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Online Matchmaking Using Collaborative Filtering and Reciprocal Recommender Systems

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----------ABSTRACT----------
The problem of unstable relationships and late marriages is an issue that continues to plague men and women. Societal values and traditions have caused many to jump into unhealthy unions to avoid shame and disgrace. Online matchmaking sites have seized this opportunity to propose matching techniques to solve the problem. However, the resultant effects are random and bad matches due to over exaggerated and unscientific matching procedures which make users feel rejected thus escalating the problem of men and women in the society. In this research, we present a way of producing optimised matches by studying recommender systems and applying it to matchmaking. Our results indicate that the rate of successful connections can be significantly improved from similarity to reciprocity match. A match based on the reciprocity recommender systems provides the highest matching percentage for most compatible users and lower for users who were not as compatible. Thus streamlining the random matching and producing higher match integrity.
Keywords – *Matchmaking, Recommender systems, Reciprocity, Collaborative filtering*

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I. INTRODUCTION

Matchmaking is the process of matching an unmarried man and woman by a matchmaker usually for the purpose of marriage; it came about due to the inability to find stable matches that lead to marriage. This problem coupled with societal values and long age traditions, has brought shame to men and women in this situation. Online matchmaking systems proposed a way out but fail because they produce random and bad matches due to matchmaking techniques which are cumbersome and redundant. In the end, users spend large amount of time and energy without getting the results they so much desire.

In traditional matchmaking people are matched based on the sentiments of a person called the Matchmaker. This sort of matchmaking has long given way for online matchmaking which promised the use of scientific algorithms to produce matches bearing in mind that in matchmaking there is the need to meet not with "all users", but with "users" who seek long-term relationships (Hitsch et al., 2006). Some of these new scientific techniques require users to create personality profiles which they then compare and use as a basis for their match. Traditional Recommender systems has been applied in matching people–to-items and have been successful. A typical example of item-people matching is seen in amazon.com, jumai.com,Konga.com etc. Where based on user shopping history, new items are recommended to users for purchase. Acceptance of online matchmaking as a culturally logical approach to mate selection and consumer spending on these services continues to rise (James, 2004), hence the need to study Recommender systems.

These sites match users to items based on certain recommender approaches. In our work, we study these approaches and apply them to matchmaking people (people-to-people) recommendation to create better matches.

This paper, describes a recommender system for online matchmaking. We apply recommender algorithms on our dataset to evaluate the quality of recommendations. We present a higher integrity matching with the use of recommender systems which has maximum benefits for users of online matchmaking systems as well as opening up the field of matchmaking to newer and broader possibilities.

II. RELATED WORK

There is a large body of research related to matchmaking systems. Researchers have previously looked at match-making from economic, mathematical, psychological and algorithmic perspectives. We now centre on researches which are more in tune to our line of study.

Mairson (1992) proposed a way to create stable matches in men and women. In the field of mathematics there is the well-known stable marriage problem. This problem aims to find a matching between all pairs of men and women such that it cannot be the case that two potential partners both prefer each other to their current partner. He paired off n men and n women, to make a set of n matching pairs such that everyone is reasonably happy. He assumes he owned an Internet matching company and has been given 5 profiles each of men and women. Male and female customers rank each other 1-5 in order of preference and need to find a stable matching of the 5 couples. A male and female each have a list of their preferred mate, with overlapping selections allowed. The stable marriage algorithm when implemented iteratively ensures a stable match for all, though it takes a long process hence it can be viewed as the basis for further proprietary algorithms and eventual tweaking.

Adachi (2003) developed a search model of two-sided matching under non-transferable utility. Using a utility function, researchers such as He provides a useful way of matchmaking users based on a calculated utility. Adachi's model is set in discrete time, with period p. He states that in each period, there are M men and W women in the matchmaking market. He defines the reservation utilities keeping a man m and a woman w from being single but continuing the search for a partner as vM(m) and vW(w) respectively single. He also defined other functions like:

$$\mathcal{A}_W(m,w) = \mathbb{I}\{\text{woman } w \text{ accepts man } m\} = \mathbb{I}\{U_W(m,w) \geq v_W(w)\},$$
$$\mathcal{A}_M(m,w) = \mathbb{I}\{\text{man } m \text{ accepts woman } w\} = \mathbb{I}\{U_M(m,w) \geq v_M(m)\}.$$

