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Preference-based Profile Matching Algorithm for users of Matrimonial Platforms

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***Abstract*— Profile matching is about matching multiple profiles based on the preferences taken by the user as inputs and matching them with suitable partners. Profile matching is based on various attributes mentioned by the user and a score was assigned to the users of the website based on their preferences. A unique pattern-based profile matching was implemented which showed better customer satisfaction compared to a filter-based profile search.**

***Index Terms*— component; matching; ai; algorithm; profile**

I. INTRODUCTION

In the 21st Century, we have seen tremendous growth in the development of Artificial Intelligence (AI) and Machine Learning. AI is revolutionizing the way we use the internet in our daily lives. AI has helped today's major tech companies like Meta, Google, Apple, and Amazon, to substantially grow and become top companies in the world by integrating AI into their systems which helps in providing personalized recommendations to their users based on their previous search analytics. We are slowly approaching the limitations of hardware as it is becoming difficult to manufacture smaller silicon wafers, AI has become necessary to adapt to the ever-growing demand of the consumer.

AI technology is important because it enables human capabilities like understanding, reasoning, perception, communication, and planning to be undertaken by software increasingly, effectively, efficiently and at low cost. Due to this, the big tech companies have integrated AI into their technology which helped them grow.

We are seeing today's tech companies are building their foundation on AI, companies like TikTok, OpenAI, and Grammarly have built their products keeping AI as the core to attract more customers to use its services.

As we are continuing in the journey of the digital revolution and this phase of AI, every company is researching on it to make use of these revolutionary technologies like AI, ML, Deep Learning, Big Data, etc., for improving their products to help them reach new possibilities with their products and services. Social applications like Facebook, Instagram, Snapchat, Twitter, Reddit, etc., have adopted AI and Deep Learning for better user experience by monitoring, analyzing, and learning user data i.e. day to day activities. Shopping applications like Amazon, Flipkart, Myntra, etc use AI for recommending products to the user according to their searches and previously purchased products. Many smartphone companies use AI in their operating system to provide interactive assistance to their customers. Siri, Alexa, Google Assistant, Bixby, etc are the trending assistants that are used daily.

With time different platforms have developed various algorithms to match their users according to their preferences

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Companies have used Profile matching which assigns a score to both the profile and the maturity profile of the entity. If the two scores are equal or close within a very small predetermined range, the profile is deemed to have achieved strategic fit. The user profile matching consists of accurately linking records corresponding to the same entity in the same or different data sources. It is a method of personnel selection in which decisions to consider candidates for a possible match are based on the characteristics fit between an applicant's characteristics and a profile of the ideal match.
Companies like Tinder, Bumble, and Happn let the user find their partners based on geolocation and distance. Meanwhile, platforms like OkCupid used multiple questions to get to know the user and to match it to a suitable profile. These platforms are dating platforms that use profile matching to some extent but most matrimonial platforms do not use profile matching to match their users. They usually rely on the traditional filter-based matching algorithms to match users based on their expectations. This has worked for some platforms but it has its limitations. To tackle this problem we tried to come up with a solution where users can use filters to get the profile best suited for them and even the match they are getting. We have discussed our approach to the problem in detail in Section III.

