

Job Recommendation Systems: A Literature Review

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Abstract:- This paper comparatively reviews the different recommendation models amidst the different classifier filtering techniques. Recommender systems have been adopted in other areas of life to provide custom-made solutions to netizen. The accuracy or weakness of a recommender system is based on the recommendation approach and filtering techniques adopted. Recommenders' systems are developed to suit the needs and personal interests of the users. This paper review looks into previous and current recommender systems with a view of the different characteristics, advantages and disadvantages. This paper also undertakes a comparative review of hybrid recommendation techniques as regards to improving job recommendation systems.

Keywords:- Recommender System, Filtering Techniques, Hybrid Models, E-Recruitment, Collaborative Filtering, Content-Based, Knowledge-Based Recommendation Approach.

I. INTRODUCTION

Adoption of web-based recommender systems has attracted increasingly high research interests due to the dynamic nature of solution -provision to majority of internet users (Nikos G. Manouselis, 2006). Recommender systems are basically tools used to provide personalized recommendations to netizens based on personal interests and useful items. Application of recommender systems spurs across a wide range spanning from e-commerce, music, movies, e-libraries and among other areas. (Khushee Singh, 2017). The achievement of accuracy in recommendations is also supported greatly by the performance of the datamining techniques especially where huge datasets are involved. Data mining in this case involves analyzing of user profiles and intelligently finding co-relations within the database (Punitavathi D, 2019). The results of the relational analytics categorize the users and further generate feedbacks to them according to their interests and needs.

With digitization of most processes in growing companies, the adoption of web-based recruiting platforms has been inevitable (Ykhlef, 2012). This has been

necessitated by the changes in business models and intentions to cut the cost-revenue ratio. Companies that have adopted recommenders' systems include LinkedIn, Google, Jobseekers, and among others (Ykhlef, 2012). Companies are able to make adverts online and majority of job-seekers apply and even attach their personal documents like the curriculum vitae and testimonials. As such, these companies have to adopt the use of enhanced filtering techniques even in classifying the information they receive. Advanced job recommender systems perform user profiling, job matching and candidate recommendations the human resource teams. In this paper, we identify job recommendations as one of the challenging areas that need concerted research efforts due to the ever-changing dynamics of internet growth (Ykhlef, 2012) (Punitavathi D, 2019).

II. JOB RECRUITMENT PROCESS

Standard procedures of recruitment are applied in majority of companies with some invoking more stages in a bid to reduce the number of applicants especially for very competitive positions (Al-Otaibi and Ykhlef, 2012). The recruitment process has two major perspectives; one for the job seeker and the other for the recruiter. Recruiters define the requirements customized for specific positions. The requirements span from academic qualifications, skill-base and expertise-levels (Ykhlef, 2012). The job seeker prepares a catchy application letter and attaches the relevant testimonials to it. The goal of the recruiter is to identify a suitable candidate for the position with relevant skills, talents and abilities. This process is what necessitates the integration of digital systems such as recommender engines to solve the complexity of the process.

According to Faber et. Al (2013), the recruiting process has two phases which include the attraction phase and the selection phase. The attraction phase involves generation of job descriptions and requirements (Ykhlef, 2012). The selection phase involves filtering by the pre-screening of candidates by checking the personal documentation. The last phase involves screening of candidates to capture the closest possible or appropriate candidate for that position.