Adachi (2003) shows that the above system of equations defines a match based on utilities gotten from user profiles. The higher the utility based on utility function, the greater the potential of a match. This method is highly mathematical and uses certain measurements to calculate match preference not taking into consideration fluctuations in human nature.

$$\mathcal{A}_W(m,w) = \mathbb{I}\{\text{woman } w \text{ accepts man } m\} = \mathbb{I}\{U_W(m,w) \geq v_W(w)\}$$
$$\mathcal{A}_M(m,w) = \mathbb{I}\{\text{man } m \text{ accepts woman } w\} = \mathbb{I}\{U_M(m,w) \geq v_M(m)\}$$

Gediminas and Alexander (2005) carried out an overview of the field of Recommender Systems. They described the current generation of recommendation methods as classified into three main categories:

i. Content-based Recommendation
ii. Collaborative Recommendation
iii. Hybrid Recommendation

In their work they also described various limitations of current recommendation methods and discussed possible extensions that can improve recommendation capabilities and make them applicable to a broader range of applications. These extensions include, improvement of understanding of users and items, incorporation of the contextual information into the recommendation process, support for multi-criteria ratings, and provision of more flexible and less intrusive types of recommendations. They concluded that the need to develop more advanced recommendation methods is even more pressing for various types of applications.

Lukas and Vaclav (2007) showed that the use of recommenders significantly outperform global algorithms that are currently used by dating sites. They implemented a system which performed a quantitative comparison of recommender systems and two global algorithms. In their work, they experimented with user profiles and discovered that users prefer recommendation systems to global popularity recommendations. They concluded that Recommender systems show a great potential for online dating where they could improve the value of the service to users and improve monetization of the service.

The use of detailed information on the users' attributes and interactions, to estimate a model of mate preferences has also been carried out. Here reference was made to Gale-Shapley algorithm to compute the (man- and woman-optimal) stable matches generated by the estimated preferences, and find that they are similar to the matches observed online.

Günter et al. (2008), also explored whether the estimated mate preferences, in conjunction with the Shapley algorithm, can explain assortative mating patterns in "offline" marriages and they conclude that the estimated mate preferences can generate assortative mating patterns similar to those observed in marriages even in the absence of search frictions.

Mo et al. (2013) proposed a Filtering method to match heterosexual users in online matchmaking which can be represented as an N x M contact matrix, in which a user is a node and an edge in the dating network always connects a male and a female. The model describes a way of matchmaking which matches users based on initial contact only creating a scenario of matches where both user preferences are not considered.
Kang et al., 2014 did further research on works done by Mo et al., 2013 and discovered a reciprocity model also known as people-people recommender. Here he worked on a filtering method to streamline matches based on reciprocal contacts only.
Having looked at all these works done by previous researchers, we see that matchmaking problem is one which has been around for a long time. Though various techniques in the field of mathematics, economics and psychology have been applied no outstanding solution arises. Hence we study the use of Recommender Systems which have seen a high success rate in matching items – people and apply it in people-people matchmaking in the hope of getting more stable matches.

III. Methodology of the Proposed System

The methodology used is the Object-Oriented Analysis and Design Methodology (OOADM). We use this methodology to enable us organize requirements around objects, integrate both behaviours (processes) and states (data) to describe better how the objects interact.

3.1 Analysis Of The Existing System

In this work, we study Recommender systems proposed by (Mo et al., 2013) which engaged the use of Content-based Filtering (CF) algorithms and Reciprocity-only model by (Kang et al., 2014). We analyze the works done by Mo et al. (2013) and Kang et al. (2014) and apply their recommender filtering methods to matchmaking.

3.2 Architecture of Existing System

Scientist Mo and his co-researchers (Mo et al., 2013) proposed a Filtering method to match heterosexual users which can be represented as an N x M contact matrix, in which a user is a node and an edge in the dating network always connects a male and a female. In this method, if user X is interested in user Y, she/he could approach Y by sending him/her a message or an initial contact and this initial contact was used to create a recommendation for a user based on one user preference only not regarding the response of the other user.