II. Literature Review

There are multiple research papers where different types of profile matching algorithms are discussed, some of them are -
A. Paper name: Privacy-Preserving Profile Matching for Proximity-Based Mobile Social Networking
Authors: Rui Zhang, Jinxue Zhang, Yanchao Zhang, Jinyuan Sun and Guanhua Yan
Description: In this paper Proximity-based mobile social networking (PMSN) is discussed, which refers to the social interaction among physically proximate mobile users. Profile matching refers to two users comparing their profiles and is promising for user selection in PMSN. It conflicts with users' growing privacy concerns about disclosing their profiles to strangers. This paper tackles this open challenge by designing novel fine-grained private matching protocols. The protocols enable two users to perform profile matching without disclosing any information about their profiles beyond the comparison result.
B. Paper name: User Profile Matching in Social Network
Authors: Elie Raad, Richard Chbeir, Albert Dipanda
Description: In this paper, it is proposed a framework for user profile matching in social networks. The framework allows users to give more importance to some attributes and assign each attribute a different similarity measure. Results of the experimentations showed improvements compared to other classical methods. They have also developed a prototype that was used to conduct the experiments.
C. Paper name: Geo-Social Semantic Profile Matching Algorithm for Dynamic Interests in Ad-hoc Social Network
Authors: Nagender Aneja, Dr. Sapna Gambhir
Description: In this paper Ad-hoc Social Network (ASN) is discussed where users can create social network connections using wireless ad hoc networks. Various techniques have been proposed to create ASN by matching the profiles of users. This paper provides an algorithm to semantically match users' profiles based on geographic location and dynamic interests. It shows that a local profile based on the GPS location of users is better if matched semantically.
D. Paper name: Profile Matching of Online Social Network with Aadhaar Unique Identification Number (Ideation)
Authors: Bhaskar Gautam, Vivek Jain, Sourabh Jain, and Annappa B.
Description: In this paper, a novel e-identity Architecture is proposed using Infrastructure as a service (IaaS) of the Cloud to reduce the computational cost of the profile matching algorithm. The proposed architecture is based on the public attributes available in the overall social network and lastly, profiles are mapped to the Aadhaar Unique Identification Number (UID). At present, there are 313 million users available on Twitter, 2.2 billion users on Google plus, and 500 million users on Instagram worldwide. To collect individual user information, they need to collect all information from all social media. In this paper, they are proposing e-Identity architecture through which computational cost is minimized by moving the profile matching algorithm to the Cloud using Infrastructure as a Service of a cloud. Their final goal of the paper is to incorporate all user attributes into a single user profile (as data from a single OSN can be inadequate, even unreliable).
E. Paper name: Perturbation Based Private Profile Matching in Social Networks
Authors: R. Li, H. Li, X. Cheng, K. Li, S. Wang, and R. Bie

Description: In this paper social networking is discussed which has become part of our life in recent years, allowing users to converse and connect with people sharing similar interests in the real world. Social networking suffers from serious privacy issues, one of which profiles attribute leakage to friend discovery. They propose a novel perturbation-based private profile matching mechanism by mixing the private data with random noise to preserve privacy. As no expensive encryption algorithms get involved, their methods are computationally efficient and thus more practical for real-world applications. While existing studies mainly focus on leveraging rich cryptographic algorithms to prevent privacy leaks, a novel perturbation-based private profile matching mechanism is proposed by mixing the private data with random noise to preserve privacy in this paper.
F. Paper name: A Profile Matching Scheme based on Private Set Intersection for Cyber-Physical-Social Systems
Authors: Yalian Qian, Xueya Xia, and Jian Shen
Description: In this paper, in the CPSS similar profile attributes are matched to socialize and ultimately achieve the purpose of information sharing. Some personal information may be included in the profile attributes, thus the users' privacy cannot be protected during the process. To meet this challenge, a privacy-preserving profile matching scheme based on a private set of intersections is proposed in this paper. Multi-tag is utilized to partition the dataset of users to achieve fine-grained profile matching. In addition, the privacy of users is protected by the re-encryption technique.
G. Paper name: Privacy-Preserving Profile Matching Using the Social Graph
Authors: Arjan Jeckmans, Qiang Tang, and Pieter Hartel
Description: In this paper, a privacy-preserving protocol is presented for users to test a match with potential new friends in an environment where all users cryptographically encrypt their private information. The matching protocol is designed to give Alice an indication if Bob is similar to her based on their profiles. It is shown that the process does so without revealing the private information of Alice and Bob to one another and the Online Social Network.
H. Paper name: S-Match: An Efficient Privacy-preServing Profile Matching Scheme
Authors: Xiaojing Liao, Selcuk Uluagac, Raheem A. Beyah
Description: In this paper, it is shown that profile matching is a fundamental and significant step for mobile social services to build social relationships and shared interests. Given the privacy and efficiency concerns of mobile platforms, they proposed a cost-effective profile matching technique called S-Match. The initial results, with three real-world datasets, show that it achieves at least an order of magnitude improvement over other relevant schemes. While doing the literature review they discussed and analyzed different techniques which were used for profile matching on different platforms with help of different technologies and algorithms. They also discussed the security concern about the privacy of the individual users and how effectively they can match different users with similar interests on a matrimonial website so that it becomes easy for the users to find the almost perfect match.

III. METHODOLOGY

Before starting with the actual algorithm we need to understand the data which we used to implement the searching algorithm for this paper. For this system, we used data of more than 2000 individuals to create the matching algorithm. Each user was individually identified by his/her email address. The user then has to fill in some data into the form about them and the expectations they have from their spouse. The data was stored in the following tabular format in the MySQL Server.

