Explanation Adaptation for Hybrid Multimedia Recommendation System

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Master thesis

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

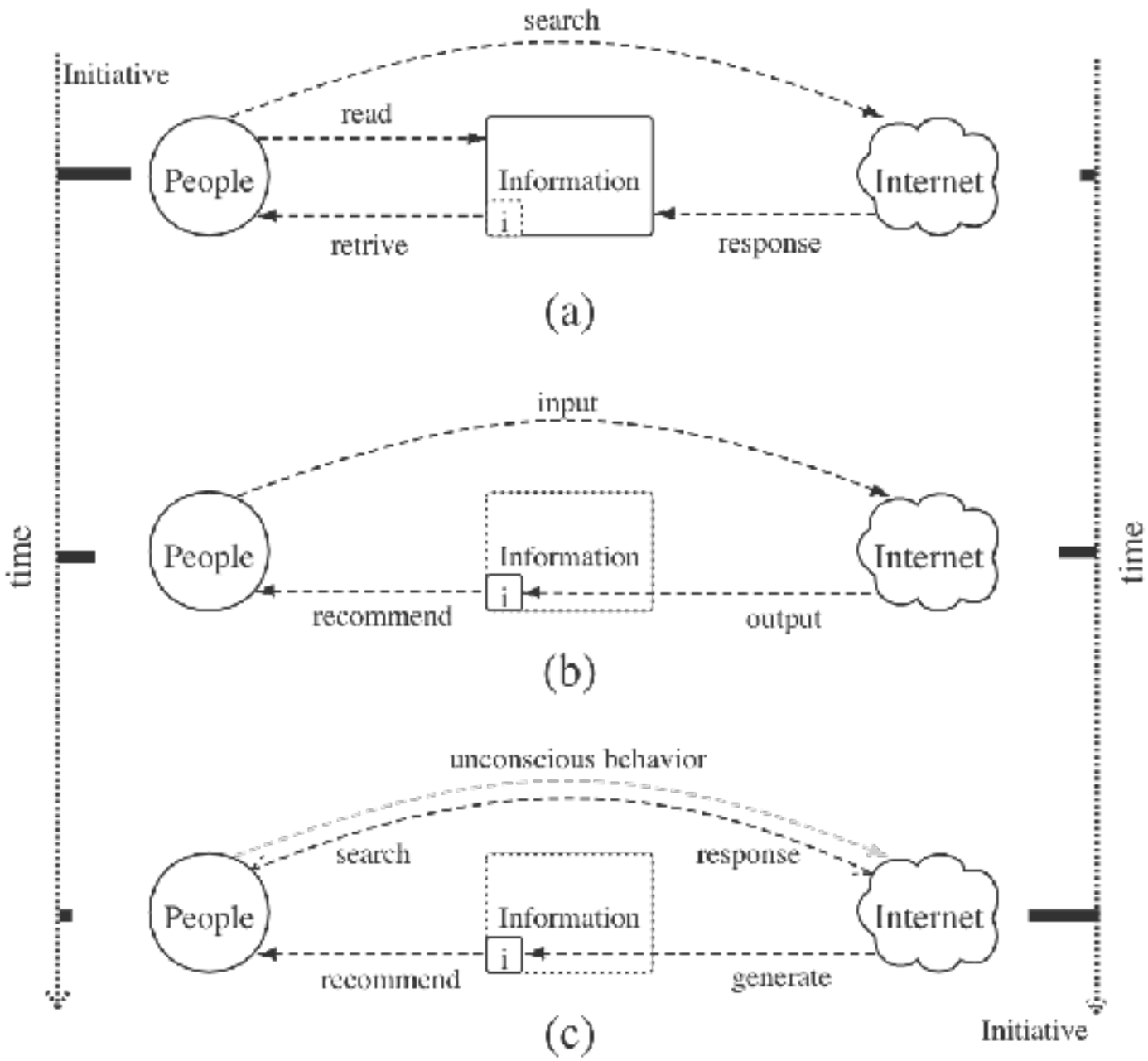
- increasing amount of information

- 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