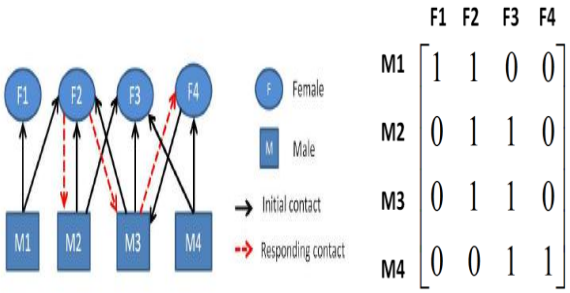


Figure 1. Matchmaking Network and Contact Matrix proposed by Mo et al. (2013).

Further works were done to improve the content- based filtering model proposed by Mo et al. (2013),which led to the works of Scientists (Kang et al., 2014) who discovered a reciprocity model also known as people-people recommender. This model worked like the content- based filtering model only that it considered both preferences before a recommendation was made. It used the same contact network as the content-based recommender but its result produced a different matrix notation showing only reciprocal contacts which were considered for recommendation.

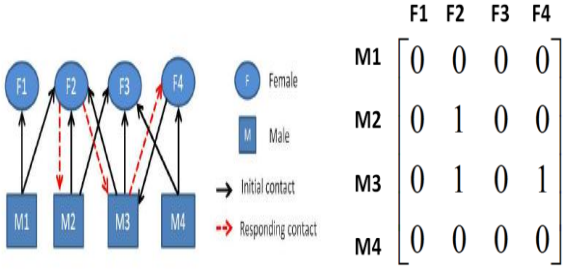


Figure 2. Matchmaking Network by Mo et al. (2013) and Reciprocal Contact Matrix proposed by Kang et al., 2014

Figure3. Architecture of existing system (kang et al., 2014)

3.3 Disadvantages of Existing system

Content-Based Filtering Recommenders

1. Data Sparsity: In using Content-based recommenders we rely on similarities to a user profile to create matches hence large amount of data should be available to compare users' profile. A situation where data is sparse will lead to poor filtering and thus bad recommendations or match.

2. **Scalability issues**: Tremendous increase in amounts of data will lead to scalability issues. As the algorithm will have to go through all profiles or similar items before a recommendation is made, resulting in computational issues and high resource consumption.

3. **Over-specialization**. When the system can *only* recommend items that score highly based on a user's profile, the user is limited to being recommended items similar to those already rated.

4. **New user problem**: A user has to rate a sufficient number of items before a content-based recommender system can really understand user's preferences and present the user with reliable recommendations. Therefore, a new user, having very few ratings, would not be able to get accurate recommendations.

Reciprocity-only Recommender

1. It is difficult to implement reciprocal recommenders in dating websites when some users are clearly more popular than others. Careful measures must be taken to balance the load of the recommendations in order not to overwhelm users and provide a good opportunity for interaction to all. So that popular users are not crowded with matches they don't want when other users with much appeal for those matches exist.

2. The use of this type of recommender leads to more decline in user requests which might be discouraging to some users.

3.4 Design of Proposed System

In the proposed system, we implement a match algorithm for a Collaborative/content-based Filtering and a Reciprocity only model to match users.

Content-based Filtering (CF) algorithms

Content-based filtering methods are based on a description of the item and a profile of the user's preference. In other words, these algorithms try to recommend items that are similar to those that a user liked in the past (or is examining in the present). In particular, various candidate items are compared with items previously rated by the user and the best-matching items are recommended

Reciprocity-only (People-to-People Recommender)

The Reciprocity model is a new type of recommender system which introduces a model of recommenders that considers only reciprocal similarities for recommendation. It is a people-to-people recommender that constitutes an important class of recommender systems.

