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ISSN: 1992-8645

www.jatit.org



JOB OPPORTUNITIES RECOMMENDATION FOR VISUALLY IMPAIRED PEOPLE USING NATURAL LANGUAGE PROCESSING

AZIMAH ABDUL GHAPAR<sup>1</sup>, FENINFERINA AZMAN<sup>2</sup>, MASYURA AHMAD FAUDZI<sup>2</sup>, HASVENTHRAN BASKARAN<sup>3</sup>, FIZA ABDUL RAHIM<sup>4</sup>

<sup>1</sup>Senior Lecturer, Institute of Informatics and Computing in Energy (IICE), Universiti Tenaga Nasional,

Malaysia

<sup>2</sup>Lecturer, Institute of Informatics and Computing in Energy (IICE), Universiti Tenaga Nasional, Malaysia

<sup>3</sup>Associate Researcher, Thea Technologies, Malaysia

<sup>3</sup>Senior Lecturer, Razak Faculty of Technology and Informatics, Universiti Teknologi Malaysia, Malaysia

E-mail: <sup>1,2</sup>{azimah, ferina, masyura@uniten.edu.my}, <sup>3</sup>hasventhran@gmail.com,

<sup>4</sup>fiza.abdulrahim@utm.my

#### ABSTRACT

This paper highlights the importance of job recommendation system and its function in helping job seekers to find available job opportunities. As various efforts focusing on job recommendation systems for sighted people, this study aims to explore how Natural Language Processing (NLP) techniques can assist visually impaired people in finding the suitable job. In this paper, we propose a job recommendation model architecture that enables the job seekers to get the most suitable job match for their profile and also allows the employers to identify qualified individuals for specific job position. The solution is based on an NLP program that will be hosted through an Application Programming Interface (API) service and connected to the Web interface. A comprehensive procedure in the proposed architecture is divided into three layers: input layer, data processing layer, and output layer. The proposed solution is expected to help visually impaired people get the result for the job that matches their qualifications and experiences and also for the employer to find a suitable candidate for the advertised position.

Keywords: Job Matching, Candidate Filtering, NLP, Job Recommendation, Recommender Systems

#### 1. INTRODUCTION

The visually impaired have consistently progressed over the last decades in job placements. With various help from blind associations, ministries, and non-profit organizations worldwide, job placements and employment barriers for the visually impaired can be improved over the years with the right tools and channels. The process of achieving a suitable pair between a person's workrelated qualities, characteristics, needs, and the demands and features of their employment is referred to as job matching [1].

Many visually impaired people, despite having talents and proper education, are unable to obtain a job that matches their qualifications and skills [2]. For example, during the Covid-19 pandemic, it is even harder for the visually impaired in Malaysia to continue working because the government does not allow massage and reflexology services, as well as other service industries, to run. In addition, the facilities constraint in the workplace and public acceptance also gives a challenge to visually impaired people getting jobs [3], [4].

People who are blind or visually impaired have a wide range of interests and abilities, just like people who are sighted. Job seekers who are visually impaired, like sighted job seekers, pursue their profession based on their skills, abilities, and values.

Various blind associations and non-profit organizations worldwide collaborate closely with relevant governments and corporate organizations to support the visually impaired in searching for workplaces and new jobs. For example, since 1956 up to date, the Malaysian Association for the Blind <u>31<sup>st</sup> January 2022. Vol.100. No 2</u> © 2022 Little Lion Scientific

ISSN: 1992-8645

www.jatit.org



E-ISSN: 1817-3195

(MAB) assists the visually impaired Malaysians in seeking job placements, from exploring new job opportunities for higher learning visually impaired people, working closely with the Department of Social Welfare and Ministry of Human Resources, organizing employment seminars, to recruitment, approaching potential employers, as well as assisting the visually impaired for the on-the-job training [2].

