I know Recommendation System ☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5

I know Explainable Recommendation System. ☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5

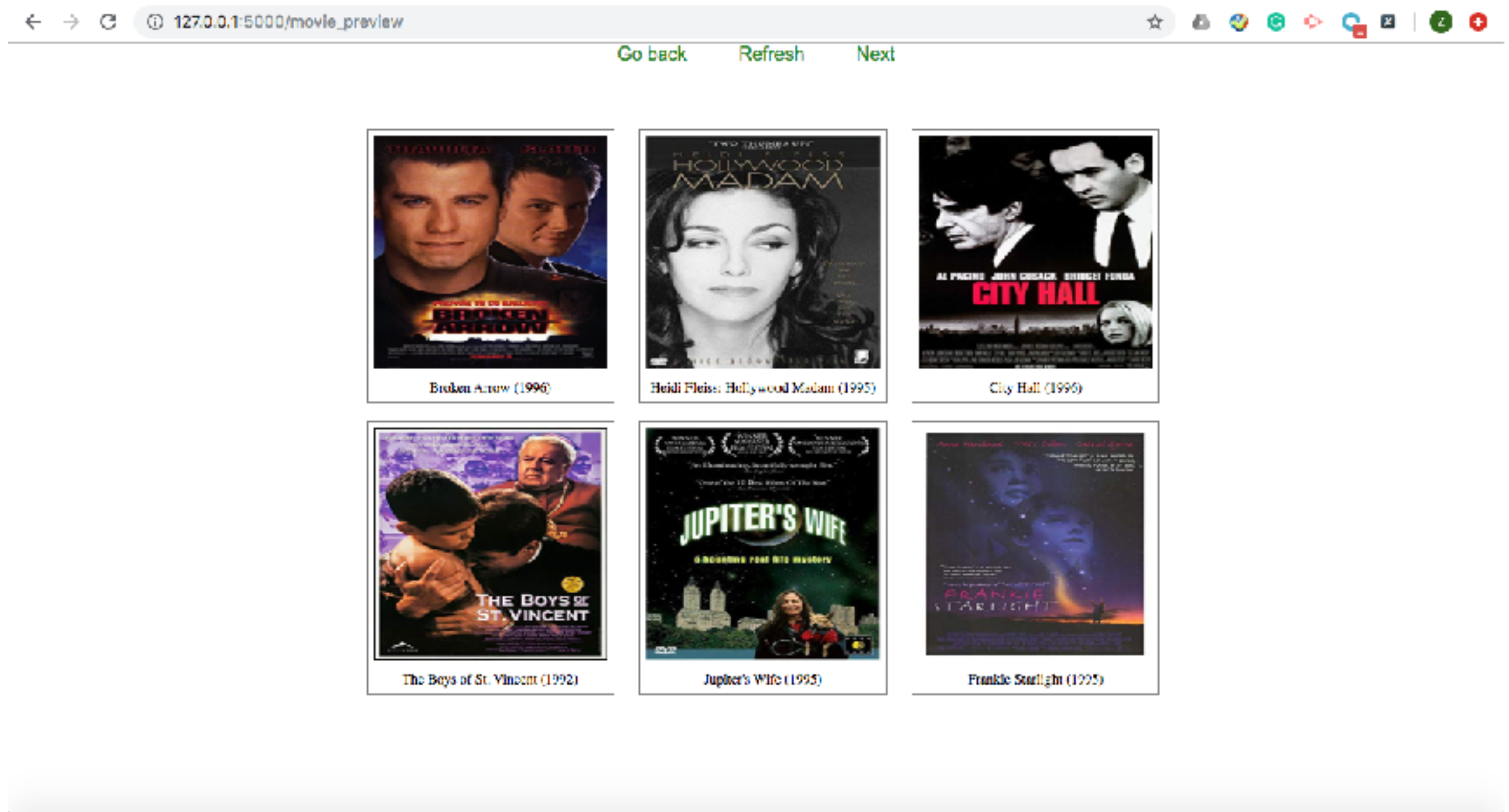
I will use a Recommend System once every ☐ 1 day ☐ 3 days ☐ 7 days ☐ 14 days ☐ 30 days