TABLE I: USER PERSONAL DATA

User Personal Data		
Name	Type	Attribute
Email ID	Text	Primary Key
First Name	Text	Required
Middle Name	Text	Required
Last Name	Text	Required
Gender	Radio Button	Required
Date of Birth	Dropdown	Required
Marital Status	Radio Button	Required
Religion-Caste	Text	Default
Sub-Caste	Text	Optional
Highest Education	Dropdown	Required
Stream	Text	Optional
Occupation	Dropdown	Required
Annual Income	Dropdown	Required

TABLE II: USER PHYSICAL FITNESS DATA

User Physical Fitness Data		
Name	Type	Attribute
Email ID	Text	Primary Key
Height	Number	Required
Weight	Dropdown	Required
Blood Group	Dropdown	Optional
Complexion	Dropdown	Optional
Physical Status	Radio Button	Required
Body Type	Radio Button	Required
Diet	Dropdown	Optional
Smoker	Radio Button	Required
Drinker	Radio Button	Required

TABLE III: USER ACCOUNT DATA

User Account Data		
Name	Type	Attribute
Email ID	Text	Primary Key
Profile Created By	Dropdown	Optional
Password	Text	Required
Confirm Password	Text	Required
Mobile Number	Number	Required
Alternate Number	Number	Optional

TABLE IV: USER GEOGRAPHICAL DATA

User Geographical Data		
Name	Type	Attribute
Email ID	Text	Primary Key
Address	Text	Required
City	Text	Required
Taluka	Text	Required
District	Text	Required
State	Dropdown	Required
Country	Dropdown	Required

TABLE V: USER RELIGIOUS DATA

User Geographical Data		
Name	Type	Attribute
Email ID	Text	Primary Key
Address	Text	Required
City	Text	Required
Taluka	Text	Required
District	Text	Required
State	Dropdown	Required
Country	Dropdown	Required

Meanwhile, the user's expectations from the spouse were stored in the database schema shown in Fig below

TABLE VI: USER EXPECTATIONS DATA

User Expectations Data		
Name	Type	Attribute
Email ID	Text	Primary Key
Spouse Qualification	Dropdown	Optional
Spouse Education Stream	Text	Optional
Spouce Occupation	Dropdown	Optional
Spouse Diet Preference	Dropdown	Optional
Spouse Income	Dropdown	Optional
Spouse Age Difference	Number	Optional
Spouse Marital Status	Dropdown	Optional
Spouse-Cast	Text	Default
Spouse Body Type	Dropdown	Optional
Spouse Complexion	Dropdown	Optional
Spouse Habbit - Smoking	Dropdown	Optional
Spouse Habbit - Alcohol	Dropdown	Optional
Spouse Other Expectation	Text	Optional

After collecting the data and storing it efficiently we needed to compute the user's expectation concerning the data stored in the tabular format in the database. For this, we created an algorithm to give scores to all the users based on the expectations and user data that has been filled.

In this algorithm, we denoted a Male user with Xi and a female user with Yi. So when a Male user wants to find a spouse the algorithm will calculate a score of all the female users concerning the expectation(Ei) of the male user. The score calculated will be stored in a list. Along with calculating the expectation of male users' preferences the algorithm also takes into consideration the preferences of the female users and adds to the score of the couple.

A couple's score is calculated based on the following formula

$$Sij = \Sigma\ XiEm + YjEn$$

where Em stands for the expectation of the mail and En for female, Em and En are the distance between the expectation of Xi and Yj, so the lower the difference between the expectation of the user, the higher the possibility of a perfect profile match.

In this method if Sij's score is less than the number of criteria is a good match, if Sij's score is equal to 0, then both the users are the perfect match for each other. So based on Sij's score the profiles would be filters, i.e. lower the score higher the priority.

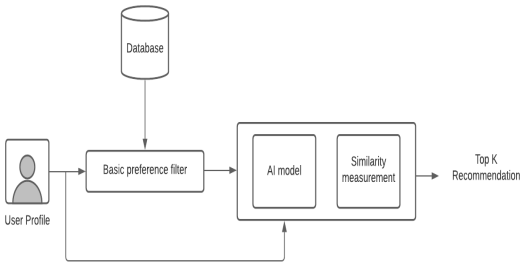

Fig 1: Flow of system

IV. Conclusion

Users were able to get more custom profiles based on their expectations and a wide range of profiles was shown. Filter based approach limited the search area of the user while this method ranked all the users of the opposite gender and showed the profiles based on preference ranking.
Even after when the user inputs more expectations the count of the profiles shown to the user remains maximum, unlike the filter-based approach where the number of profiles shown decreased drastically when more expectations were added or changed.

V. Acknowledgment

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