However, individuals with visual disabilities do not always learn the same things about a specific profession in the same way sighted people do. In most countries, vocational training for the visually impaired is available based on their interests and educational level. Such training in certain areas includes office administration, Information and Communication Technologies (ICT) related work, massage and reflexology services, and selfemployment skills [3].

Apart from vocational training, other job-related skills should also be made available for the visually impaired, such as problem-solving and community living skills [4]. In other words, individuals who are blind or visually impaired make a living doing a variety of jobs according to their interests and skills. In addition, with the advancements in modern technology, various adaptive equipment such as screen-reading software and braille displays are available to make any job accessible to an individual with vision loss.

Psychometric tests, which can be written, administered online, or administered orally, are frequently used in the recruitment process in some organizations. However, using these examinations may disadvantage the blind and partially sighted people [8]. This is because visually impaired people differ in terms of their level of vision or blindness, and this situation has created lots of new challenges. In this context, it is important that organisations find the use of assessment tools in the recruitment process for visually impaired people to be appropriate.

Employers play a significant role in providing employment opportunities to individuals with visual disabilities. This is also aligned with the recommendation by Ng et al. that employers should give people with disabilities a chance to work [4]. Employers may have a proper platform to offer their positions openly on the visually impaired market without having to worry about being reluctant in hiring them as the application done on their side can be seen transparently on the employers' side. This might also facilitate the blind associations and non-profit organizations in finding visually impaired's jobs in the future.

In this paper, we discuss how Natural Language Processing (NLP) techniques can assist visually impaired people in meeting their suitable future job that matches their qualifications, skills, abilities, personality, and character, as well as their needs. This paper proposes an architecture that uses an NLP program that is connected to a Web interface that performs the functions mentioned above. Components like Sequential model from Keras and Natural Language Toolkit (NLTK) library from Python are used to perform the job matching through job seekers' input. The proposed architecture is expected to identify any relevant jobs related to the job matching result. The visually impaired job seeker can choose and apply for the relevant job from the list of the matched jobs presented. The job suggestions displayed to them will be extracted from a database that is filled with job openings from potential employers. The result from the proposed architecture also can help employers to find suitable and ideal job seekers for them to hire.

We present a proposed architecture built as an information probing and gathering environment. Its goal is to reduce the time it takes for the visually impaired job seeker to land a decent job that is suitable with their skills and qualifications, and ultimately to ensure that every individual will be able to generate their own income without having to rely on the monthly welfare aid, as well as benefiting from the economic well-being of the country.

## 2. RELATED WORKS

Job matching is a form of recommendation system. Most recommendation systems employ explicit and implied feedback from job seekers to develop predictions and recommendations [5]. The aim of recommendation systems is to provide job seekers with tailored recommendations about items that may fit their preferences and interests. It is different from the fact that the job recommendation system suggests jobs to job seekers and recommends suitable candidates to employers [6].

In the job matching context, a number of studies explored multiple methods to compute relevant recommendations, as summarized in Table 1. According to [7], a normal job matching process typically begins with retrieving data from both resumes and vacancies. The data is stored in a different format in an external storage system. The task is generally predefined by matching rules on 31<sup>st</sup> January 2022. Vol.100. No 2 © 2022 Little Lion Scientific

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| ISSN: 1992-8645 | www.jatit.org                  | E-ISSN: 1817-3195 |

the extracted data. These rules consist of necessary resume and vacancy criteria that are defined by an expert panel in the job market area. This good practice aims to prevent conflict of interest and prejudice in the decision-making process.

The predefined criteria is derived from the job market experts, such as work expertise and fundamental candidate's requirement. These solutions are generally driven by a set of rules with predefined weight factors that will be calculated for the filtering and ranking process [8]. The final weight value defines the relevance between a resume and job vacancy or vice versa.

## 2.1 Job Matching Application Development

There are applications that have been developed to help in the job matching process. Yadav et al. [9] developed a job portal to serve students in engineering campuses in Pulchowk Campus, Nepal. The portal recommends a job to students based on their skills and assists the company in finding potential candidates suitable for the job.