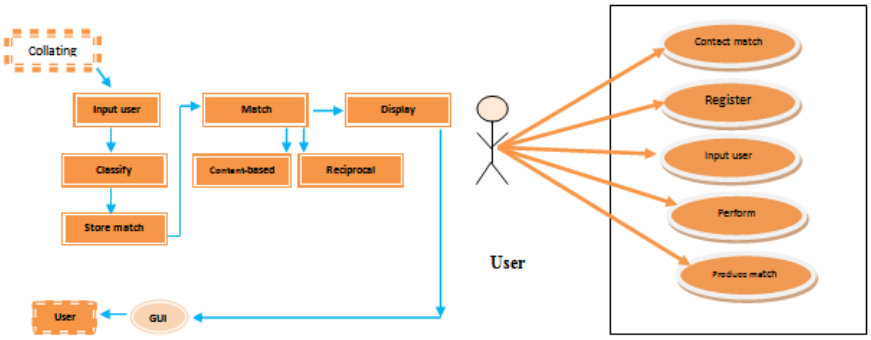


Figure4: Proposed system Architecture

3.4.1 Advantages of Proposed System

1. Combining two matching criteria provides a clearer judgment for people-people recommendations.
2. Based on the two outcomes of the matches which will be given, users have a wider range of options to choose from to get their match.
3. The proposed system re-assures the users of the matches they receive as all outputs are displayed and the differences in outputs are made clear convincing the user of the match output.
4. With this new system, users of matching system are given a higher sense of satisfaction as their matches are not based on speculations but scientific algorithms which reduces the incidence of errors.
5. This proposed system reveals to users more possibilities in the application of recommender systems used in sales websites like amazon, jumai, konga etc.
6. The system encourages more study to be done in the area of matchmaking systems opening up a world of more applications in that area of study.

3.4. 2 Use Case Analysis of Proposed System

In the case diagram of the proposed system shown below a user interacts with the system, registers a profile, provides user data and a match algorithm is implemented to produce an output of an optimal match.

Figure5: Use Case diagram of Proposed System

3.5 Match Algorithm

The match algorithm is the algorithm that performs the actual matching after the data set has been processed, classified and the match criteria obtained. For this system, we implement a match algorithm for a Collaborative Filtering and a Reciprocal match using the concept of the recommender systems. The algorithm works by measuring a weighted score given to each question which users fill to give the system a match criteria as shown in TABLE 1

Table 1. Match Criterion for Matching Algorithm

No	**Question**
1	Do you like to be the centre of attention? Yes No Answer you will accept from a potential match Yes No Any of the above How important is this question to you? Not important A little important Important Very important Bottom of Form
2	Could you date a quiet person? Yes No Answer you will accept from a potential match Yes No Any of the above How important is this question to you? Not important A little important Important Very important
3	How often do you exercise? Regularly Somewhat regular Rarely Never Answer you will accept from a potential match Regularly Somewhat regular

	Rarely Never Any of the above How important is this question to you? Not important A little important Important Very important
4	Are you a funny person? Yes No Answer you will accept from a potential match Yes No Any of the above How important is this question to you? Not important A little important Important Very important
5	Would you get upset if your Boyfriend/Girlfriend flirted in front of you? Yes No Answer you will accept from a potential match Yes No Any of the above How important is this question to you? Not important A little important Important Very important
6	Are you a heavy spender? Yes No Answer you will accept from a potential match Yes No Any of the above How important is this question to you? Not important A little important Important Very important
7	Do you like to cuddle? Yes No Sometimes. It depends Answer you will accept from a potential match Yes No Sometimes. It depends Any of the above How important is this question to you? Not important A little important Important Very important
8	Is it important that your partner smell good?

	Very important Important Less important Not important Answer you will accept from a potential match Very important Important Less important Not important Any of the above How important is this question to you? Not important A little important Important Very important
9	If a potential match is overweight, would that be a deal breaker? Yes, even if they were slightly overweight Yes, but only if they were obese No, it won't be a deal breaker No. Infact, I prefer an overweight match Answer you will accept from a potential match Yes, even if they were slightly overweight Yes, but only if they were obese No, it wont be a deal breaker No. Infact, I prefer an overweight match Any of the above How important is this question to you? Not important A little important Important Very important
10	How often do you use social networks? All the time Sometimes Rarely Never Answer you will accept from a potential match All the time Sometimes Rarely Never Any of the above How important is this question to you? Not important A little important Important Very important

The answers to the various questions in table 1 are given a weight based on the relevancy or importance given to the question by whoever is answering it. The weight given to the questions are based on these relevancy levels in table 2

Table 2. Relevancy level of match Criteria

Level	**Criteria**
0	Not important
1	A little important
2	Important
3	Very important

Upon answering these questions in the user profile, the match is then calculated using an algorithm we create based on Content based and reciprocity-only models.

