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Social Network Analysis to Assist Hiring Process

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ABSTRACT:Over the past few years, Social media have become the predominant information propagators on the internet. It has given people the ability to express their viewpoints. Studies say that nearly one in four people worldwide will use any one of the social media. People share information, watch images or videos, express their views, make social contacts and share lot more things on social media. All these activities can reveal many things about an individual like his personality traits, behaviour, communication skills and so on. Using social media for recruiting purpose is gaining popularity globally. Recent researches shows that the information stored in large-scale social networks is more truthful compared to simple manually generated or manipulated CVs. In this paper, a novel approach to suggest the employment suitability rate of a person using the data from his or her facebook profile has been proposed. Various parameters from a user's facebook profile will be extracted and analysed and a score card indicating the score against each parameter will be generated. Finally the scores against each parameter will be aggregated and an overall score will be calculated using Pearson correlation. This gives a clear picture of how suitable a job applicant is for that particular job.

KEYWORDS:Social networks, Recruitment, Facebook, Employment suitability, Training, Classification.

I. INTRODUCTION

The recruitment process to select and appoint suitable candidates for jobs is an age old process. It is one of the crucial process and selecting a suitable candidate with the required skills and right attitude is a trivial task. The major steps followed in recruitment process are, (i) the company first defines the job description to the candidates (ii) it attracts potential employees by advertising the job and (iii) it selects the right people by conducting a detailed interview[1]. Today we live in an internet world where almost anything can be done over internet. Recruitment process is not an exception. In 1990s, the first internet job portal started. These portals offered companies with services such as posting of online job ads and the searching of CV databases, to fill their vacancies with qualified staff [2]. Such databases store individual information only.

On the other hand, we currently observe a boom of so-called social networking platforms. As social networking platforms are extensively being used, recruiters are drifting towards using social media for hiring. The main aim of this project is to assist the hiring process by using one of the most widely used social networking site, facebook. Communication skills, team spirit, how positive a person is, their nature, problem solving skills, hobbies and interests are few major parameters based on which the HRs judge a job applicant while hiring. The main aim of this project is to rate a person's job suitability based on these parameters. Each parameter can be realized by considering one or more activity of the job applicant on facebook. For example, using any abusive or illicit words can mark a negative impact. The posts or pages a person likes or shares can reveal his nature and interests.

The remaining paper is structured as follows: In section II, related works, why facebook is chosen particularly, limitations of using facebook and research gap that exists are discussed. In section III, we discuss about the proposed system to assist hiring process. In section IV, implementation details are discussed briefly. Finally, Section IV contains summary and conclusion.

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II. LITERATURE REVIEW

A. Review on existing work

Social network analysis is the mapping and measuring of relationships and flows between people, groups, organizations, computers, URLs, and other connected information/knowledge entities [3]. Online Social Networks (OSN) have already become an important tool for recruiters. In fact, recruitment and selection professionals regularly use OSN such as LinkedIn and facebook and they state that they are able to draw conclusions on personality traits from an applicant's profile and network. Some of the major things that recruiters look for while hiring are communication skills, team spirit, interests, and personality traits and so on. Inferring personality traits from OSN use is an emerging area of research. Authors in [4] give a well-researched state of the art overview on how personality traits influence behaviour on facebook and other OSN. In [5], work on inferring personality traits of people using facebook has been carried out.

Authors in [6] say that communication intensity can be derived from blogging and tweeting intensity or wall use in facebook. In [7], the author gives a framework for recommender systems in online social network recruiting. This work is almost similar to our work except that we solely concentrate on just extracting and analysing the facebook data. In [8] a framework for recommender system for matching human resources has been proposed. It extracts information out of candidates' CV and they are rated. In [9,10], authors have carried out a work on extracting facebook status updates for sentiment classification.

Social recruiting (social hiring or social media recruitment) is recruiting candidates by using social platforms as talent databases or for advertising. Social recruiting is gaining huge popularity these days. Some of the existing social recruiting tools are discussed below.

