

AI based Match Maker using Recommendation System and K means Clustering Algorithm

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ABSTRACT

Matchmaking in the modern era has undergone a transformative shift, with algorithms playing a key role in connecting individuals for various purposes, including dating and matrimony. Modern matchmaking platforms employ advanced technologies, such as artificial intelligence (AI) and machine learning, to enhance the compatibility assessment process. The project aims to turn traditional matchmaking through advanced machine learning. it aims to predict compatibility by analyzing diverse factors including values and personality traits, utilizing supervised learning on extensive datasets. K means clustering identifies distinct group based on shared traits, focusing on more precise matchmaking model. The system assesses accuracy, performance and ethical considerations. The model addresses ethical concerns and employing K means clustering for insightful data clusters, the project aims to enhance compatibility prediction, offering a more tailored and informed matchmaking experience.

Keywords: K mean Clustering, Collaborative filtering, AI, NLP, Match Making

INTRODUCTION

Online Match making, is indeed one of the fastest growing facet in social platforms. It involves a unique form of recommendations. And In contrast, to recommendations that primarily suggests items to users online. matchmaking recommendations rely on the requirement of shared interests between the two users to facilitate communication, from the outset. One of the significant/biggest challenges lies in efficiently identifying matches for a user among the millions of users present on the online matchmaking networks [3] . The most prevalent recommendation systems, specifically content driven and collaborative based systems, are widely used, but also do come with its limitations. In the realm of online match making recommendations, there has been a limited explorations. The authors of a study applied an existing collaborative

recommendation technique, from an online dating platform, where we can employ the user's rating data. However, crucial factors like age, education, occupation, ethnicity etc. which significantly impact matchmaking, were overlooked in this study, resulting in low accuracy [4]. The matchmaking platform also contributes and lead towards the growth, of the creative economy sector, anticipated to support the business landscape especially in Indonesia and the other emerging countries. This growth will lead to a rise in exports of products, promote job opportunities and at the same time support the growth of startup education whether its, in its early phases or already established [15] . To improvise user satisfaction, on platforms we can use recommender systems. They help overcome the limitations of search functions and matching based on user

profiles. By organizing and prioritizing matches, these systems make it easier for users to find their match. This streamlined approach promotes their interactions and communication with matches benefiting users who may not be as prominent on the platform. Moreover, by suggesting connections involving these less visible users when suitable, there's potential to reduce the overwhelming volume of unwanted communication. It's important to note that such a recommender system wouldn't replace existing search tools, but rather complement them, serving as an augmentation to the current interface [2]. Content based recommender systems, generate suggestions for users based on an analysis of their past item selections, forming a profile from this content. These approaches, which have their roots in research, on information retrieval and machine learning, employ a range of strategies to extract and compare user profiles and item content. However, initial trials revealed challenges in leveraging user profiles for contentbased recommendations. Users often provide insufficient or unstructured information, primarily in free text, making reliable analysis difficult. Additionally, a significant drawback of content based systems is their inability to recommend new items of potential interest to users, as they solely rely on suggesting items akin to a user's past preferences[2]. An important aspect of utilizing matchmaking platforms involves creating a matrimonial profile, typically involving the upload of photos and information which includes name, age, social media platforms etc., to create a positive image. Studies indicate that people highly prioritize their dating profiles, intending to make a positive impression on potential partners. The primary goal is often to transition online connections into real life meetings. Nevertheless, building a matrimonial profile poses a lot of challenges and requires a significant and immense

amount of efforts, taking in the manual input of information while selecting content to attract potential matches. Additionally, study shows that individuals have a hard time creating appealing profiles as they move towards the delicate balance between showcasing positive traits and their authenticity to others[11]. finding and stopping fake user accounts stays as a challenging task. In an social network that boasts millions of engaged users and countless user interactions the number of false accounts is extremely low. In order to prevent unintentionally blocking genuine users it is imperative to maintain low rates of false positives. Certain fraudulent accounts exhibit indications of being automated. Many of them are deliberately created to mimic ones. security measures like SMS based phone verification and Captchas aim to investigate accounts that seem suspicious, thereby heightening the obstacles associated with creating fake profiles [6]. At the heart of this approach lies the incorporation of K means clustering methodology. This technique provides a unique advantage by enabling the system to identify inherent patterns and groupings within the dataset. By categorizing individuals into distinct clusters based on shared traits, the system can offer a nuanced understanding of compatibility dynamics. The utilization of K means clustering goes beyond conventional models, allowing for a more precise and tailored matchmaking experience. As individuals seeking life partners exhibit diverse preferences and characteristics, the inclusion of K means clustering serves as a key mechanism to enhance the granularity and accuracy of the prediction model. Through assessing the precision, effectiveness, and ethical implications of the system, our objective is to guarantee the dependability and impartiality of the recommendations it offers. The Research not only addresses the contemporary challenges in traditional matchmaking, but