Content-based Filtering Match Algorithm is as follows:

1. Fetch user1 answers to question
2. Set_Usercorrect_answer=0, Userquestion_sum = 0
3. For each question:

Userquestion_sum = Userquestion_sum + User question_relevancy
If user1expected_answer = user2 answer
THEN
Usercorrect_answer = Usercorrect_answer + User question_relevancy
End if
End for each
Match =Usercorrect_answer ÷ Userquestion_sum

Reciprocity Match Algorithm is as follows:
1. Fetch user1 answers to question
2. Fetch user2 answers to question
3. Set_user1correct_answer=0, user1question_sum= 0
4. Set_user2correct_answer=0, user2question_sum= 0
5. For each question:If user1 expected _answer is the same as user2 answer

User2correct_answer=user2correct_answer+ question_relevancy to user1
User2question_sum = user2 question_sum + question_relevancy to user1
end if
If user2 expected_answer is the same as user1 answer
User1correct_answer = user1correct_answer + question_relevancy to user2
User1question_sum = user1 question_sum + question_relevancy to user2
end if
end for each.
User1Match%=User1correct_answer÷User1question_sum
User2Match%=User2correct_answer÷User2question_sum

$$\text{Reciprocal Match} = 10 \sqrt{\frac{\text{no of questions}}{\text{User1 match\%} \times \text{User2 match \%}}}$$

3.6 Calculating the Match percentage

After the user fills in the match criteria by answering the questions in table 3.3, we calculate the match percentage using the two recommender algorithms. We calculate the match percentage for some existing users with new users to further explain the process.

Question Relevancy Legend
1. Very Important = 3 points
2. Important = 2 points
3. A Little Important = 1 point
4. Not Important = 0 point

Example1

Match for a new user Deematch to suit an old user Deedee profile

Table3. Match criteria for users "Deedee" and "Deematch"

S/No.	Deedee (Old User) – 26 years Female	Deematch(New User) 29 years – Male
1.	Do you like to be the centre of attention? Your answer: **Yes** Answer you will accept: **No** Relevancy: Important	Do you like to be the centre of attention? Your answer: **No** Answer you will accept: **Yes** Relevancy: Important
2.	Could you date a quiet person? Your answer: Yes Answer you will accept: No Relevancy: A Little	Could you date a quiet person? Your answer: Yes Answer you will accept: Yes Relevancy: Important

	Important	
3.	How often do you exercise? Your answer: Rarely Answer you will accept: Any of the above Relevancy: Not Important	How often do you exercise? Your answer: Rarely Answer you will accept: Rarely Relevancy: A Little Important
4.	Are you a funny person? Your answer: Yes Answer you will accept: Any of the above Relevancy: Not Important	Are you a funny person? Your answer: Yes Answer you will accept: Yes Relevancy: Important
5.	Would you get upset if your Boyfriend/Girlfriend flirted in front of you? Your answer: Yes Answer you will accept: Yes Relevancy: Very Important	Would you get upset if your Boyfriend/Girlfriend flirted in front of you? Your answer: Yes Answer you will accept: Yes Relevancy: Important
6.	Are you a heavy spender? Your answer: No Answer you will accept: No Relevancy: Important	Are you a heavy spender? Your answer: Yes Answer you will accept: Yes Relevancy: A Little Important
7.	Do you like to cuddle? Your answer: Yes Answer you will accept: Yes Relevancy: Important	Do you like to cuddle? Your answer: Yes Answer you will accept: Yes Relevancy: Important
8.	Is it important that your partner smell good? Your answer: Very important Answer you will accept: Very important Relevancy: Very Important	Is it important that your partner smell good? Your answer: Very important Answer you will accept: Very important Relevancy: Very Important
9.	If a potential match is overweight, would that be a deal breaker? Your answer: Yes, even if they were slightly overweight Answer you will accept: Yes, even if they were slightly overweight Relevancy: Important	If a potential match is overweight, would that be a deal breaker? Your answer: Yes, even if they were slightly overweight Answer you will accept: Yes, even if they were slightly overweight Relevancy: Very Important
10.	How often do you use social networks? Your answer: Sometimes	How often do you use social networks? Your answer: All the time Answer you will accept: Any of the

