Generating Personalized Job Role Recommendations for the IT Sector through Predictive Analytics and Personality Traits

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***Abstract*— Collectively, the Information Technology sector forms one of the topmost recruiting industries as of 2015.The industry continues to grow rapidly by expanding its footprint into unexplored verticals and newer technologies. It is imperative that the IT workforce is one that is competent, versatile and adaptive. Numerous studies have determined that there is a direct correlation between the success achieved in a particular job role and the personality traits that an individual possesses. This study focuses on identifying suitable job roles for an individual who seeks a career in the IT sector by analyzing their personality. Additionally, an attempt is made to suggest potentially beneficial and currently relevant skills that the individual could acquire to excel in the suggested job roles. The study uses Holland Codes to understand the individuals' personality and to identify these job roles. Additionally, the five factor model is used to further strengthen the quality of the recommendation made. The identification of skills relevant to a job role is done through the application of data analytics to job listings on web portals.**

Keywords—Personality Types, Software Engineering, Human Factors in Software Engineering, Software Skills

I. INTRODUCTION

With the global software industry having grown to be worth $407.3 billion in the year 2013 [9], a renewed focus is required on the quality of the talent that is employed by the industry. This talent must be well equipped to perform and deliver according to the global expectations.

As the software industry shifts from the conventional waterfall model of software development to the leaner agile model, there is an increase in what is expected from the employees. These employees are required to be able to adapt to quickly changing requirements, communicate effectively with both, the clients and team members. They must also work on producing modular and efficient software. Therefore, it is necessary that the personality traits of the employee, align with the job role that has been assigned to him or her.

Various studies have analyzed and proven the effect of personality traits on job performance. Vinchur et al. in their review of the predictors of job performance in sales persons observed that the individuals who exhibited traits of extraversion and conscientiousness faired higher with respect to predicted sales performance [4]. Hörmann and Maschke, in their study on the relationship between personality and job performance of airline pilots concluded that successful pilots were more sociable, well-balanced and self-assertive. These pilots scored low on hostility and arrogance as compared to the other [5].

The objective of this study is to suggest suitable job roles that an individual of a particular personality type could take up, along with the skills that would be relevant to that particular role. To ensure that the job roles remain relevant to the current times, ONETOnline is used as a resource to identify the roles based upon the individuals' Holland Codes. Additionally, the five factor model is used to filter the suggested roles by matching commonly occurred keywords in the job role description to those in the big five traits and Holland codes. To suggest and predict potentially useful skills that should be acquired by the individual, a predictive analytics algorithm is used.

II. PERSONALITY TRAITS

A. Holland Codes

Dr. John Holland developed the Holland Codes to simplify the complicated existing system that classified personality types. The codes help organize information about people, and information about occupations, and thereby draw a relation between the two. There are six different categories i.e. Realistic, Investigative, Artistic, Social, Enterprising and Conventional. Through his research, Dr.Holland concluded that there was a direction correlation between the success rate and job satisfaction to the corresponding set of codes that an individual was mapped to. These six personality traits groups people into six different categories, however a person may be a part of more than one category, generally one more dominant than the other. Each group is represented by a letter from RIASEC. The combination of 2-3 letters makes a Holland Code for a person.

Each personality attribute can be defined as follows:

Realistic: Realistic individuals are those who prefer to work on a task that is hands on in nature. They are focused individuals and exhibit self-control. Tasks that require motor coordination are of particular interest to them. They prefer to deal with concrete and tangible projects rather than abstract ones. Engineers and architects are individuals that rank high on the realistic trait.

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Investigative: These are people who are problem solvers and are intellectual. They are curious individuals who like to question things. They tend to prefer individual work rather than people oriented activities. They like to work with data. Analysts, chemists and researchers tend to rank high on this trait.

Artistic: People who are usually creative, sensitive and emotional tend to fall under this category. They prefer free and unstructured work environments. They may work without a routine and are generally not organized. They prefer doing things by themselves and are expressive. Editors, writers and musicians tend to rank high on this trait.

Social: Social individuals are team workers who enjoy solving the problems of others. They are extroverts who are generally friendly and may prefer helping or tutoring others. These individuals are motivating as well. Social workers, teachers and counsellors tend to rank high on this trait.

Enterprising: These individuals are good talkers and are generally very convincing and outgoing. They enjoy competitive work environments and are confident of themselves. They may use their skills to manipulate others for their personal gains or for a greater good. Sales managers, politicians and managers have been found to rank high on this trait.