also explores the potential to foster more harmonious and enduring relationships. As we navigate the intersection of technology and human relationships, this project represents an effort towards creating a more informed and adaptive approach to marriage matchmaking, promising a future where compatibility predictions are not only accurate but also ethically sound and tailored to the individual. This model mainly applies the K means clustering approach. This methodology shows a unique advantage by enabling the system to identify inherent patterns and forming groups within the dataset. By categorizing people into clusters based on their characteristics and traits the system provides a deeper understanding of how compatibility works, the use of K means clustering goes beyond methods enabling an accurate and personalized matchmaking experience. Since people have preferences and characteristics when looking for life partners, incorporating K means clustering is a way to improve the precision and detail of the prediction model. We analyze the systems precision, effectiveness and ethical implications to guarantee the dependability and impartiality of the suggestions given. This study is not just looks into challenges in traditional matchmaking but also explores the potential to foster more harmonious and enduring relationships. In our journey through the convergence of technology and human connections this undertaking signifies an endeavor to develop a informed and flexible method for matchmaking in marriages. it shows that predictions about compatibility are not just precise but ethical and customized to each user.

LITERATURE SURVEY

[1] The Research paper title "**Ref: [01] Personalized recommendation of social software items based on social relations**". The system uses information, from networks and offers explanations

based on individuals for the suggested items. The researchers behind the study engaged 290 Lotus Connections users to explore and contrast familiarity and similarity networks as fundamental elements for generating recommendations. Additionally, they examined the significance of providing explanations based on individuals and compared various categories of recommended items in their tests. The conclusion of this paper is that individuals found the recommendations beneficial and in handy, with positive ratings for interesting and relevant items.

[2] The Research paper title "**Ref: [02] Interaction Based Collaborative Filtering (CF)Methods for Recommendation in Online Dating.**" aims to enhance user satisfaction on online dating platforms by introducing novel collaborative filtering techniques. The authors propose several innovative methods and metrics to assess and forecast potential improvements in user interaction satisfaction, ultimately leading to heightened overall user contentment with the dating website. The study delves into diverse collaborative filtering strategies, encompassing Basic Collaborative Filtering (Basic CF), Inverted Collaborative Filtering (Inverted CF+ Sender and Inverted CF+ Recipient), and a combination of these methods like Combined CF+ and Best Two CF+. These methodologies are designed to rank potential matches based on user interactions, considering both successful and unsuccessful interactions. The effectiveness of these techniques is evaluated using historical data sourced from a commercial online dating platform. The results demonstrate that the suggested methods can enhance the user success rate by approximately 2.3 times.

[3] The Research paper title "**Ref: [03] Improving Matching Process in Social Network**". The paper centers on the

utilization of the SimRank algorithm, specifically employed to gauge the similarity among users within online social networks. Its application aims to refine the matching procedures within these social platforms. It comprehensively explores how these scores derived from the SimRank algorithm influence user recommendations, presenting experimental findings alongside an examination of related studies within the domain of social network analysis and user interaction. The study also includes trials performed on a dataset obtained from a dating platform that has approximately 2 million registered users. These experiments compare the proposed methods success with similarity measures and techniques. Additionally, the paper references research papers that are related to social network analysis, user interaction and similarity measurement. Altogether it provides a summary of the advancements in this field.