How would you describe your overall experience with Recommend System? ☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5

I hope that this recommendation system will recommended the right movies to me. ☐ 1 ☐ 2 ☒ 3 ☐ 4 ☐ 5



System Prototype



System Prototype

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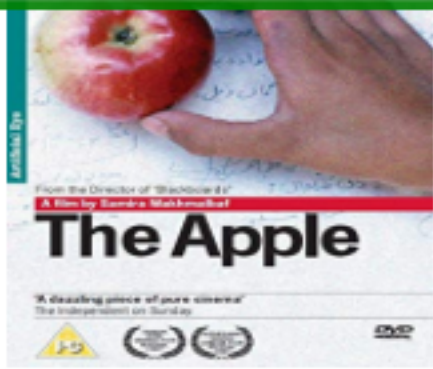

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Make the image selected if you would like to watch this movie, and rate our recommendation reasons(1-5 points)

<p>Maybe, Maybe Not (1994)</p> <p>You are recommended with "this movie" because user 5457 is similar with you and user 5457 likes this movie</p> <p>★☆☆☆☆</p>	<p>Band Wagon (1953)</p> <p>You are recommended with "this movie" because user 3475 is similar with you and user 3475 likes this movie</p> <p>★☆☆☆☆</p>	<p>Secret Agent (1995)</p> <p>You are recommended with "this movie" because user 998 is similar with you and user 998 likes this movie</p> <p>★★★★☆☆</p>	<p>Back to the Future (1985)</p> <p>You are recommended with "this movie" because user 1953 is similar with you and user 1953 likes this movie</p> <p>★★★★☆☆</p>	<p>Blood for Dracula (1974)</p> <p>You are recommended with "this movie" because user 5457 is similar with you and user 5457 likes this movie</p> <p>★☆☆☆☆</p>
<p>Face/Off (1997)</p> <p>You are recommended with "this movie" because user 3475 is similar with you and user 3475 likes this movie</p>	<p>Stag (1997)</p> <p>You are recommended with "this movie" because user 998 is similar with you and user 998 likes this movie</p>	<p>From Night III: The Last Kiss (1959)</p> <p>You are recommended with "this movie" because user 1953 is similar with you and user 1953 likes this movie</p>	<p>My Blue Heaven (1990)</p> <p>You are recommended with "this movie" because user 5626 is similar with you and user 5626 likes this movie</p>	<p>No Small Affair (1984)</p> <p>You are recommended with "this movie" because user 4457 is similar with you and user 4457 likes this movie</p>



System Prototype

<p>Aiqing wansui (1994)</p> <p>You are recommended with "this movie" because user 3389 is similar with you and user 3389 likes this movie</p> <p>☆☆☆☆</p>	<p>D3: The Mighty Ducks (1996)</p> <p>Gender: M Age: 25 Occupation:customer service Favorite Movies:['Haunting (1963)', 'Pleasantville (1998)', 'Coolie' (1989)', 'Runnings (1993)', 'My Life as a Dog (1985)', 'Fast Times at Ridgemont High (1982)', 'Mr. Jealousy (1997)']</p> <p>☆☆☆☆</p>	<p>Love Bug (1969)</p> <p>You are recommended with "this movie" because user 4894 likes this movie</p> <p>☆☆☆☆</p>
 <p>Mr. Jealousy (1997)</p> <p>You are recommended with "this movie" because user 1245 is similar with you and user 1245 likes this movie</p>	 <p>Apple (1998)</p> <p>You are recommended with "this movie" because user 4894 is similar with you and user 4894 likes this movie</p>	 <p>Inspector Gadget (1999)</p> <p>You are recommended with "this movie" because user 2224 is similar with you and user 2224 likes this movie</p>