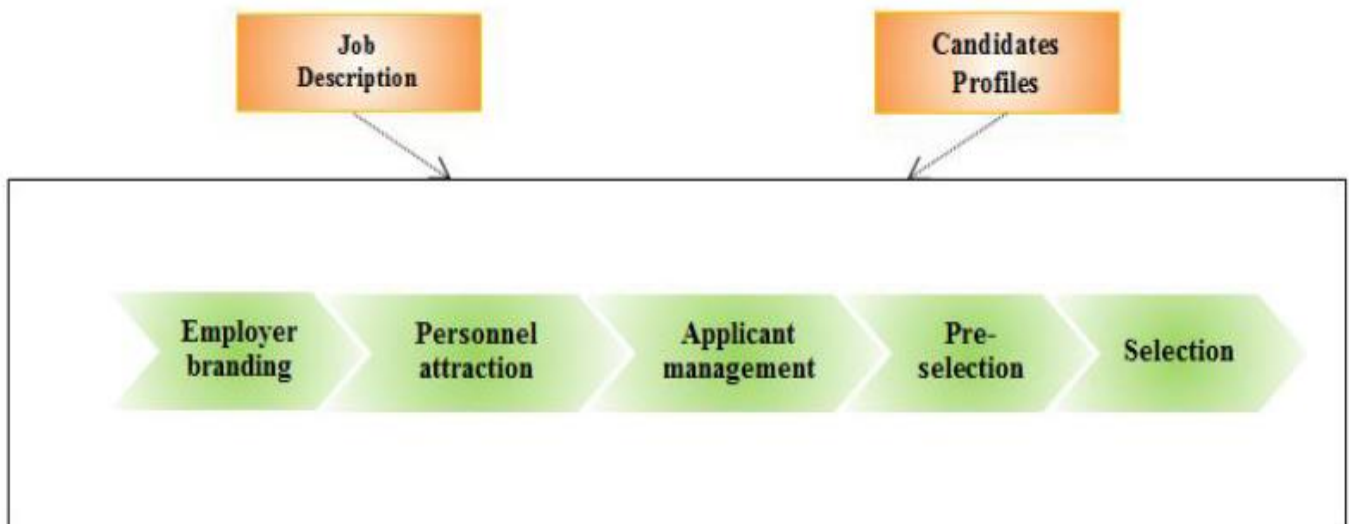


Fig 1 Standard Recruitment Process

The figure above summarizes the recruitment process as described by Lang et. Al(2011). This involves employer branding which leads to personal branding, application management, preselection and selection of candidates.

Breugh and Starke(2000) described the recruitment process as one that involves five major tasks (Ykhlef, 2012). This includes short term candidate attraction, long term candidate attraction managing applications, preselection and final section of candidates.

III. EVOLUTION OF E-RE. CRUITMENT

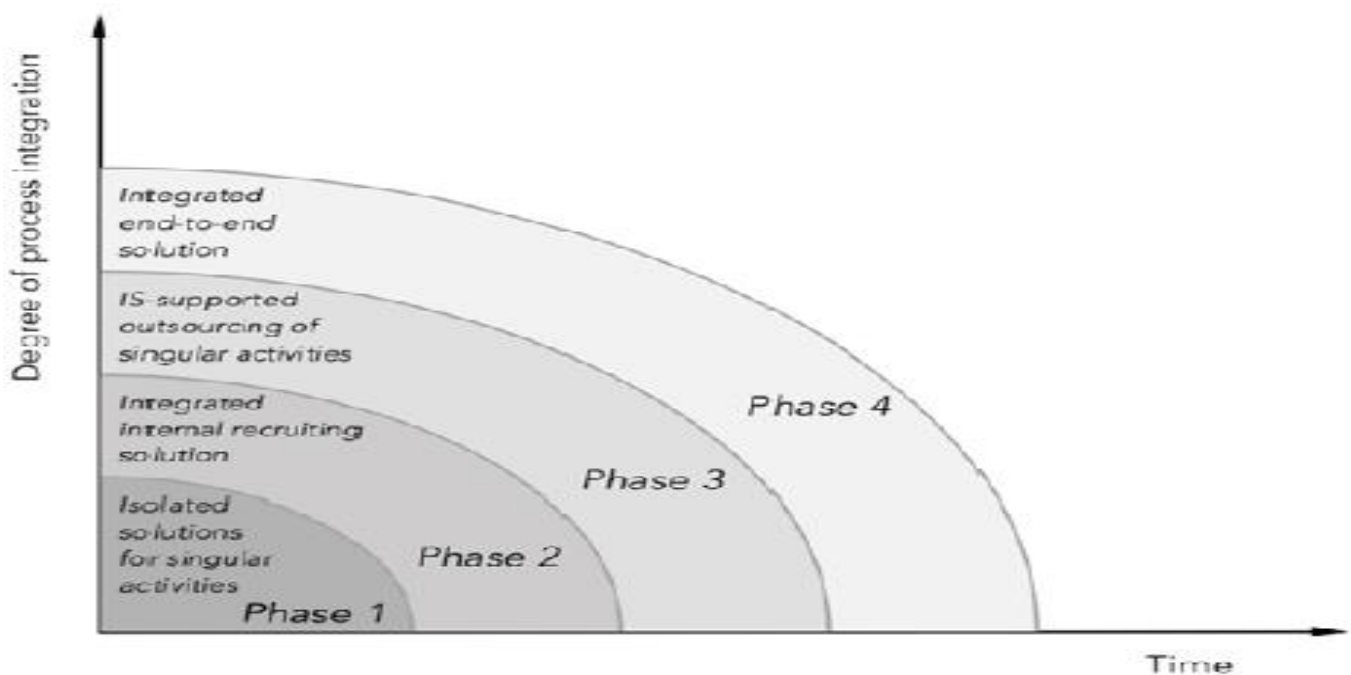


Fig 2 Phases of E-Recruitment

- According to Benjamin (2017), e-recruitment has evolved in four phases as indicated in the Recruitment Phase Mode above.
- Phase 1: Involves the introduction of isolated solutions where individual activities in the process are stored up in computer systems within the organization. This data includes testimonials captured and scanned as hard copies.