Conventional: People who like rules and regulations and emphasize self-control are conventional in nature. They prefer an organized and ordered work environment. They work in a very methodical fashion. They also like to work with data. Accountants and secretaries have been found to rank high on this trait.

Each Personality type is related to each other, hence they form a hexagonal model.

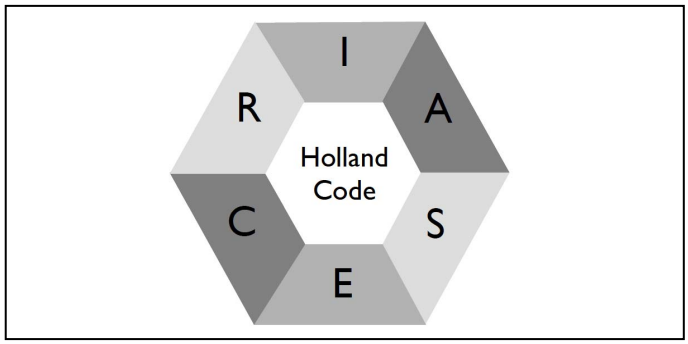

Fig. 1. Holland Code Hexagonal Model [8]

B. Big 5 Model

The five factor model is a highly reliable and preferred test diagnosed for personality analysis. It is the organization of personality traits into five basic dimensions. These five dimensions represent personality at the broadest level of abstraction, and each dimension summarizes a large number of distinct, more specific personality characteristics. These dimensions are Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness.

Neuroticism: These people are prone to the effects of negative experiences. Thus those who score higher on this trait feel more emotional distress as compared to those who score less on this trait. They are generally anxious and insecure. These individuals may be prone to depression and hostility.

Extraversion: People with extraversion as their personality trait are assertive, active and energetic. These individuals have an optimistic outlook to things. They are social in nature and like the company of others

Openness to Experience: These people are imaginative and creative, and because of their imaginative or creative nature they are more into learning. They may be more expressive in their behavior and adventurous.

Agreeableness: People who fall under this dimension of personality are kind, co-operative and trustworthy. They are generally emotionally stable and well-balanced individuals. They are team players who are trusting and cooperative in nature.

Conscientiousness: These people are more focused towards their goals and are disciplined. They are well organized workers. They believe in planning a systematic approach to achieve their goals.

III. BACKGROUND WORK

A great deal of work has been done in identifying the role of personality in jobs and work environment of an individual. While various studies have been carried out an investigation into the relationship between the Myers-Briggs Type Indicator(MBTI) and software engineering, relatively little work has been done with respect to the information technology industry and the Holland Codes.

Rehman et al. [1] analyzed the personality characteristics required for five different kinds of software engineers. The study maps the skills required by software engineers to the Big Five Personality or Five Factor Model traits. The Five Factor Model has been used to overcome the concerns with the MBTI model.

The paper lists the various jobs that form the software development lifecycle along with the activities that they perform. Skills required by the engineers are classified into hard skills and soft skills. The study goes on to describe each job role in a detailed manner with a description of the job role and the equivalent traits exhibited. For example, the paper describes that software analysts are have traits of extraversion and agreeableness. Similarly, the rest of the job roles and their requirements are mapped to soft skills which are then mapped to the five factor model [1].

Capretz and Ahmed [6] study the need for personality diversity in software engineering. They studied the various job descriptions for software engineers that appeared in newspapers, magazines and on portals and determined the preferable skills and related them to personality

characteristics. Subsequently, the skills that were desirable and high desirable for performing the tasks in each phase of the development life cycle was mapped to corresponding Myers-Briggs dimensions. The job requirements were then mapped to soft skill requirements which were then mapped to Myers Briggs traits.

Capretz [7] also investigates the role of personality type in software engineering. In the study, 100 software engineers were sampled and were administered the MBTI to determine their personality types. The study observed that the subjects were more introverts than extroverts. They ranked significantly greater on thinking than feeling. The author relates the reason for software systems not meeting user requirements to the dominance of introverts in the software field. The author also observed that a significant number of subjects could be classified as belonging to ISTJs (I-Introverts, S-Sensing-Thinkers-Judging) traits.

IV. Proposed Work

The objective of this study involves providing suggestions to an individual based upon evaluation of results of the Holland codes test. These suggestions are related to the career paths that one should take in the information technology sector and the corresponding skills that should be acquired for the respective job roles taking into account his or her personality traits and the traits required by various job roles in the information technology sector. This study involves an individual attempting the various questions that constitute the Holland Code test. The Holland code test, categorizes an individual as being Realistic, Investigative, Artistic, Social, Enterprising and Conventional. The three most dominant of these six categories are identified and selected and job roles for these Holland codes are obtained. Every Holland code will have a corresponding set of job roles that best suits the personality of that individual. ONETOnline is used as a resource to fetch the corresponding jobs. ONETOnline is a tool sponsored and maintained by the US Department of Labor. It is updated periodically. This will ensure that the designed system would be relevant to its time as newer job roles are added.