	Answer you will accept: Sometimes Relevancy: A Little Important	above Relevancy: Not Important

Match Calculations
Content Based Filtering Match
User_Correct_answer = 0
User_question_sum = 0
Abbreviations used:
Q- Questions
U-1CA - User1_Correct_Answer
U-2CA - User2_Correct_Answer
U-1QS - User1_Question_Sum
U-2QS - User2_Question_Sum
QR - Question Relevancy
S - Question Status (Correct = √, Incorrect = X
Following the Content-Based Filtering algorithm, we derive the match percentage.

Table 4: Match Calculation for Deemach using Content-Based Filtering Algorithm

Q	Status	(QR)	U-1CA	U-1QS
1	√	2	0+ 2 =2	0+ 2 =2
2	√	2	2+2 = 4	2+2 = 4
3	√	1	4+1=5	4+1=5
4	√	2	5+2=7	5+2=7
5	√	2	7+2=9	7+2=9
6	**X**	1	9+0=9	9 + 1= 10
7	√	2	9+2-11	10 + 2= 12
8	√	3	11+ 3=14	12 + 3= 15
9	√	3	14+3=17	15+ 3 =18
10	**X**	0	17+0=17	18 + 0=18
			U.C.A= 17	U.Q.S=18

i. **Content Based Filtering**
User1_Correct_Answer= 17
User1_Question_ Sum = 18
Match Percentage = User1_Correct_Answer /User1_Question_ Sum
=17/18
= 0.94
= 94 %
Following the Reciprocity algorithm, we derive the match reciprocity match percentage.

Table 5. Match calculation using Reciprocity Algorithm

Q	S	QR	User1_ Correct_ Answer	User1_ Question_ Sum	S	QR	User2_ Correct_ Answer	User2_ Question_ Sum
1	√	2	0+ 2 =2	0+ 2 =2	√	2	0 + 2 = 2	0 + 2 = 2
2	√	2	2+2 = 4	2+2 = 4	X	1	2+0=2	2+1=3
3	√	1	4+1=5	4+1=5	X	0	2+0=2	3+0=3
4	√	2	5+2=7	5+2=7	X	0	2+0=2	3+0=3
5	√	2	7+2=9	7+2=9	√	3	2+3=5	3+3=6

6	X	1	9+0=9	9 + 1= 10	X	2	5+0=5	6+2=8
7	√	2	9+2-11	10 + 2= 12	√	2	5+2=7	8+2=10
8	√	3	11+ 3=14	12 + 3= 15	√	3	7+3= 10	10+3=13
9	√	3	14+3=17	15+ 3 =18	√	2	10+2=12	13+2=15
10	X	0	17+0=17	18 + 0=18	X	1	12+1= 13	15+1=16
			U-1.C.A=17	U-1.Q.S=18			U-2.C.A=13	U-2.Q.S=16

ii. Reciprocal Match
User1_Correct_Answer= 17
User1_Question_ Sum = 18
Match Percentage = User1_Correct_Answer /User1_Question_ Sum
=17/18
= 0.94
= **94 %**
User2_Correct_Answer = 13
User2_Question_ Sum = 16
User2MatchPercentage = 13/16
= 0.81
=81%
Reciprocal Match = 10th-root ((17/18) x (13/16))
= 0.97
= 97%

Example 2
Match for users "Funke" and "Funmatch"

Table 6: Match criteria for users "Funke" and "Funmatch"

S/No.	Funke (old User) – 26 yrs Female	Funmatch – 30 yrs Male
1.	Do you like to be the centre of attention? Your answer: Yes Answer you will accept: Yes Relevancy: Important	Do you like to be the centre of attention? Your answer: Yes Answer you will accept: No Relevancy: Very Important
2.	Could you date a quiet person? Your answer: Yes Answer you will accept: Yes Relevancy: A Little Important	Could you date a quiet person? Your answer: Yes Answer you will accept: Yes Relevancy: A Little Important
3.	How often do you exercise? Your answer: Rarely Answer you will accept: Regularly Relevancy: Very Important	How often do you exercise? Your answer: Regularly Answer you will accept: Regularly Relevancy: Important
4.	Are you a funny person? Your answer: Yes	Are you a funny person? Your answer: Yes