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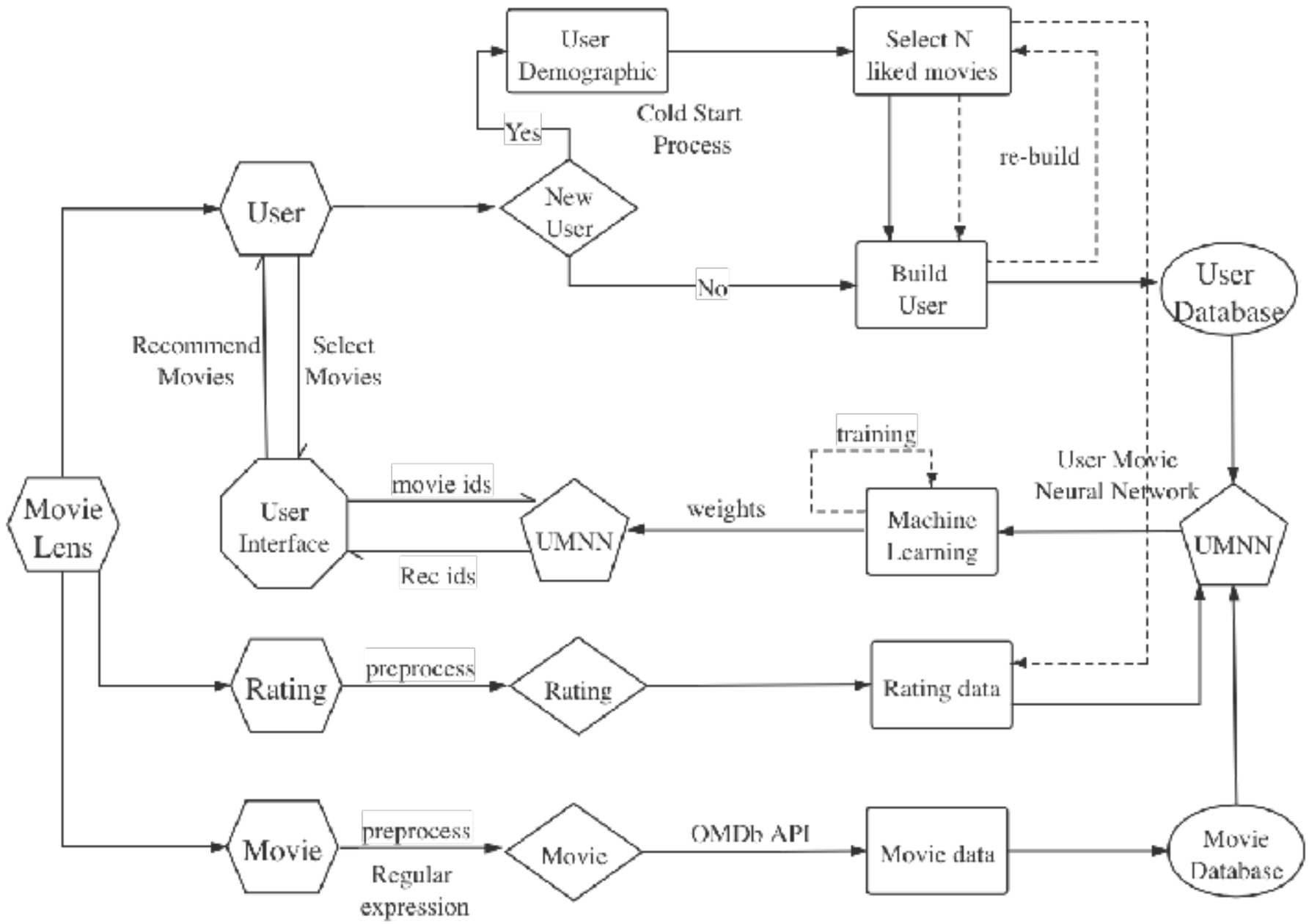
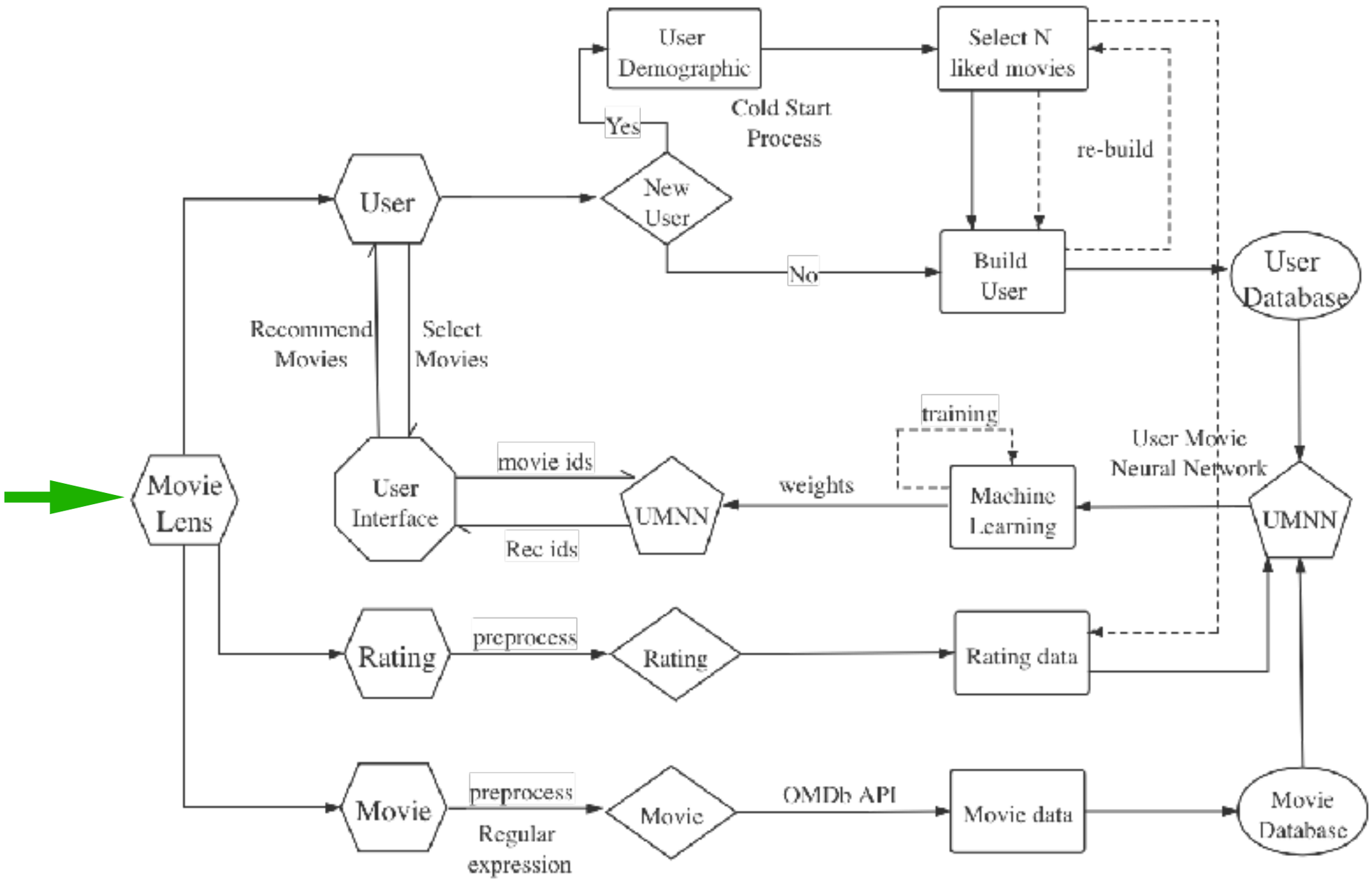
Steps

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

System Architecture Diagram



System Architecture Diagram



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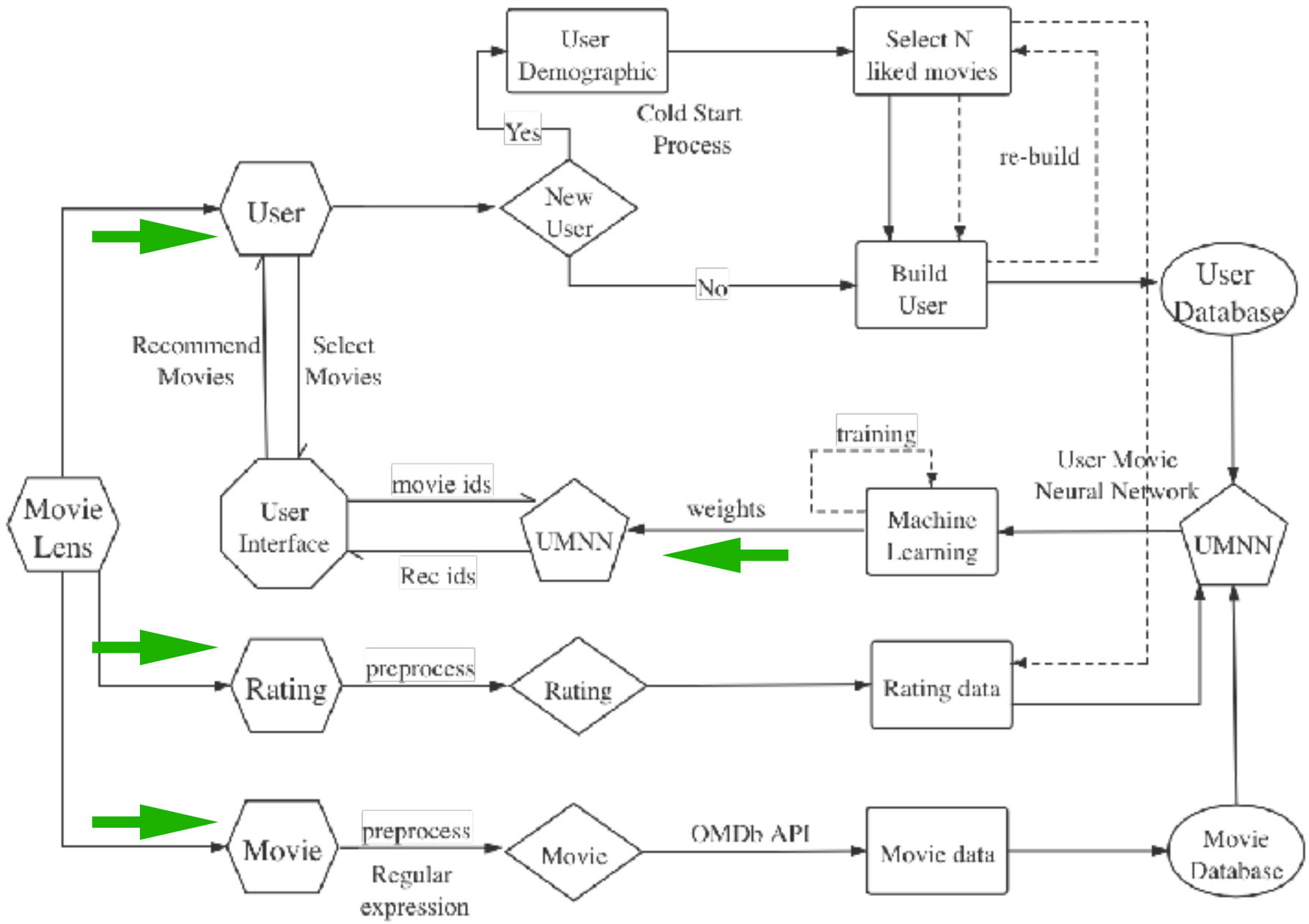