[4] The Research paper titled "**Ref: [4] A Recommendation Method for Online Dating Networks Based on Social Relations and Demographic Information**". The research paper introduces an innovative method for constructing a recommendation system tailored to online dating networks. The focus is on addressing the challenge of efficiently pairing users within these networks, considering the inherent sparsity and scale of the dataset, along with the necessity for bidirectional matching. Leveraging social networking principles, the paper proposes a solution using clustering techniques, SimRank, and modified SimRank algorithms to suggest compatible matches. Evaluating this approach with a dataset sourced from a dating platform reveals empirical evidence showcasing its performance, demonstrating a twofold improvement compared to conventional collaborative filtering and common neighbor

recommendation methods.

[5] The research paper titled "**Ref: [05] Reciprocal Recommendation System, for Online Dating**" introduces similarity features that capture the characteristics of dating networks. The recommendation systems proposed in this study perform better than methods. Specifically the content based algorithm CB2 shows improvements in precision and recall for both female users surpassing CB1 in evaluating attractiveness and interest between users. The hybrid collaborative filtering algorithm (HCF) aims to suggest users who're likely to engage in communication and demonstrates performance compared to content based algorithms in terms of precision and recall. Importantly it takes into account differences between female users when it comes to seeking potential dates providing valuable insights into user preferences and behaviors. Additionally the content based reciprocal algorithm RECON outperforms methods, offering a framework for reciprocal recommendations on online dating platforms that considers both positive and negative preferences while integrating collaborative filtering, with a stochastic matching approach.

[6] The Research paper title "**Ref: [06] Detecting Clusters of Fake Accounts, in Online Social Networks**". This research delves into the identification of clusters of counterfeit profiles within online social networks (OSNs) using machine learning techniques. The authors propose an efficient and time aware machine learning framework designed to uncover groups of fake accounts linked to a singular actor. They construct features based on user generated text elements like usernames, email addresses, affiliated organizations (such as companies or universities), aiming to facilitate classification tasks. Their approach employs a supervised machine learning process, comprising

three key components: the Cluster Builder, the Profiler Featurizer, and the Account Scorer. Through experimentation, it was found that the random forest algorithm delivered the most robust performance, achieving an AUC of 0.98 on a reserved test set and 0.95 on out of sample testing data. Following its implementation, this method has been operationalized and has successfully identified over 250,000 fake accounts.

[7] The Research paper title "**Ref: [07] A Survey of Collaborative Filtering(CF)Based Recommender Systems from Traditional Methods to Hybrid Methods Based on Social Networks**". This paper fixates on recommendation systems (RS) and their applications in various domains, such as digital information content services, e commerce, information retrieval, mobile news, e tourism and education. The document explores conventional collaborative filtering (CF) techniques used in recommendation systems. It covers memory based and model based CF methods, as well as the latent factor model (LFM) and its adaptations like matrix factorization, nonnegative matrix factorization, and singular value decomposition. Additionally, the paper illustrates diverse applications of recommender systems across various domains such as news platforms, social networks, video streaming platforms, and music services.

[8] In a research paper titled "**Ref: [08] Switching Strategy of Recommendation Algorithms in Online Dating Platforms**," presents an approach, to transitioning between different recommendation algorithms based on user feedback and preferences. The paper introduces the concepts of recommended user algorithm (RUA). Recommended algorithm algorithm (RAA) and outlines the system architecture and

data sources for their implementation. It presents five RAA strategies, including queue, highest grade, grade weight random and user CF random. Additionally, it discusses four RUA algorithms; CF, self CF, active and content match. The performance of the proposed method is evaluated using metrics such as MAE, precision, recall and coverage. The results are compared with both single and hybrid recommendation algorithms. The findings demonstrate that the multi algorithm switching strategy achieves accuracy and coverage. This underscores its adaptability, to user preferences and situations.

[9] The research paper title "**Ref: [09] Sharing and Privacy in Dating Apps**," is a research paper that explores the scientific research related to sharing privacy issues in online match making applications. Its primary aim is to furnish app designers with methodologies to enrich user experiences while effectively addressing concerns surrounding sharing and privacy. The research encompasses a comprehensive literature review and an observational analysis of two prominent dating apps, Tinder and OkCupid. This analysis aims to pinpoint sharing functionalities that contribute significantly to aspects like social presence, trustworthiness, and intimacy, while concurrently highlighting key privacy concerns. The paper extensively discusses various forms of sharing, encompassing geolocation, photo sharing, and the divulgence of personal descriptions and interests. Additionally, it emphasizes distinct privacy issues associated with the outcomes of sharing and the involvement of third party trackers. The authors arranged it in such a way that to discuss the different aspects of sharing and its parts of privacy.