System Prototype

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1:Fully disagree, 2:Somewhat disagree, 3:Neutral, 4:Somewhat agree, 5:Fully Agree

I will watch one movie in the future every ☐ 1 day ☐ 3 days ☐ 7 days ☐ 14 days ☐ 30 days

I will visit a movie recommendation website I think in the future every ☐ 1 day ☐ 3 days ☐ 7 days ☐ 14 days ☐ 30 days

I have know Recommendation System more after the User Study ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

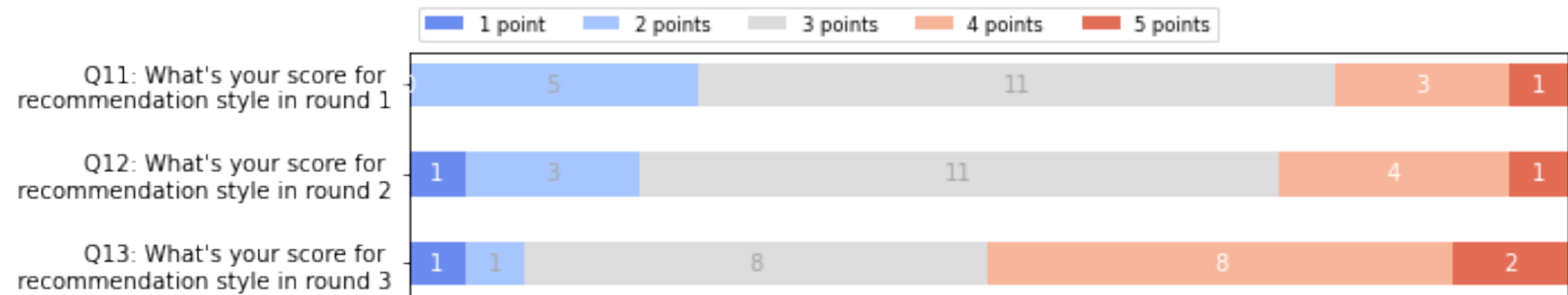
I have know Explainable Recommendation System more after the User Study ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

I will use a Recommend System I think in the future once every ☐ 1 day ☐ 3 days ☐ 7 days ☐ 14 days ☐ 30 days

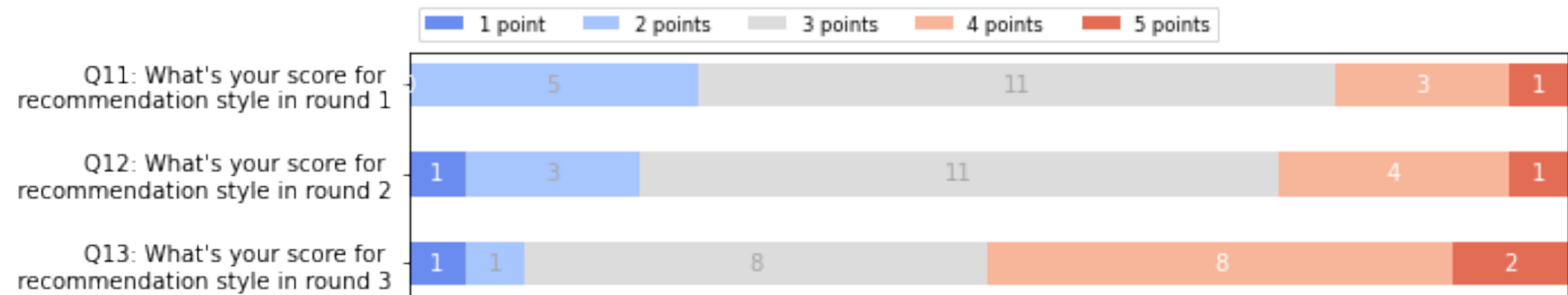
How would you describe your overall experience with Recommend System after the User Study. ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5



User Study Analysis



User Study Analysis



Questions



Thanks