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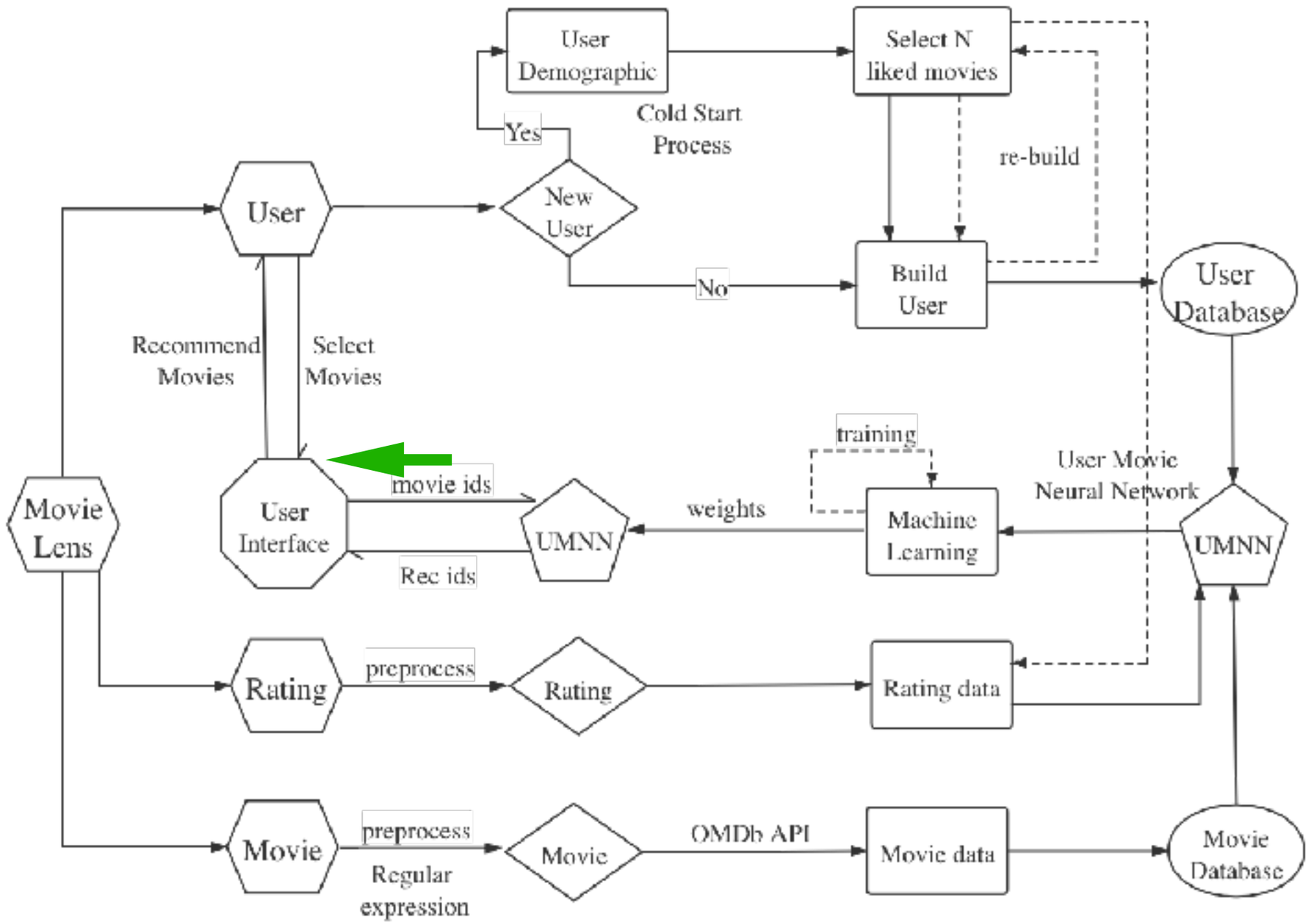
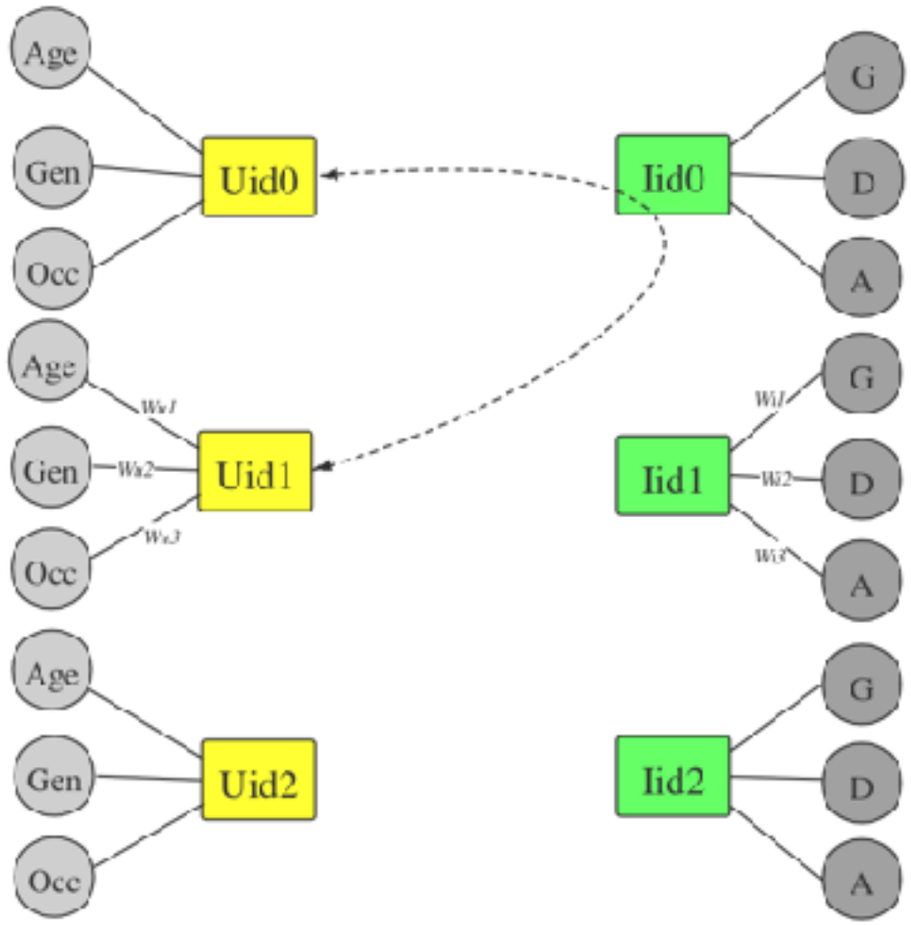