- Lippl is a free service created to help recruiting activities on facebook and LinkedIn. It allows recruiters to quickly uncover LinkedIn profiles that are out of their network, identity facebook email addresses, and find out if their prospective candidates have anything in common with their facebook friends.
- about.me is another social network where people create pages about themselves, their thoughts, passions and expertise. The users create a one-page user profile containing their abbreviated biography.
- BranchOut is a free facebook application which allows users to create professional profiles that include their work history and education. RecruiterConnect allows recruiters and hiring managers to search through BranchOut's database to search through their network of facebook friends by job title and company.
- HireRabbit is another social recruiting tool which allows companies to combine their career site and facebook page into one, making it easy for candidates to find and apply for jobs.
- Jobvite is a job invitation which recruiters can share with their contacts in social networks. It is used to refer employees as well as to make job announcements. It consists of applicant tracking, recruiter CRM, and social recruiting software modules.

B. Why Facebook?

Facebook is currently the largest used social media worldwide with almost 1.28 billion active users. People share, upload, post, like and comment every day. Addiction to facebook has been such that Researchers have even proposed a "facebook addiction scale" to measure the level of users' obsession with facebook [11]. A recent research shows that 71% of online adults use facebook whereas 23% use twitter and 28% use LinkedIn. These numbers clearly show the need for researchers to look beyond twitter and study other social networks to get a better understanding of information flow. Also the enormous user base, potentially makes facebook one of the largest and most widespread sources of information on the Internet [12].

C. Limitations of using facebook

One of the biggest limitations of using facebook is that it provides its users with a fine grained privacy settings. This enables the users to control who can see what information from their profile. Although these privacy settings provides tremendous control to the users over their content, it becomes a serious problem from research point of view. Recent research shows that no more than 28% of facebook users share their content with people other than their friends. This leaves only quarter amount of total information available for the researchers to collect and analyse [12]. Collecting

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personal information from individual profiles becomes a huge challenge. Especially because some consider their facebook pages private and only meant for friends and family. These more private individuals may feel collecting information from their profile invasive. There are also a few legal implications to be considered while extracting information from facebook. In practice we cannot assume that all information stored in OSN is freely available. Different laws and legal systems have given different answers which vary by country and also over time [13].

D. Existing gaps

As discussed earlier, it can be observed that various existing methods for social recruiting are all based on the organizations advertising the job opportunities and job seekers finding and applying through social media. It is clearly evident that no method exists in analysing and rating a person's suitability for a job based on his social profile.

III. PROPOSED SYSTEM

The system architecture is shown in fig 1. It defines the structure and behaviour of a system and each block in the figure represents a module. Facebook profile extraction phase is the first phase. Here the required information is extracted from a person's facebook profile. The information which is extracted has to be pre-processed. The goal behind pre-processing is to clean the dataset by removing words and punctuations that are not useful. It may include steps like stop words removal, stemming and so on [14,15].