The description of the thus obtained list of job roles from Holland code test is obtained from ONETOnline. An extensive and detailed description of the job is present. This description is then scanned through and the keywords will be extracted from these descriptions. Thus, every job will be associated with a set of keywords.

Now, the set of job roles will go through an additional level of filtering using a five factor model or the big 5 model that gives the general personality traits of an individual. .Big five traits corresponding to the Holland codes are identified by using keyword matching. The keywords obtained from the description of the job roles will be matched with the keywords associated with the respective big 5 traits .Thus, certain job roles may be filtered out from the set depending on the keywords matched hence resulting in a more accurate and precise set of job roles that suits best to an individual.

Based upon this final list of generated job roles, job listings on popular web portals are crawled. The study proposes to use RSS feeds as a mechanism to obtain the job listings from the website in the event of a failure of a crawler. The feeds from websites such as www.naukri.com and www.monster.com are intended to be crawled. The corresponding descriptions of these listings is processed and depending upon their XML tag, the listings are added into a database. These crawled descriptions are scanned to get keyword from them. This study specifically focuses on the technical skills that are extracted from the job listing.

This study proposes to predict, and ultimately recommend to the user, the skills that may be in demand in the near future. This is intended through the use of time series analysis. Time series forecasting is the use of a model to predict future values based upon previously observed values. An appropriate time series algorithm is applied to understand the demand of certain skills required for previous job listings. Once understood, the future values are expected to be forecasted with a certain level of accuracy. This study intends to test the model against data obtained over a set of feeds dating two year prior to this study.

Finally, the individual will have the opportunity to view potentially useful skills that the corresponding job is expected to demand.

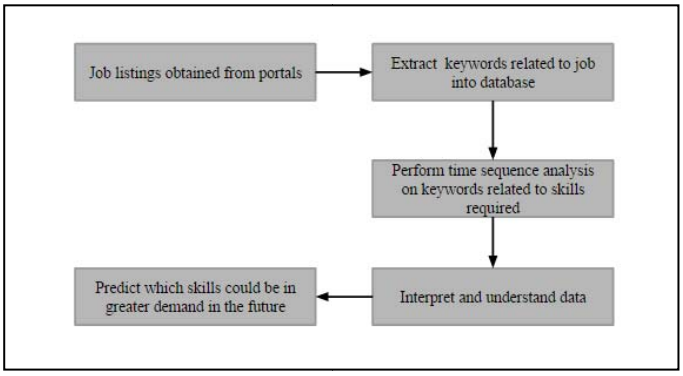

Fig. 2. Flowchart for the Skills Prediction module

V. Expected Outcome

This study seeks to address two issues. Primarily, the issue that various individuals and career counsellors are required to address with respect to identifying the most suitable area in which one would perform to his or her greatest potential. Various studies have successfully linked job satisfaction and performance to the personality traits and this study seeks to use primarily the Holland Codes, a practical and widely adopted standard for suggesting job roles in the information technology industry. This study also seeks to address the problem of a lack of high quality workforce in the ever growing industry. The outcome of this study could be used by a wide range of people, both for personal and industry related purposes.

The person attempting the Holland code test will be allotted a set of 2-3 letters that correspond to his or her Holland Code. Further, this will be used to identify the most suitable jobs and their corresponding technical skills. The expected result of this study aims to act as a decision support system in the quest to identify what a particular individual of a certain personality type is best suited for ,and what steps can be taken in the direction of achieving a successful career in that role.

CONCLUSION

Software engineering has grown into a process that involves the active participation of all stake-holders. Communication is of great importance to ensure the success of a particular software project. Additionally, the team must be flexible and should be able to adapt to constantly changing demands. They need to have the intellectual ability to analyze a particular real world problem and address it optimally.

The success of a particular organization is dependent upon the performance of its workforce. It can thus be said that organizations will be benefit from selecting individuals for certain job roles whose personality aligns with the requirements of the job.

Computer system analysts have demonstrated traits that are investigative, conventional and realistic in nature [11]. An analyst who shows a dominant artistic trait, may not perform as well as one with a dominant investigative trait. Thus, electing the right person for a particular job is of great importance. An increased understanding of how the personality of an individual in a workforce would most definitely benefit companies in boosting the prospects of success in software projects.

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