Recommendation Style

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



Gen: Gender Occ: Occupation G: genre D: director A: actor

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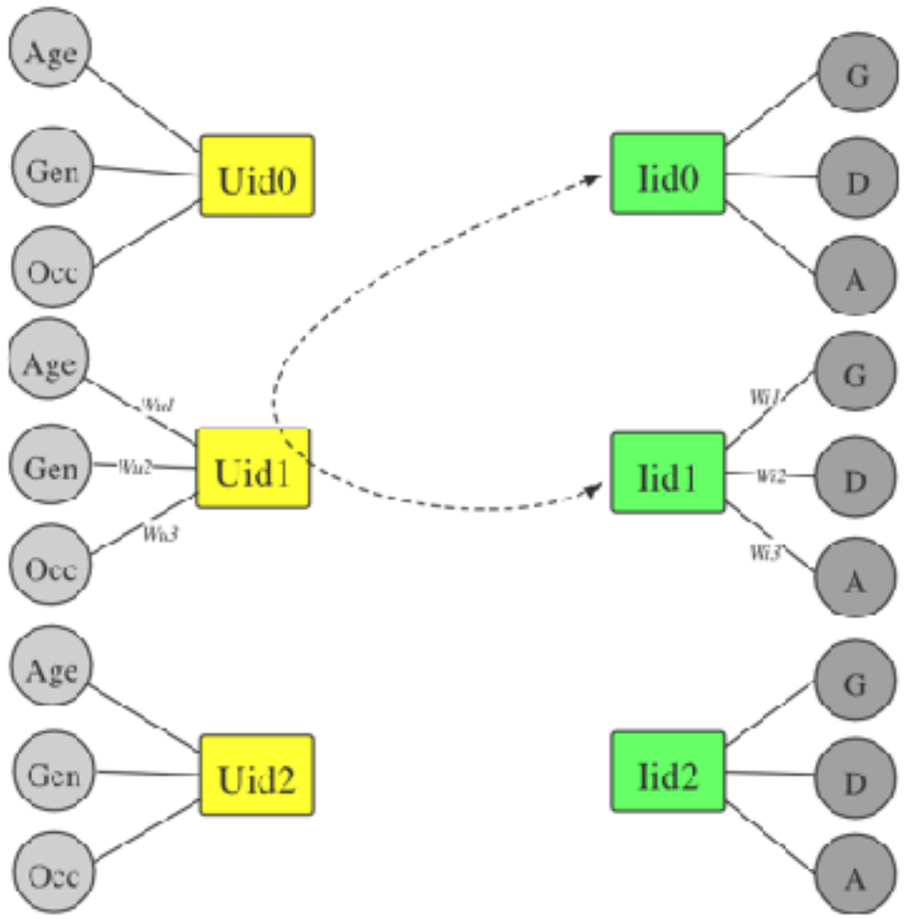

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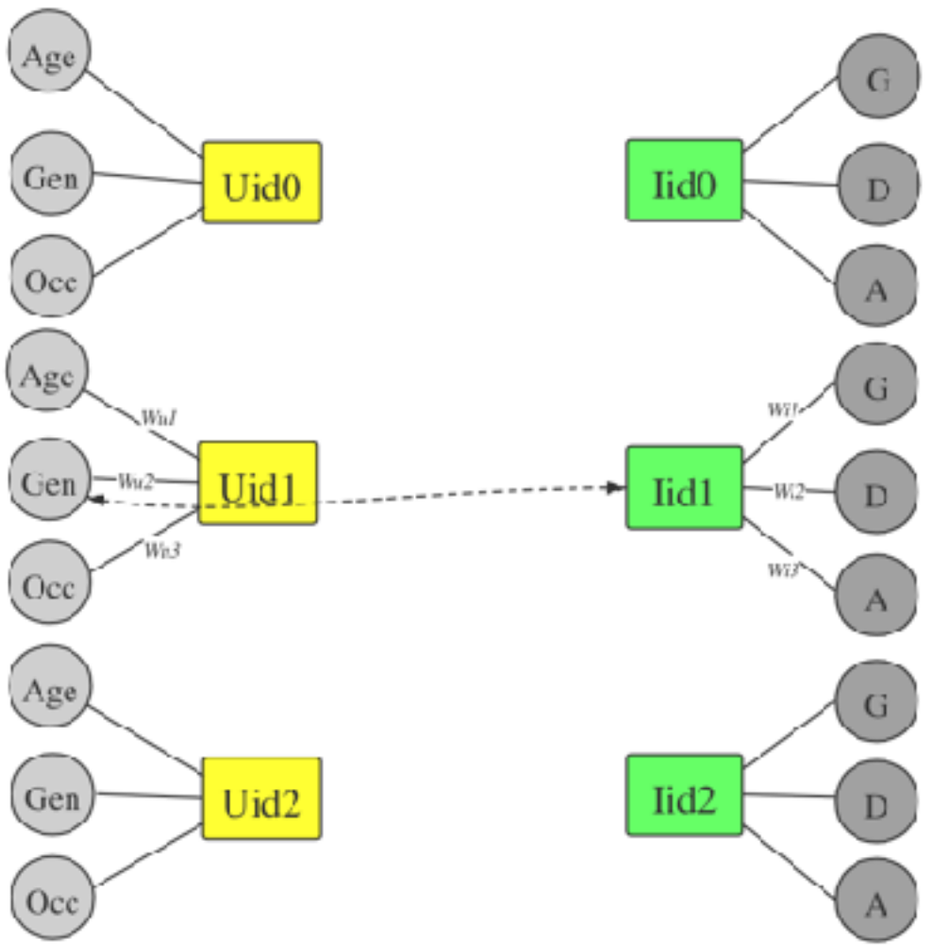

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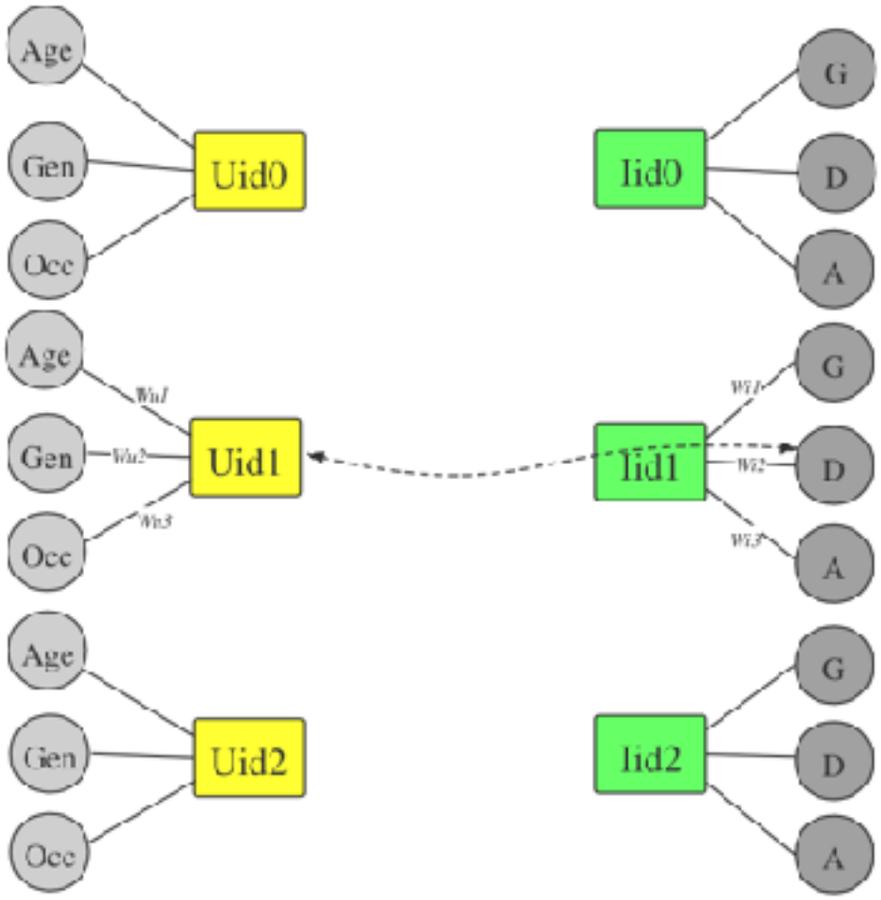
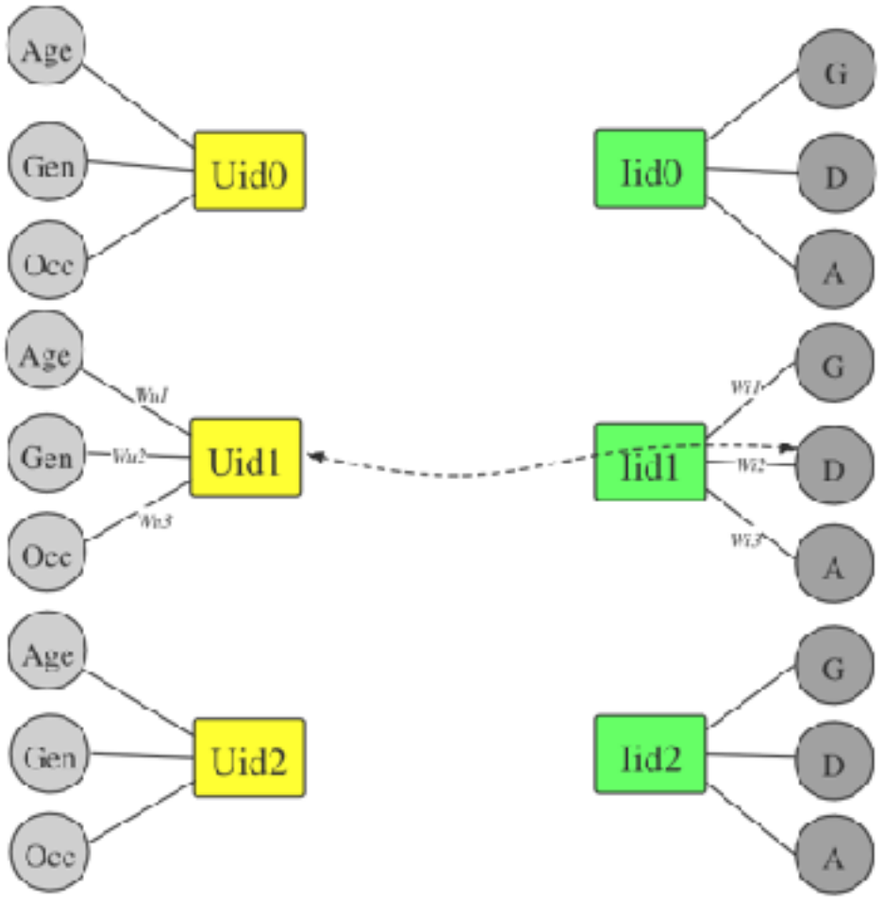