- Phase 2: Organizations adopted the use of integrated applicant management system where potential candidates view and make applications directly to the system right from pre-screening to final selection.
- Phase 3: Information systems that involved even external providers with company-based information systems linking for a continuous flow in the process.

- Phase 4: End to end fully integrated systems where companies interact with applicants and perform all stages of the recruitment process up to the final selection of expected candidates.

IV. FILTERING TECHNIQUES

According to Shahab et al (2017) and Al-Otaibi & Ykhlef (2012), recommender systems adopt the use of filtering techniques which determine the accuracy of the output. Based on their research, there are three factors to consider when selecting an appropriate filtering technique. One is to identify the target recommendation. Second is to determine the recommendation method and third is to identify the data mining mode to be used.

Filtering techniques are classified into three types (Tanya Maan, 2018)(Ykhlef, 2012). These types are encompassed as approaches used in recommendation engines.

- Type 1: Content-based filtering method categorizes data that is structured within the database such as user profiles and references. This technique is user dependent and transparent. A major challenge is that it is not a scalable method of recommendations.
- Type 2: Collaborative filtering automatically generates unstructured data that is not generated by content-based filtering methods. This includes the user's interaction with the system and areas they show interest. Collaborative filtering adopts two algorithms which are model-based and memory-based. Memory-based algorithms capture user ratings and store in the database. This algorithm is also termed as a lazy recommendation algorithm because it does not calculate the customer precedence immediately. For instance, the user-based top-N and neighbourhood-based recommendations are perfect examples of this algorithm. Model-based algorithm basically attempts to guess the user preference of an item based on user interactions. This algorithm adopts a technique where it has to be trained to learn the changing user preferences so that it is able to predict any item added to the user view.
- Type 3: Hybrid filtering methods encompass both content-based and collaborative-filtering techniques. According to (Tanya Maan, 2018), hybrid filtering techniques are currently adopted for e-recruitment. This filtering technique empowers the user to view recommendations dynamically based on user profiles and user viewed items for preferences.

V. HYBRID RECOMMENDER MODELS

Internet-based online recruitment platforms have evolved to adopt hybrid recommendation methods and approaches to achieve end to end solutions (Sonu Mishra, 2016). These models vary based on the data mining, filtering techniques and algorithms to be used for analysis and

output. According to Shaha and Mourad (2018), hybrid recommender models achieve to bridge the job requirements and candidates' aptitude to produce the best-fit candidate.

According to (Ykhlef S. A.-O., 2012) and (Tanya Maan, 2018), hybrid systems are classified into four major types.

Weighted hybridization: This model adopts content-based and collaborative filtering using both recommendation approaches. The overall performance of the system is boosted to become faster since it eliminates the disadvantages of the individual techniques. Computation involves summation of itemized scores then tabular comparison for prediction display.

Switching hybridization: This hybrid models adopts a technique of switching between different classification methods based on need basis. This approach majorly favors new users by solving challenges individual to each method. "Daily learner", a professional informative platform adopts this hybrid model for users based on need basis.

Mixed hybridization: This model produces combined results from different techniques as opposed to one recommendation per object. Each object is bound to view several results emanating from the different filtering techniques. This model has an advantage of not affecting the overall performance from individual views.

Cascade hybridization: This model refines the predictions displayed to the users. One recommendation displayed acts as an input to the other recommendation techniques. This makes the model tolerant to noise and external effect on its performance. "EntreeC" is an example, which adopts the use of collaborative filtering and knowledge-based approaches.

VI. CONCLUSION

This paper comprehensively reviews different recommender systems used in lieu of e-recruitment processes. As cited in the previous section, hybrid recommender systems are best suited to provide end to end solutions for organization-dependent or individual-recruitment companies. It is difficult to produce intended results using one recommendation technique hence why hybrid models provide a comprehensive result that meet the user demands. We have analyzed the e-recruitment process, touching on the different phases of recruitment. Also outlines are the different filtering techniques and types of models that can be adopted to make the recruitment process favorable. More specifically, we have analyzed the different hybridization models with the cascade hybrid model outstanding with better results. The e-recruitment teams could consider adopting this type of recommender model as an integrated end to end platform.

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