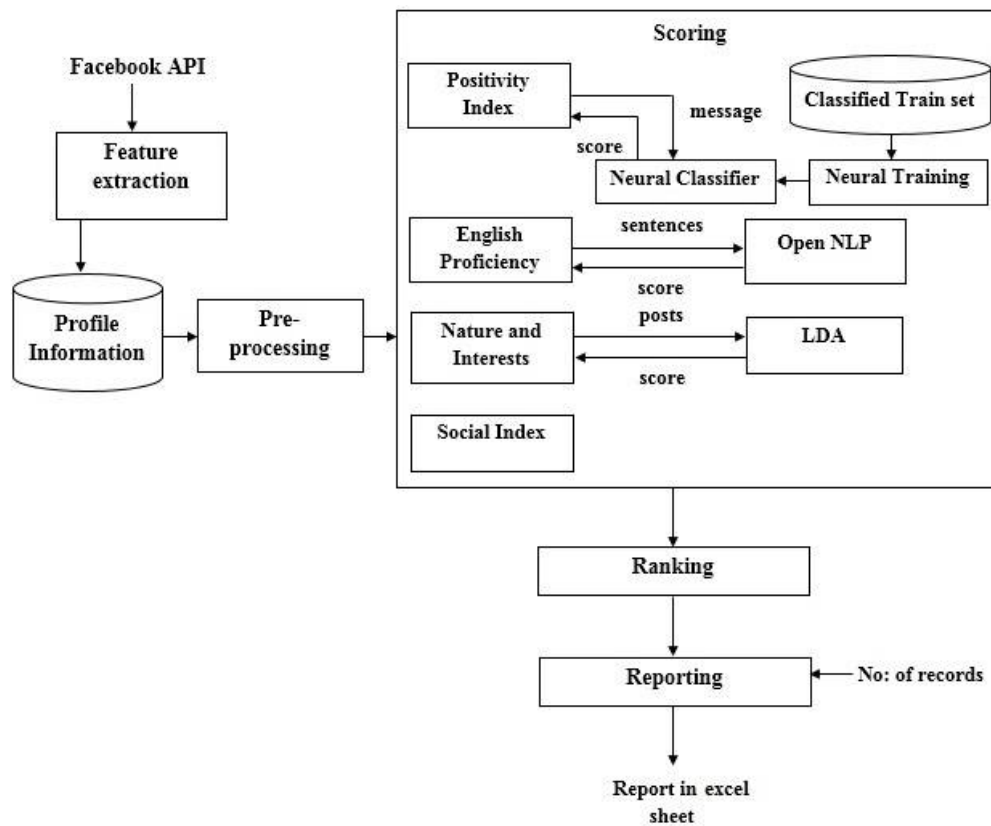


Fig.1 Typical System Architecture for Proposed System.

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Once the text is pre-processed, it can be trained and then used for generating score. In this phase four parameters are considered which are positivity index, social index, English proficiency and nature & interests. These are the various parameters which the recruiters look in a candidate while hiring. A score of 1 to 100 is generated against each parameter. The next phase is to rank the candidates according to their scores. Score against each parameter is aggregated and an overall score is calculated. Once the final scores are calculated a report can be generated which arranges the candidates in descending order of their scores.

IV. IMPLEMENTATION

Activities carried out by a person on facebook will be used as the key input to rate him/her. Various parameters are chosen based on different attributes which the recruiters look for while selecting a candidate. Positivity index, social index, nature, interests and language proficiency are the parameters considered. Details about each parameter, facebook activities which are extracted and method used for calculating score is discussed below.

A. Positivity index

This parameter is used to know how positive a person is. Status updates posted by individuals are extracted from their facebook profile. The words used in these updates are classified as normal or abnormal messages using an artificial neural network [16,17,18,19]. Here legitimate words are considered as normal messages and any abusive or illicit words are considered as abnormal messages. After classifying each word as normal or abnormal, score is calculated indicating the positivity index of that person. Algorithm that calculates the positivity index is given below.

Algorithm to find the positivity index.