Gen: Gender Occ: Occupation G: genre D: director A: acter

Hybrid Recommendation

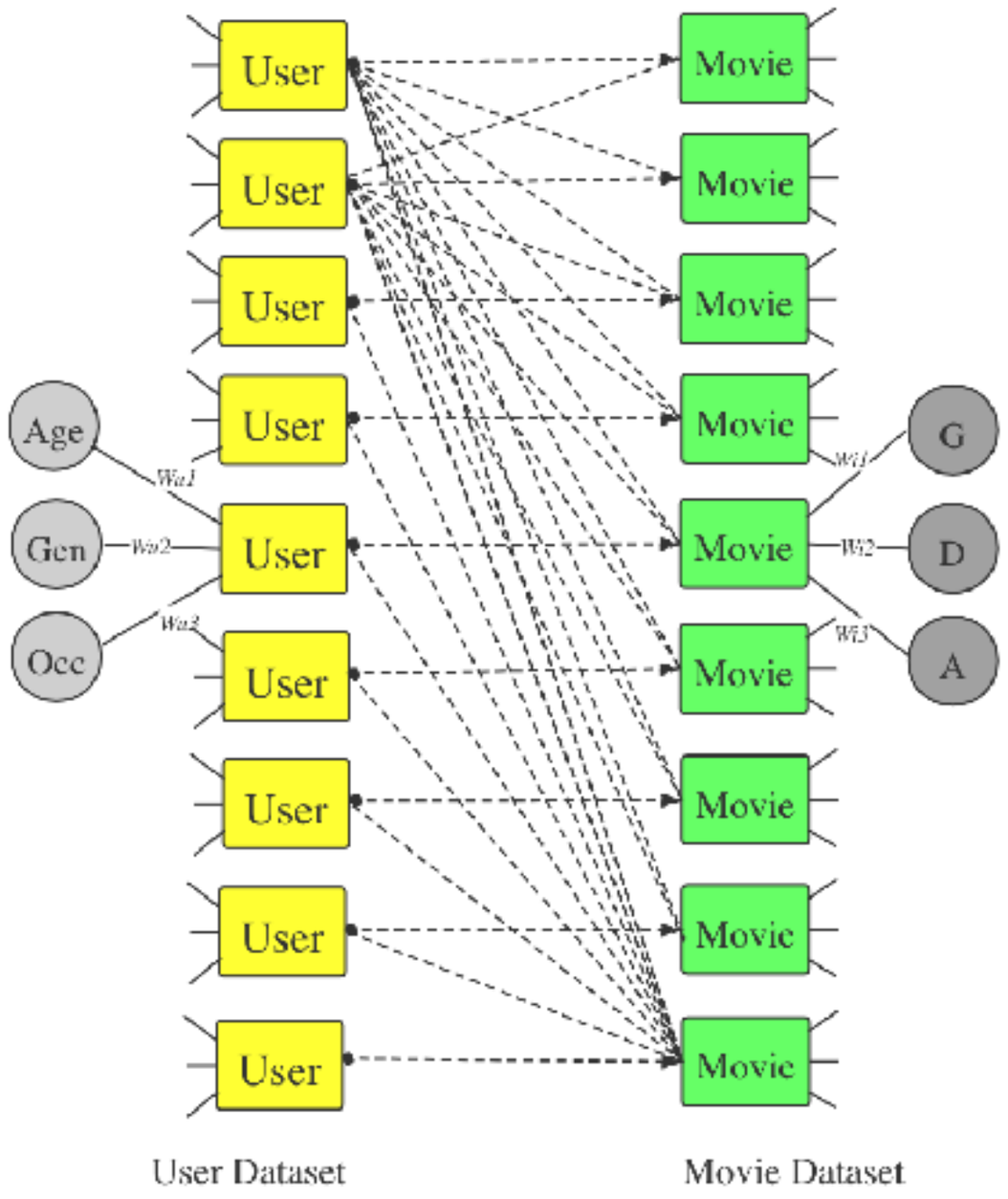
- Popularity-Based
- User-Based
- Item-Based
- Demographic-Based
- Content-Based



Gen: Gender Occ: Occupation G: genre D: director A: acter

Hybrid Recommendation

- Path-aware Attention Graph Neural Network



Hybrid Recommendation

- Path-aware Attention Graph Neural Network

Algorithm 3: Path Generated Algorithm

Result:

$$P_{v_1}$$

$$\hat{r}$$

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

$$L_P : Length\ of\ Path$$

$$N_P : Count\ of\ Path$$

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

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

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

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

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}-DFType{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}-CFType{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