[10] In this research titled "**Ref: [10] Marriage Recommendation Algorithm**

Based on KD KNN LR Model. ” we propose a method that combines KD KNN, for user classification and LR for reverse classification to find suitable matches. We take into account factors such as age, education and location for male and female users. To ensure fairness we normalize these features within the range of 0 to 1. Remarkably our algorithm achieves an accuracy of 86percent in recommending candidates who're likely to be accepted by both parties. The efficiency of our approach surpasses that of KNN due to the implementation of the KD tree structure. Furthermore we suggest improvements by refining feature representation and incorporating model regularization techniques.

[11] In a research study titled **”Ref: [11] Online Dating Meets Artificial Intelligence; How the Perception of Algorithmically Generated Profile Text Impacts Attractiveness and Trust.”** an investigation was conducted to examine the influence of AI involvement, in creating reliable profile descriptions. Involving 48 participants, this study exposed them to text extracted from 10 distinct dating profiles. These profiles were presented to participants with the information that they were either crafted by individuals or assisted by artificial intelligence. The results indicated that while the perception of AI involvement didn't notably impact perceived attractiveness, it did lead to a decline in the perceived trustworthiness attributed to the authors of these profiles. Analyzing these outcomes through the lens of the social information processing theory, the study delved into the trade offs associated with the decision to reveal or conceal the use of AI in the creation of dating platforms. Despite the utilization of AI in generating text for user profiles, the study underscores the importance of considering other factors like profile pictures and communication style when assessing the

impact of AI on dating experiences. Further analysis incorporating AI into these areas may provide insights into the relationship, between AI and online dating. [12] The research study titled **”Ref: [12] Application of Machine Learning to Create a Recommendation in Social Communication Based on Data Analysis.”** proposes the use of neural networks to analyze various attributes like attractiveness, age and gender from user photos on Tinder. Additionally the study involves object identification within these photos to generate keywords. By combining these keywords with confidence scores obtained from photo analysis and analyzing profiles recommended first message texts can be generated. The researchers have developed software to demonstrate a simplified interaction but note that the current test system has limitations in terms of features. They suggest that further work is needed to enhance capabilities and improve the user interface.

[13] The research work titled **”Ref: [13] Detecting Bogus User Profiles on Matrimonial Sites Using Machine Learning Techniques.”** evaluates the effectiveness of regression random forest, XGBoost and SVM classifiers in identifying profiles on matrimonial platforms. The dataset includes features such, as location, income and education level. Preprocessing techniques are employed to handle missing values and encode categorical features. Out of all the classifiers the random forest achieves an accuracy rate of 93percent. Shows excellent precision, in classifying test profiles when compared to other models. This achievement is significant because it helps in protecting users by identifying and preventing fake profiles that attempt to deceive them. The research indicates that there is potential to apply this approach across platforms, which would expand its reach and influence.

[14] The research paper title **"Ref: [14] Predicting romantic interest during early relationship developmentA preregistered investigation using machine learning"** was featured in the European Journal of Personality in 2023. This empirical study aims to delve into the initial stages of relationship formation, where individuals encounter fluctuating levels of romantic interest in potential partners. The research encompassed data from 208 individuals who reported on 1065 potential matches, accounting for 7179 data points collected over a span of 7 months. Utilizing random forests, a machine learning technique, the study sought to identify factors predicting participants' romantic interest in these potential partners. The findings highlighted substantial main effects for various variables, particularly perceptions of the partner's positive attributes, attachment traits, and perceived interest. Interestingly, the study did not find support for ideal partner preference matching effects on these matches. The survey offers valuable insights into the early stages of relationship development, shedding light on the factors that shape romantic interest.