Input: Status updates extracted from user's facebook profile

Output: Score indicating positivity rate of a person

- (1) Trainset=null;
- (2) For each message in Normal class
 - (a) $V \leftarrow$ convert message to Vector Space Notation;
 - (b) Add to Trainset (V , Normal);Endfor
- (3) For each message in Abnormal class
 - (a) $V \leftarrow$ convert message to Vector Space Notation;
 - (b) Add to Trainset (V , Abnormal);Endfor
- (4) $NN \leftarrow$ create NeuralNetworkClassifier(Trainset);
- (5) Assign weights randomly for each connection;
- (6) For each input connection
 - (a) Compute the product of the first input connection weight and the output from the transmitting feature vector;
 - (b) Add that product to the cumulative total;
 - (c) Compute the output value for this unit by applying the output function $f(x)=1/(1+e^{-x})$, where $x =$ input total;Endfor
- (7) Compare the final output value with the desired output and compute the error of j^{th} output layer using $(err)_j = O_j(1 - O_j)(y_j - O_j)$, where O_j is the output value obtained and y_j is the desired output;
- (8) Compute the rate of weight change, Δw_j , using $\beta * (err)_j * O_i$, where β is the learning rate;
- (9) Compute the new weight of output layer using $w_{j_{new}} = w_{j_{old}} + \Delta w + (\alpha * \Delta(t - 1))$, where α is the momentum term and $\Delta(t - 1)$ is the previous Δ change of weight;
- (10) Now to back propagate to hidden layers, calculate the error of j^{th} hidden layer using $(err)_j = (err)_k * w_{j_{new}}$, where $(err)_k$ is the error derivative of node k of next higher unit layer;
- (11) Update weights after finding all the errors.
- (12) Repeat steps 2 to 5 until desired output is obtained;
- (13) Calculate score for positivity index;
- (14) NormalCount=0;

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- (15) For $i=1$ to n , where n is the number of messages
 (a) If $\text{Classify}(\text{message}(i)) == \text{normal}$
 (i) $\text{NormalCount}++$;
 Endif
Endfor
(16) $\text{Score} = \text{NormalCount}/\text{NumberOfUpdates}$;

B. Team spirit

One of the major quality to survive in industry is the team spirit where all the team members work together for the success of that group. Individuals who mingle with people easily can always work together comfortably. A person who has more number of friends, who identifies himself with many groups and is active on facebook is considered to have a higher level of team spirit.

Number of friends a person has and the number of groups he is a part of can be extracted directly from his facebook profile. A threshold count will be fixed and the score for team spirit will be calculated based on that threshold count.

C. Language proficiency

This parameter corresponds to the attribute communication skills. It indicates how well a person can communicate with his colleagues and higher authorities. To evaluate this parameter, a three level corpus containing different levels of words and sentences will be created. The three levels can be named as A: elementary, B: intermediate and C: advanced [20]. Each level consists of predefined set of words which belong to that particular class. For example, class A will contain all the basic words, class B will contain words higher than the basic set of words and class C will contain high level words.

The classifier should be trained to classify each new word to any one of the class. Status updates and comments of a user will be the input. After classifying each word into one of the three classes, a score indicating the language proficiency of the candidate is calculated which is shown in the algorithm below.

Algorithm to find the language proficiency.

Input: Status updates and comments extracted from user's facebook profile.

Output: Score indicating the language proficiency rate.

- (1) $\text{Trainset} = \text{null}$;
(2) For each message in dataset
 (a) $V \leftarrow$ convert message to Vector Space Notation;
 (b) Add to Trainset (V , $\text{ComplexityOfMessage}$);
Endfor
(3) $\text{NB} \leftarrow$ create NaiveBayesClassifier(Trainset):
(4) For $i=1$ to n , where n is the level number
 (a) $\text{Level}(i) \leftarrow 0$;
Endfor
(5) For $i=1$ to m , where m is the total number of message
 (a) $le = \text{classify}(\text{NB}, \text{message}(i))$;
 (b) $\text{Level}(le) ++$;
Endfor
(6) $\text{score} = 0$;
(7) $\text{int } t = 100$;
(8) for $i=1$ to m
 (a) $\text{score} = \text{score} + \text{Level}(i)*t$;
 (b) $t = 100 - i*10$;
Endfor
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D. Nature and Interests