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

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

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

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

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

while

$$count_{sum} == 10$$

do

$$count_{IUI} \mathrel{+}= func_{propotion}(scōre(IUI) - scōre(sum))$$

$$count_{UIU} \mathrel{+}= func_{propotion}(scōre(UIU) - scōre(sum))$$

$$count_{IUDD} \mathrel{+}= func_{propotion}(scōre(IUDD) - scōre(sum))$$

$$count_{UICC} \mathrel{+}= func_{propotion}(scōre(UICC) - scōre(sum))$$

if

$$count_x < 0$$

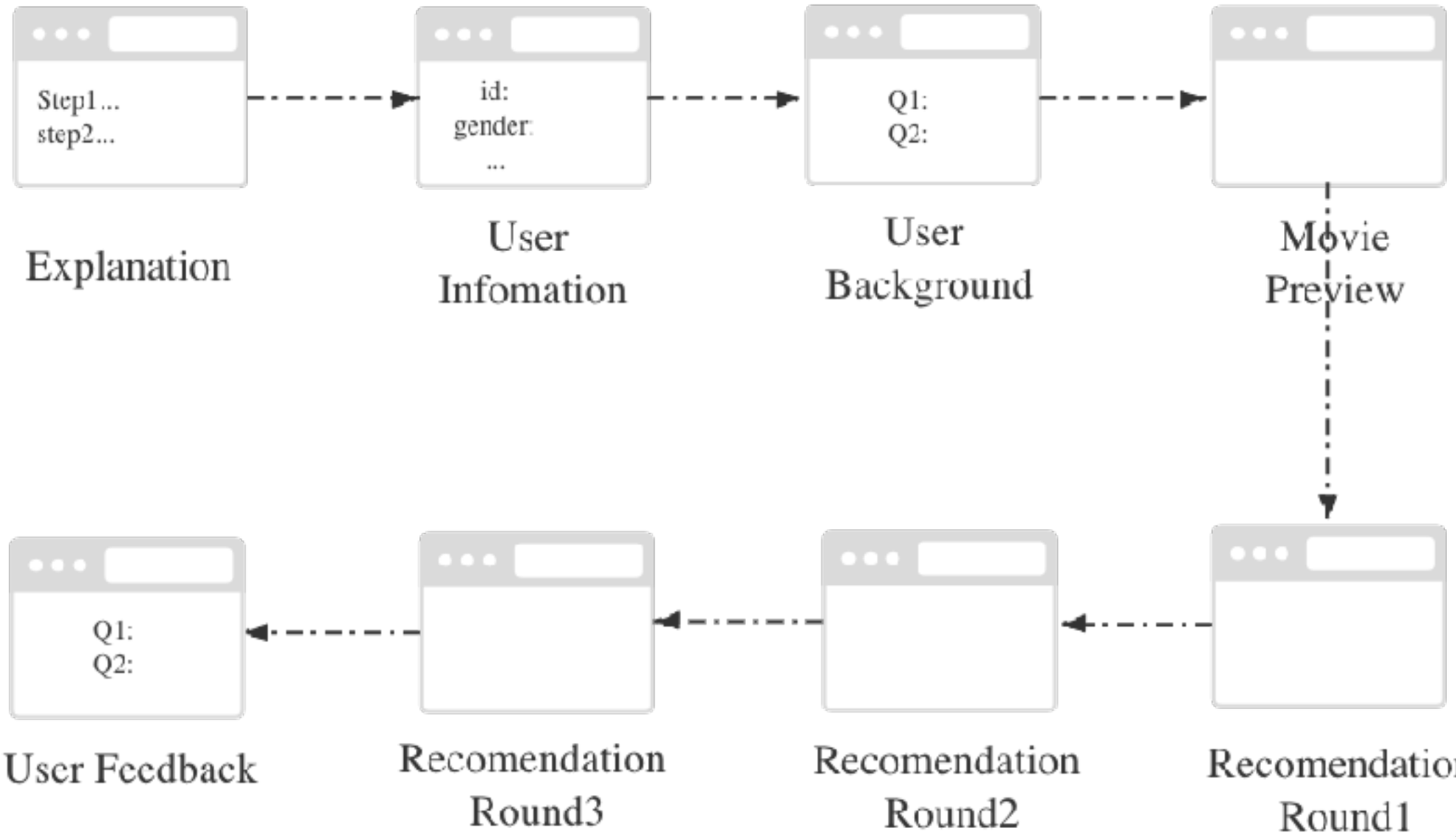
then

$$count_x = 0$$

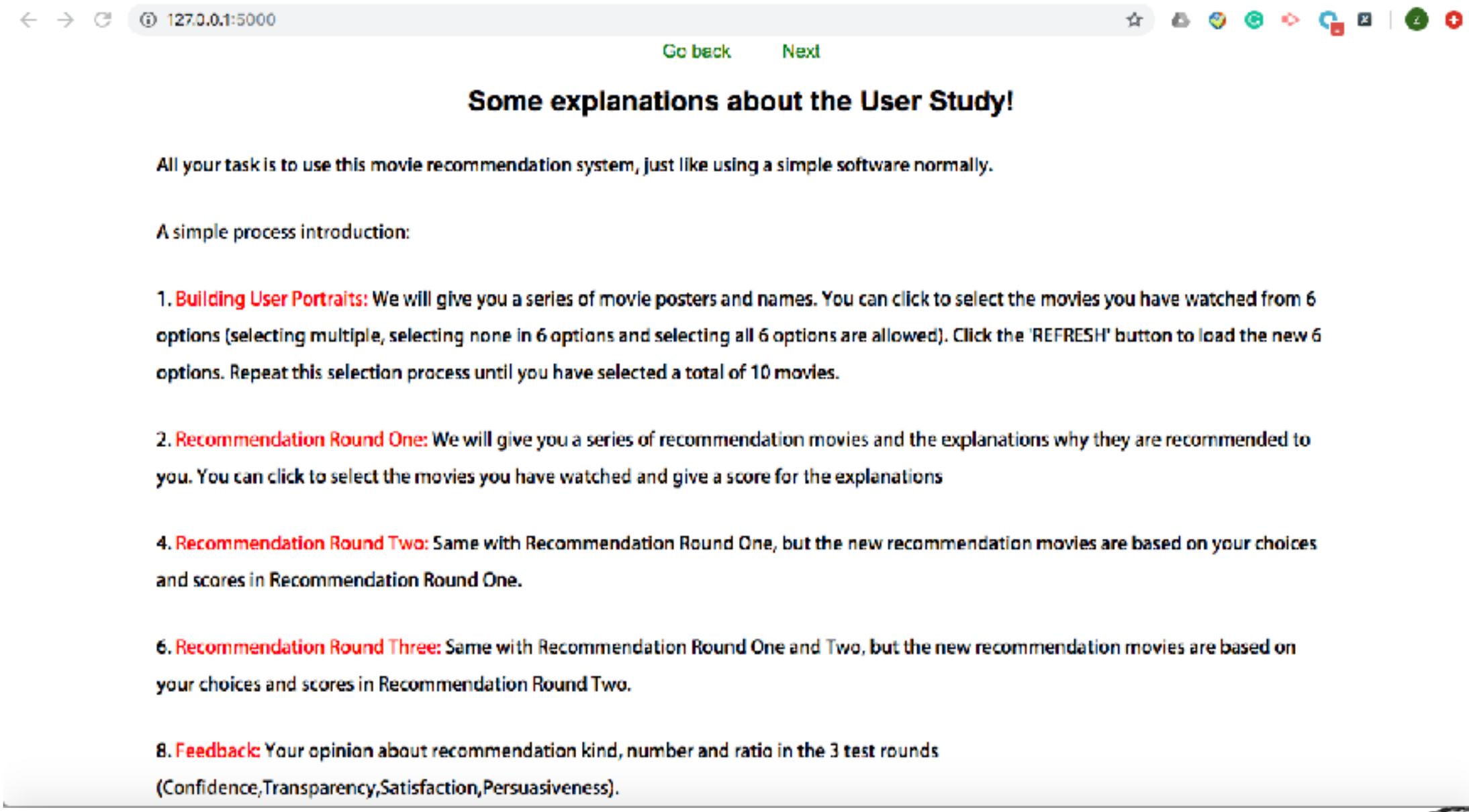
end

end

System Prototype



System Prototype



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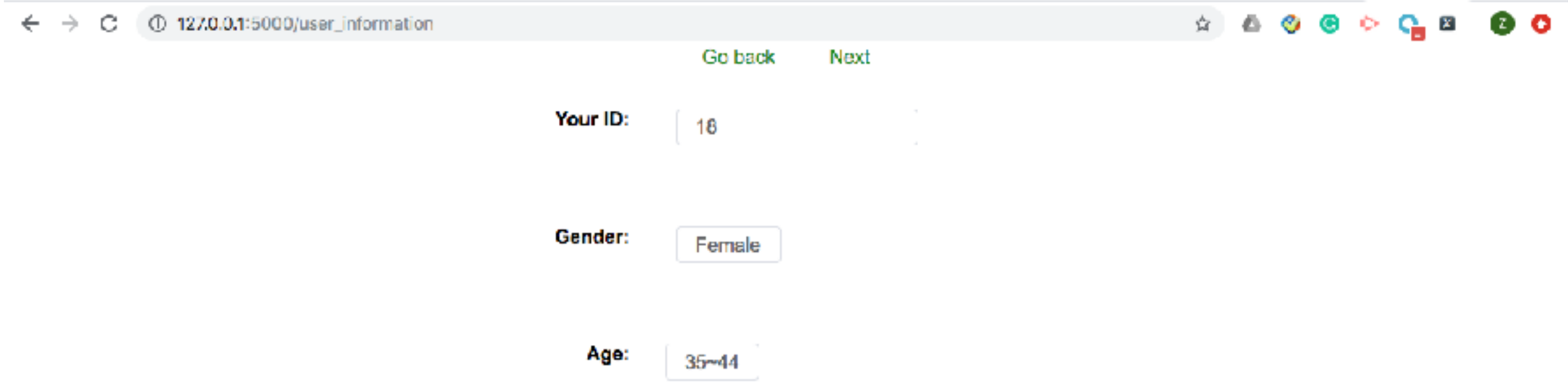

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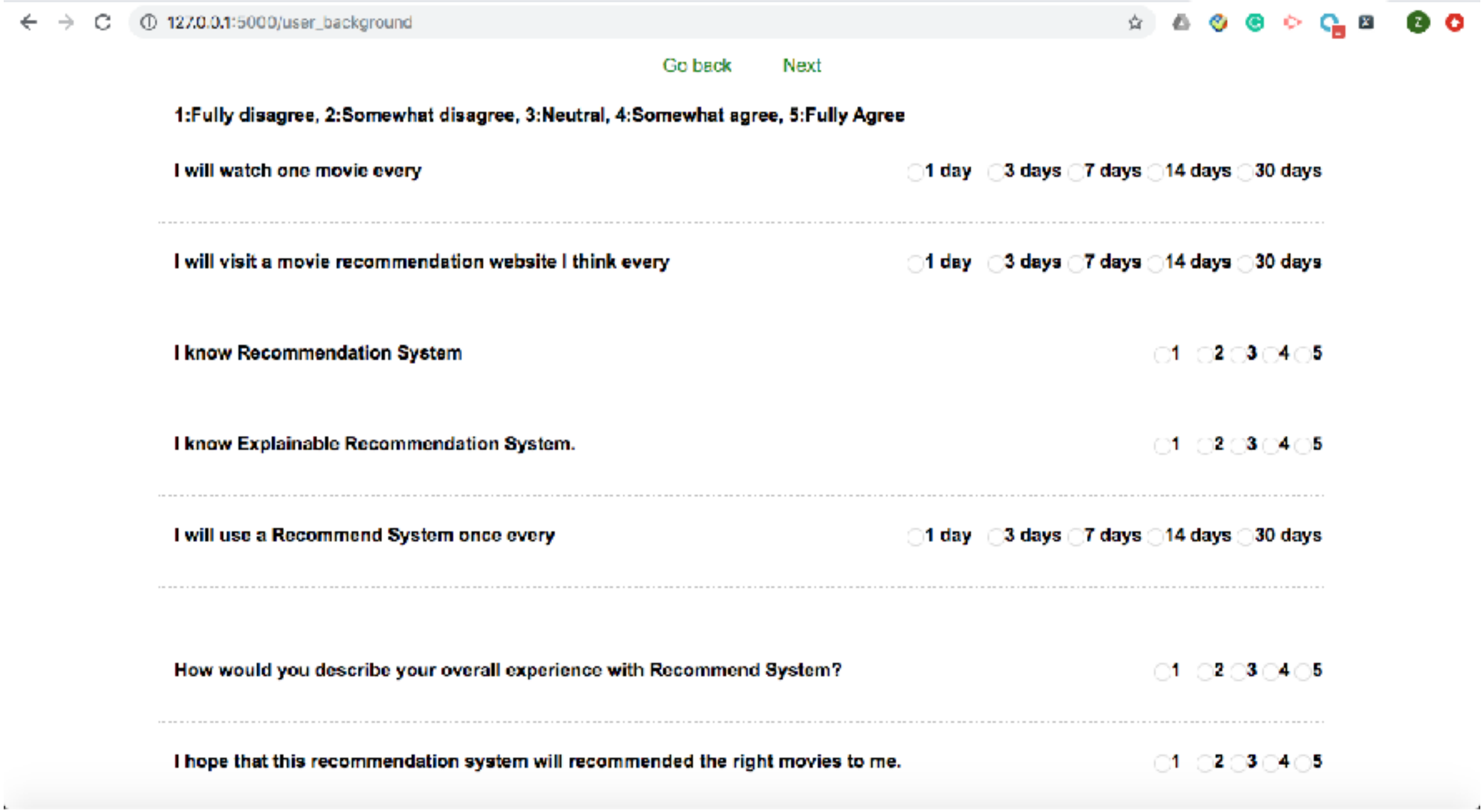
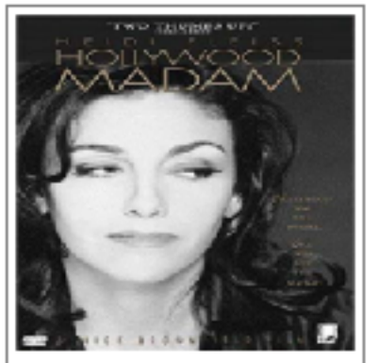


System Prototype

127.0.0.1:5000/movie_preview

Go back Refresh Next

Broken Arrow (1996)



Heidi Fleiss: Hollywood Madam (1995)

City Hall (1996)

The Boys of St. Vincent (1992)

Jupiter's Wife (1995)

Frankie Starlight (1995)

System Prototype

127.0.0.1:5000/movie_degree

Go back Next

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

Maybe, Maybe Not (1994)

You are recommended with "this movie" because user 5457 is similar with you and user 5457 likes this movie