	Answer you will accept: Yes Relevancy: Very Important	Answer you will accept: Yes Relevancy: Important
5.	Would you get upset if your Boyfriend/Girlfriend flirted in front of you? Your answer: No Answer you will accept: No Relevancy: Very Important	Would you get upset if your Boyfriend/Girlfriend flirted in front of you? Your answer: Yes Answer you will accept: Yes Relevancy: Important
6.	Are you a heavy spender? Your answer: No Answer you will accept: No Relevancy: Very Important	Are you a heavy spender? Your answer: No Answer you will accept: No Relevancy: A Little Important
7.	Do you like to cuddle? Your answer: Yes Answer you will accept: Yes Relevancy: Very Important	Do you like to cuddle? Your answer: Yes Answer you will accept: Yes Relevancy: Important
8.	Is it important that your partner smell good? Your answer: Less important Answer you will accept: Less important Relevancy: A Little Important	Is it important that your partner smell good? Your answer: Important Answer you will accept: Important Relevancy: Important
9.	If a potential match is overweight, would that be a deal breaker? Your answer: Yes, but only if they were obese Answer you will accept: Yes, even if they were slightly overweight Relevancy: Very Important	If a potential match is overweight, would that be a deal breaker? Your answer: Yes, even if they were slightly overweight Answer you will accept: Any of the above Relevancy: Not Important
10.	How often do you use social networks? Your answer: All the time Answer you will accept: All the time Relevancy: Very Important	How often do you use social networks? Your answer: All the time Answer you will accept: All the time Relevancy: A Little Important

MATCH CALCULATIONS
i.Content Based Filtering
User1_Correct_ answer= 7
User1_question_sum = 16
Match = 7/16
= 0.44
= 44%

ii. Reciprocity
User2_Correct_ answer =21
User2_question_sum = 25
User2MatchPercentage = 21/25
= 0.84= 84%

Reciprocal Match =
10th-root ((7/16) x (21/25))= 0.9
= 90%

IV. RESULTS

After getting the user preferences, we use the same match algorithm and calculate the match percentage of several users with our sample user "Deematch" and get the following results:

Table 4.1 Match percentages of user "Deematch"

	Content Based Match(%)	Reciprocity Match (%)
Dedee	**94**	**97**
Ama	61	87
funke	50	87
Mamus	44	86
Kezzigal	44	72
Paula	39	87
Aren	28	69

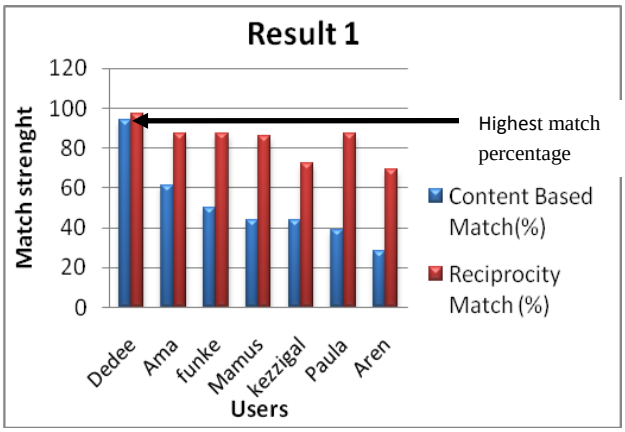


Figure 4.1 A graphical representation of Example1

Example2
Match percentage of several users with our sample user "Funmatch"