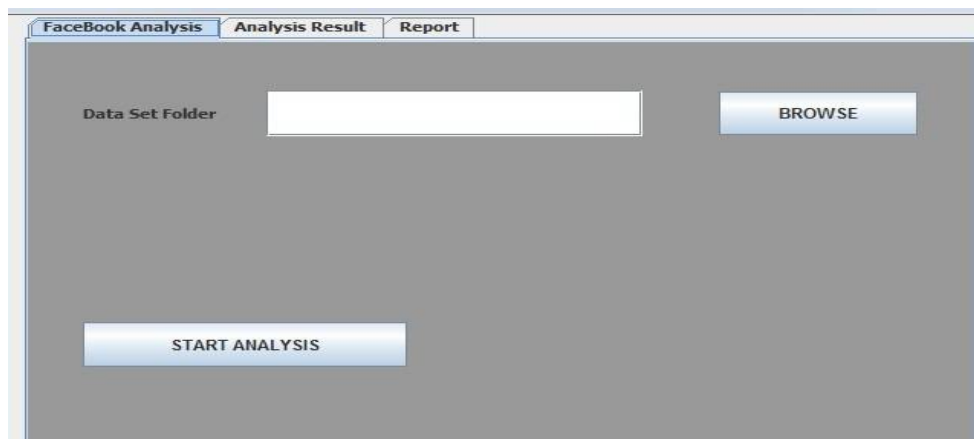
A person's nature and interests reflect his personality traits. Various posts and pages that a person likes can be used to know his nature and interests. For example, a person who likes and shares more of cricketers pages or posts related to cricket may be more interested in that sport. A person sharing pages related to emotions, relations and so on can be considered more emotional. This can reveal about a person's nature and interests. Latent Dirichlet Association (LDA) will be used to know the same.

A final score card will be generated in excel format which aggregates the score of each parameter to give a final score for each candidate and arranges the candidates in descending order of their scores.

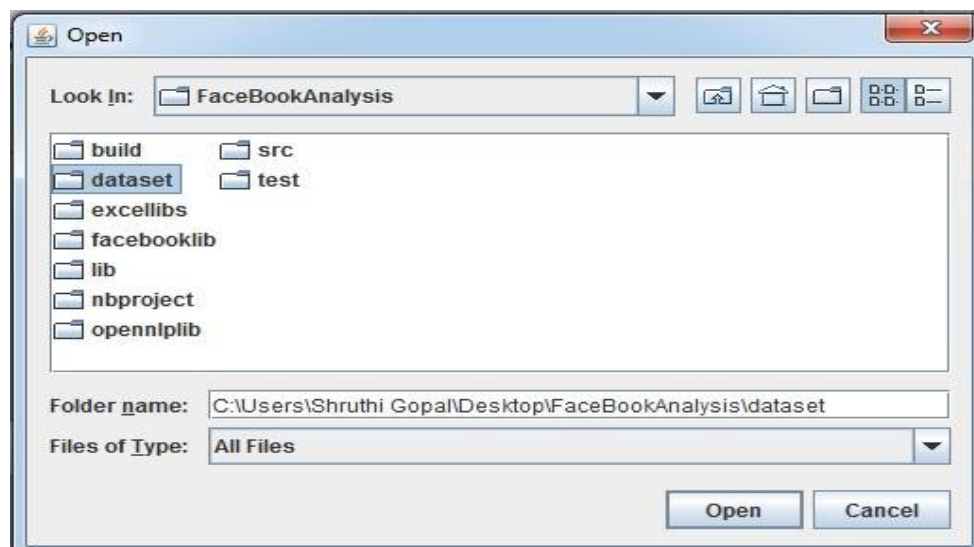
V. RESULTS

The following snapshots define the results or outputs that we obtain after the execution of all the modules of the system.