[15] " The Research paper titled **"Ref:**

[15] Artificial Intelligence Based on Recommendation System for StartupMatchmakingPlatform". This research paper delves into the utilization of an AI driven recommendation system aimed at enhancing the process of connecting startups. The primary goal is to develop an exceptionally intelligent platform geared towards assisting industries in accessing information by facilitating startup matchmaking. Emphasizing the rapid growth of startups, the study is wholly integrated with Communication. The paper extensively explores the employment of Agile Sprint methodologies in software development and thoroughly analyzes the incorporation of artificial intelligence and machine learning in matchmaking startup platforms. Within the results and discussion segment, an in depth evaluation of these platforms is presented. Conclusively, the paper suggests that integrating artificial intelligence into matchmaking platforms can significantly contribute to the global expansion of the local creative economy. Furthermore, the study investigates three key research inquiries pertaining to the impact of matchmaking platforms, their adaptability, and the utilization of intelligent functionalities embedded within these platforms.

PROPOSED WORK

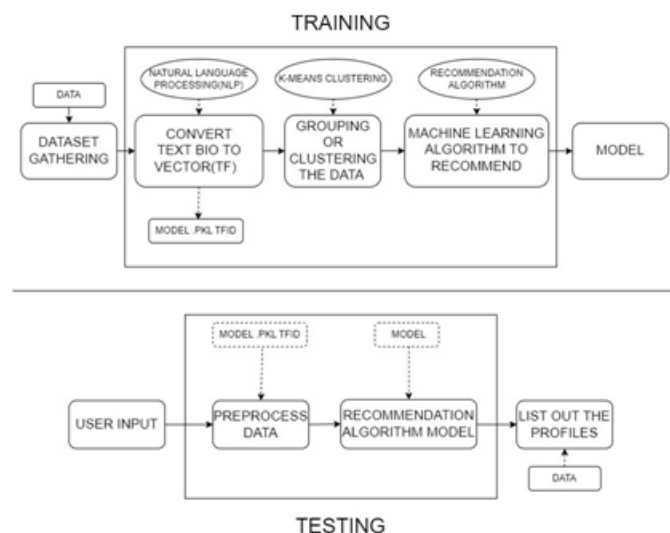


Fig.1: Matchmaking Architecture Diagram

The Match making architecture diagram in the provided for the data driven proposal encompasses several key components. It begins at dataset Gathering, which involves collecting data from many sources including social media platforms, news articles and databases for analysis and modeling. The next step in this process is to make use of Natural Language Processing techniques, by which the text data is converted into a particular format. Following that the next stage involves converting the text data into a format, for machine learning processing through the Text, to Vector process. The architecture also shows components like Model PKL TFID, which is used for text feature extraction and representation. Next, we use K means clustering to cluster the user inputs. further it moves towards testing phase which includes Data Preprocess , Recommendation Algorithm, Machine Learning Algorithm to Recommend, Model Recommendation — Algorithm Model, Model List and Profiles. bringing together all the components plays a role in the data analysis, modeling and recommendation processes of the proposed matchmaking system.

Data set Collection, Processing and feature Engineering

The selection of Dataset, plays a essential role in the model platform. The dataset has an impact, on the development and validation of the models in our matchmaking system. Our primary objective is to acquire a dataset that faithfully reflects the profiles, preferences and behaviors of users on the matchmaking platform. Once we've obtained it we prioritize employing techniques for data preprocessing. These techniques encompass stages like cleaning, transforming, integrating, reducing and addressing any imbalances, in the data. Feature engineering is extremely important as it helps us extract insights define characteristics and discover relationships,

within the dataset. In AI based matchmaking thoughtful feature engineering enables the system to genuinely understand and interpret user preferences. By enhancing the dataset through techniques, like imputation, categorical encoding, feature splitting, handling outliers, variable transformations and scaling; our methodology ensures that our AI models are well equipped to provide personalized matchmaking recommendations. Ultimately this enhances the user experience[1].

Using NLP for Text Bio

Natural Language Processing converts textual information from a bio related setting into vector representations using Term Frequency . Essentially, we're making sense of the words in a way that a computer can understand. NLP techniques are employed to extract and analyze key features within the text. capturing the inherent semantics and context of biological information. The transformation of the textual data into TF vectors gives a numerical form that keeps the essential information for subsequent analysis. This method helps to look into patterns, relationships and insights within the bio related text, which results to more comprehensive understanding of the underlying data. The use of both NLP and TF vectorization enhances the processing and interpretation of biological information, ultimately supporting advancements in related research domains and computational biology, text classification using NLP techniques such as removing stopwords, replacing negations with antonyms, and part of speech tagging. [16]

K Mean clustering Algorithm

To start we begin by importing the libraries to run the algorithm successfully. We load the Pandas DataFrame that was created when generating individuals profiles as our dataset. After importing we

focus on optimizing the clustering algorithms performance by scaling dating categories, like movies, TV shows and religion. This step is important as it can potentially reduce the time required for

fitting and transforming the algorithm. Next we vectorize the bios extracted from profiles.