★☆☆☆☆

Band Wagon (1953)

You are recommended with "this movie" because user 3475 is similar with you and user 3475 likes this movie

★☆☆☆☆

Secret Agent (1996)

You are recommended with "this movie" because user 998 is similar with you and user 998 likes this movie

★★★☆☆

Back to the Future (1985)

You are recommended with "this movie" because user 1953 is similar with you and user 1953 likes this movie

★★★☆☆

Blood for Dracula (1974)

You are recommended with "this movie" because user 5457 is similar with you and user 5457 likes this movie

★☆☆☆☆

Face/Off (1997)

You are recommended with "this movie" because user 3475 is similar with you and user 3475 likes this movie

Stag (1997)

You are recommended with "this movie" because user 998 is similar with you and user 998 likes this movie

Prom Night III: The Last Kiss (1989)

You are recommended with "this movie" because user 1953 is similar with you and user 1953 likes this movie

My Blue Heaven (1990)

You are recommended with "this movie" because user 5626 is similar with you and user 5626 likes this movie

No Small Affair (1984)

You are recommended with "this movie" because user 4457 is similar with you and user 4457 likes this movie

System Prototype

Gender: M Age: 25 Occupation:customer service
Favorite Movies:['Haunting (1963)', 'Pleasantville (1998)', 'Cool Runnings (1993)', 'My Life as a Dog (1985)', 'Fast Times at Ridgemont High (1982)', 'Mr. Jealousy (1997)']

Aiqing wansui (1994)