1. AUI appears after the execution of the program.



2. The admin should browse for the dataset and click on start analysis button.

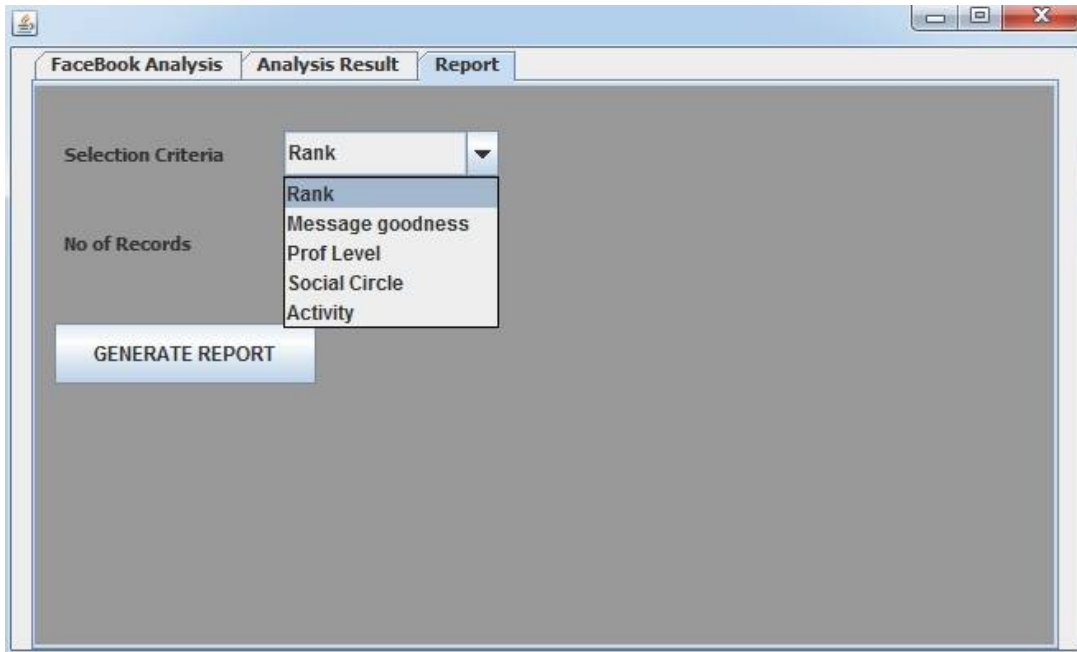


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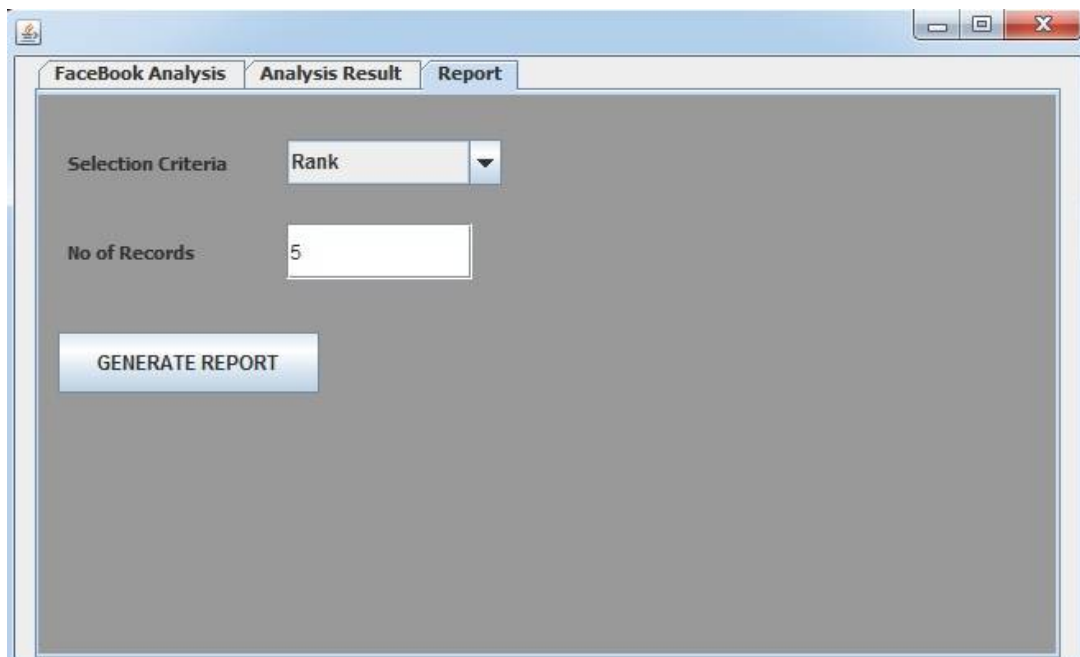
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3. The admin should select the parameter based on which the report should be generated.