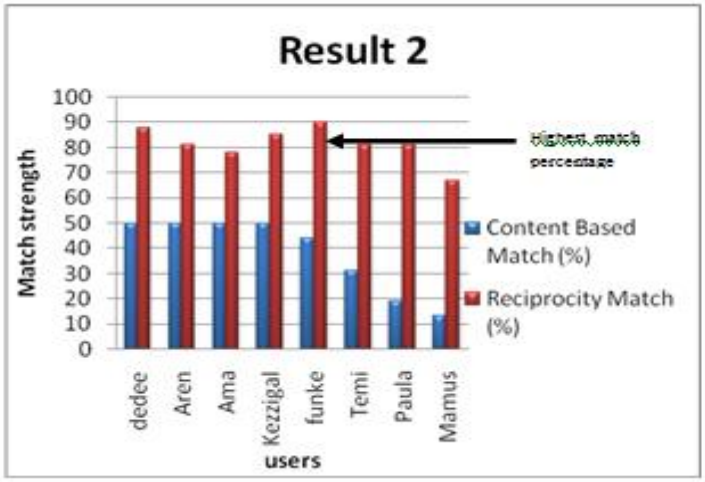
MATCH CALCULATIONS
Content Based Filtering
User1_Correct_ answer= 7
User1_question_sum = 16
Match = 7/16= 0.44
= **44%**
Reciprocity
User1_Correct_ answer = 7
User1_question_sum = 16
User1MatchPercentage = 7/16= 0.44
User2 Correct Sum = 21
User2_question_sum = 25
User2MatchPercentage = 21/25
= 0.84

Match = 10th-root ((7/16) x (21/25))= 0.9
= **90%**

Table 4.2 Match percentages of user "Funmatch"

	Content Based Match (%)	Reciprocity Match (%)
dedee	50	88
Aren	50	81
Ama	50	78
Kezzigal	50	85
Funke	**44**	**90**
Temi	31	81
Paula	19	81
Mamus	13	67

Figure 4.2 A graphical representation of Example2



V. Result Discussion

On carrying out test runs of the system, we see that users who have a similar or match criteria will most often than not have a reciprocal match criteria with higher match percentage. This proves that users who have reciprocal tastes will have a higher percentage success in matching and building stable relationships than users who are paired randomly based on geographical, age or other factors.

Result 1: Match Output for a user "Deematch"
Table 4.1 shows a match output of a user "Deematch" displaying the results of a Content Based match and a Reciprocal match. From the result we see that for a Content based match, Deematch matches with the users "Dedee, Ama, Funke, Mamus, kezzigal, Paula and Aren on a match scale of 94%,61%,50%,44%,44%,29% and 38% respectively. i.e. based on the similarities in Deematchs' profile "only" ; not taking into consideration other user preferences.
This is a one-sided match and it is uncertain if the users would gladly be matched or paired with Deematch.
A reciprocal match for Deematch however gives a match percent of 97%, 87%, 87%, 86%,72%,87% and 69% respectively with users "Dedee, Ama, Funke, Mamus, kezzigal, Paula and Aren". This reciprocal match is a match gotten from both user preferences based on match criteria. It therefore has a higher match score as seen in the result. This shows that pairing with the reciprocal match would most likely yield more successful results that would lead to stable matches which is the end goal of this system.

Result 2: Match Output for a user "Funmatch"
The match output for male user Funmatch gives variable match results. From the match output in Table 4.2, we see the match percentages of the various users using the two matches. Based on content based or similarity match, we see that users Dedee, Aren, Ama, Kezzigal, Funke, Temi, Paula and Mamus match our user with match percentages of 50%, 50%, 50%, 50%,44%, 31%,19% and 13% respectively. While in the reciprocity match, users Dedee, Aren, Ama, Kezzigal, Funke, Temi, Paula and Mamus match our user with 88%,81%,78%,85%,90%,81% and 67% respectively.

VI. CONCLUSION

We have presented a problem of matchmaking in online social systems. We have reviewed recommender systems popularly used in item-item recommendations and applied it to people-people recommendations. To achieve this we looked into types of recommender systems and have chosen to work with two to further our work, namely: Content-based and Reciprocity.

We found through our work that to help achieve our aim which is stable matches among users, the best of the recommender systems is Reciprocity recommender,as it gives a higher match percentage taking into consideration both user preferences unlike content-based which uses a one-sided matching as basis for its match output.

There is a wide range of applications for matchmaking in science, future works may include application of recommender filtering algorithms in matchmaking giving room for more study into k-clustering, Naïve Bayes and other machine learning algorithms to master and predict matches between user profiles.

Further Study can also be done to introduce matchmaking systems to institutes of learning to match Lecturers to students and courses, companies to pair trainee workers with their training programs and even in health sector matching specialist doctors to patients.

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