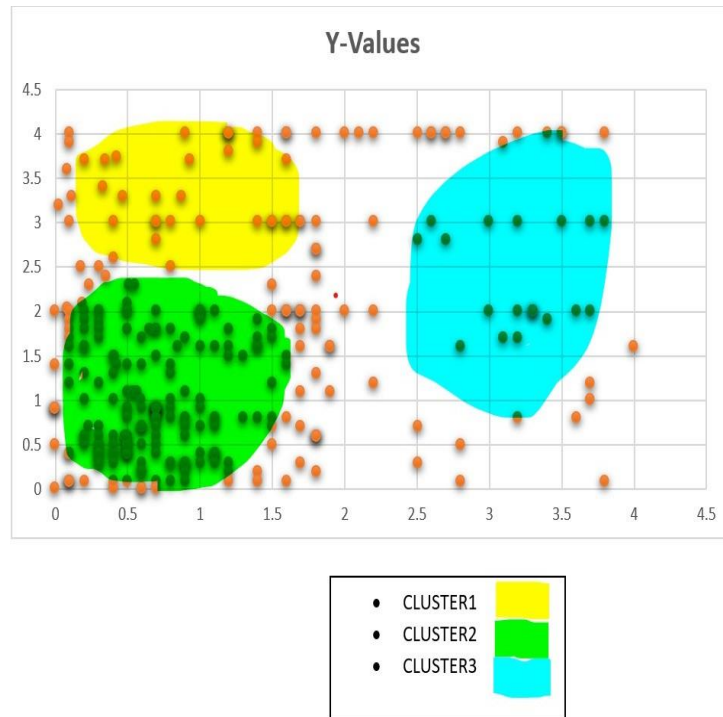


Fig.2:-Cluster graph data

Create a new DataFrame that contains these vectorized bios. We use two approaches. Count Vectorization and TFIDF Vectorization. To experiment and find the vectorization technique. Since our final DataFrame has over 100 features it's important to reduce its dimensionality. We use Principal Component Analysis (PCA) to streamline the dataset while preserving its characteristics. With our data scaled, vectorized and transformed using PCA we can now proceed with the clustering process. Determining the number of clusters is crucial for grouping profiles together. We evaluate metrics such as Silhouette Coefficient and Davies Bouldin Score to determine this number of clusters. These metrics provide insights, into how clustering algorithms perform. Help us make informed decisions. By running our algorithm with numbers of clusters we can

effectively identify the optimal number of clusters for robust profile clustering. This approach utilizes code execution and evaluation metrics to ensure results.

A. Recommendation System with Collaborative Filtering

The recommendation algorithms based on filtering as described in our paper demonstrate an improvement, over previously suggested methods. Furthermore, when compared to content based algorithms, our collaborative filtering based approaches exhibit performance, in terms of precision and recall.[5] Collaborative Filtering leverages user interaction data to identify patterns and preferences, recommending potential matches based on the behavior of similar users. collaborative Filtering aligns with our model goal of providing tailored

matchmaking suggestions by considering the historical interactions and choices of users with comparable profiles. It enriches the matchmaking process by identifying latent correlations and shared preferences among users, contributing to the creation of clusters in K means that exhibit more meaningful and personalized groupings. By adding Collaborative Filtering into our model thus ensures a more refined and accurate matchmaking system, aligning with the overarching objective of optimizing user experience and satisfaction in the realm of AI based matchmaking.

CONCLUSION

To maximize user engagement and satisfaction, a data driven approach is paramount. A robust user profiling system, powered by NLP, recommendation engines and K Means clustering, personalizes user experiences in real time. Scalability, inclusivity, and rigorous performance evaluation, ensures both customer trust and system agility. This holistic strategy fosters deeper customer understanding, driving sustainable business growth through personalized experiences and data backed decision making.

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