4. The admin should also select the total number of records to be included in the report

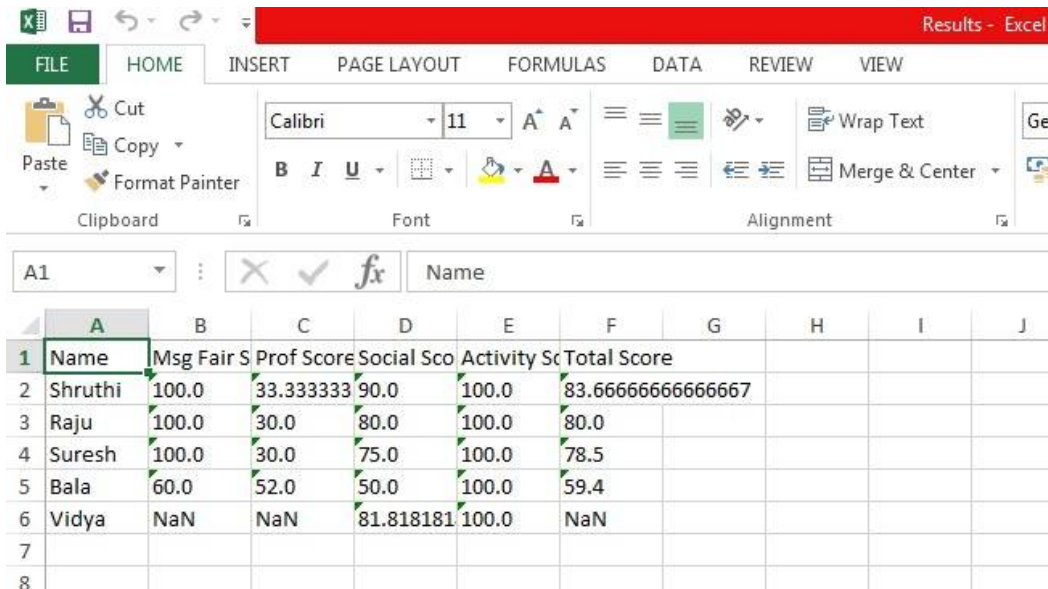


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5. A report will be generated in excel sheet.



	A	B	C	D	E	F	G	H	I	J
1	Name	Msg Fair S	Prof Score	Social Sco	Activity St	Total Score				
2	Shrutthi	100.0	33.333333	90.0	100.0	83.66666666666667				
3	Raju	100.0	30.0	80.0	100.0	80.0				
4	Suresh	100.0	30.0	75.0	100.0	78.5				
5	Bala	60.0	52.0	50.0	100.0	59.4				
6	Vidya	NaN	NaN	81.818181	100.0	NaN				
7										
8										

VI. CONCLUSION

Currently, the extensive social media usage and the unprecedented amount of data which is being generated as a result of it has become a hot topic for researchers. Using social media for recruiting purpose is also gaining popularity of late. However, the literature review reveals that the various existing methods for social recruiting are all based on the organizations advertising the job opportunities and job seekers finding and applying through social media or the recruiters going through the job applicant’s social media profile manually. It is clearly evident that no method exists in analysing and rating a person’s suitability for a job based on his social profile.

Our work aims to address this research gap and develop a tool that gives a rating on the employment suitability of a person based on his activities on facebook. As stated earlier, information stored in large scale social networks is more truthful compared to simple manually generated/manipulated CVs. So this project can be a useful and powerful tool in assisting recruiters during hiring process.

The future work can include data from more than one social media instead on solely concentrating on facebook. This gives a broader idea about a person’s behaviour and personality traits. It also increases the amount of input data which may help in generating results with better accuracy.

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