You are recom mended w
"this movie" b
3389 is simila
user 3389 lik es this movie

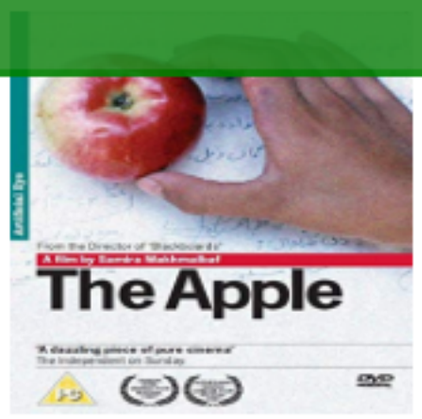
D3: The Mighty Ducks (1996)

Love Bug (1969)

mended with
ecause user
with you and
s this movie

Mr. Jealousy (1997)

You are recommended with "this movie" because user 1245 is similar with you and user 1245 likes this movie



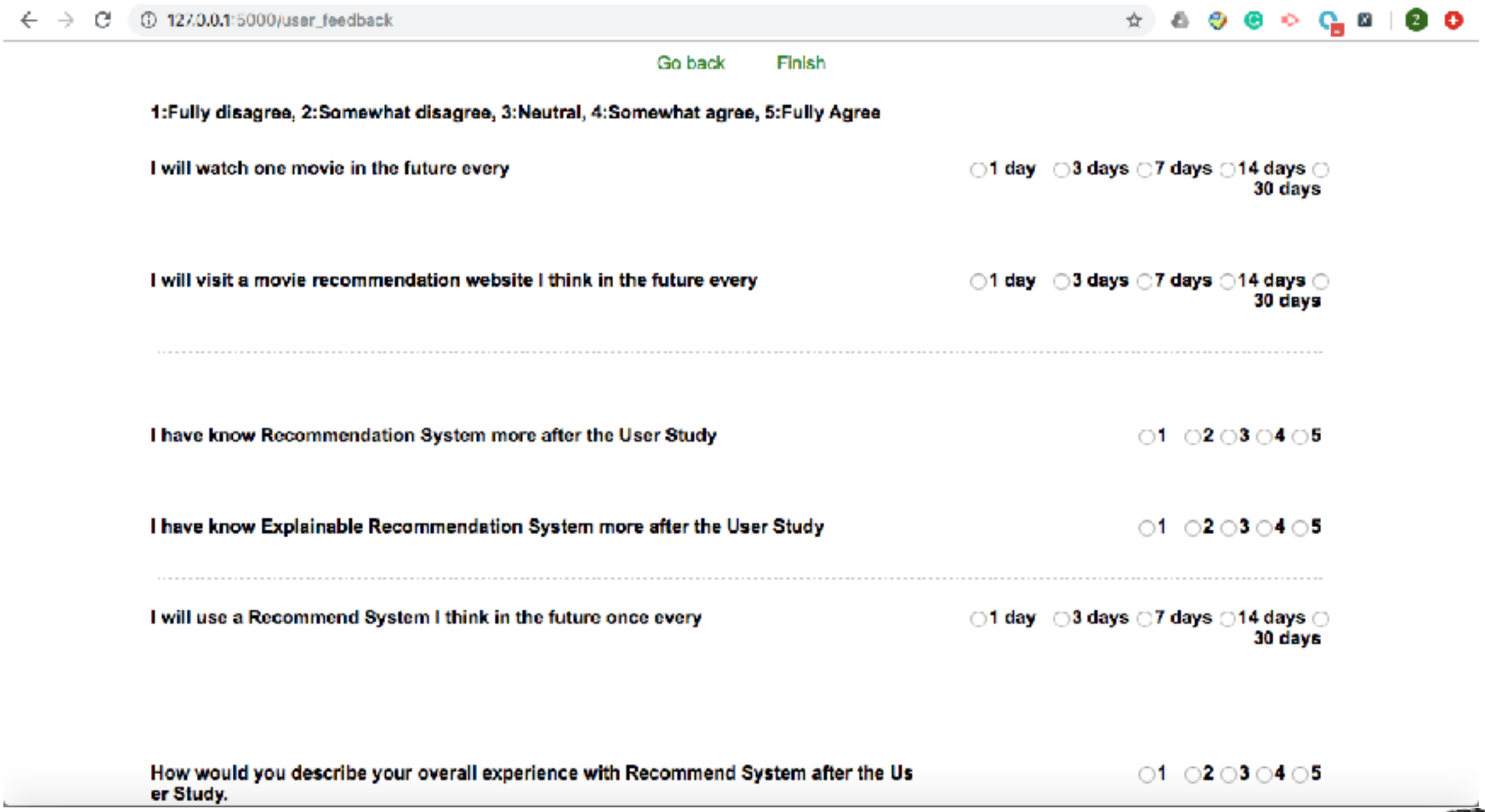
Apple (1998)

You are recommended with "this movie" because user 4894 is similar with you and user 4894 likes this movie

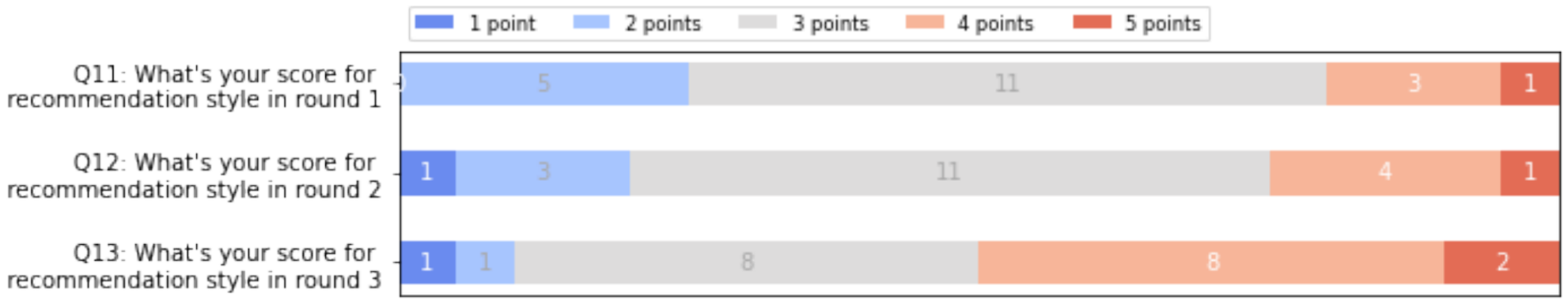
Inspector Gadget (1999)

You are recommended with "this movie" because user 2224 is similar with you and user 2224 likes this movie

System Prototype



User Study Analysis



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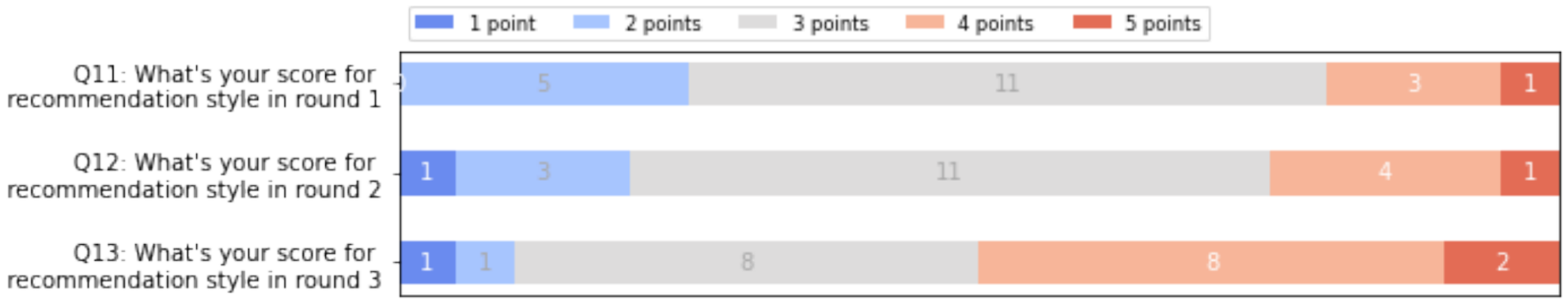

Questions

Thanks