In another study, Dela Paz et al. [10] developed a database system known as Online Job Finder. The purpose of this system is to make the process of job recruitment easier for both job applicants and companies during the Covid-19 pandemic. Job applicants submit their information and upload the relevant documents to the system, and the system automatically matches them with the job available. Bellini et al. [11] developed a job posting search and recommendations platform called GUapp for the Italian public administration department. GUapp recommends a job that matches a user profile and the system has a "chat bot" that allows users to interact with the application through natural language.

Chou et al. [12] developed a system that can be applied in large job fairs where in this job fair there will be numerous job applicants seeking to match the maximum job vacancies provided by many companies. The developed system conducts personal competitiveness analysis, personality trait analysis and gives job vacancy recommendations according to the applicants' electronic resumes. The system will generate a talent recommendation list for the companies to choose their potential candidates.

Kino et al. [9] applied a Japanese text analysis tool using KH Coder to improve the keywords' quality to match the candidates and the employers. The search system uses both numerical and text data. The proposed solution uses techniques such as historical matching, keyword extraction, hierarchical cluster analysis, and co-occurrence network to present a high-quality list of candidates to the recruiters.

Mishra & Rathi [10] proposed a Deep Semantic Structure Modelling (DSMM) algorithm with a multilayer perceptron (MLP) network to create a job recommender system. The DSMM has three main parts, word hashing, a non-linear activation function and ranking. Word hashing is applied to the user input and further processed by the nonlinear activation function. The processed data will be used by MLP to rank the candidates and will be learned by the DSSM algorithm.

An automated Resume Classification and Matching has been proposed by Roy, Chowdry, and Bhatia [11]. The system is based on two different models which are classification and recommendation. Classification model will categorise the resumes that have been cleansed into right category. On the other the hand. recommendation model will create a summary based on the similarity of job descriptions and the most relevant resumes. Zhang et al. [12] proposed a stable two-sided matching decision making with incomplete fuzzy preference relations based on disappointment theory. In this method, the priority weight vectors from each matching object's incomplete fuzzy preference relations were measured in obtaining the satisfactory degree of matching.

In the meantime, numerous research studies have focused on applying NLP to online recruitment platforms, improving the competitive edge. NLP is linguistics, computer science, and mathematics integrated science. Most research related to NLP will involve natural language (the language used by people in daily life), which is closely related to linguistics research and is an important direction in the area of computer science and human intelligence. It mainly explores different theories and approaches to achieve effective communication using natural language between humans and computers.

For example, Soni, Gomathi & Adhyaru [13] works on job portal enhancement by utilizing the NLTK library, a suite of text processing libraries for classification and tokenization, stemming, tagging, parsing, and semantic reasoning based on Python language. The portal is used to keep records of jobs where the organization's recruiter must submit vacancies details. The job seeker may apply <u>31<sup>st</sup> January 2022. Vol.100. No 2</u> © 2022 Little Lion Scientific

#### ISSN: 1992-8645

<u>www.jatit.org</u>



E-ISSN: 1817-3195

for the advertised job, while the employer may choose a suitable candidate.

Giabelli et al. [14] propose a recommendation system that identifies the best-suited jobs from a large dataset, starting with a set of users' skills. The gathered data is structured in a graph database, and many recommendations can be generated. Labour market experts assessed the results, and the identifying of jobs from a range of skills and a high correlation between the judgements of experts and the rank of the recommendation that was highly accurate.

Chou et al. [19] designed a resume evaluation system based on text mining for resumes written in Traditional Chinese. They developed an Artificial Intelligence (AI) based interviewing system to reduce the loss of talent caused by interviewers' emotional reactions and subjectivity when viewing resumes. The general assessment on competencies of the applicants may involve education and experience, skills, and personality traits. The resume will also be assessed and classified into four dimensions of soft power which are dominance, influence, steadiness and compliance (DISC). Job advertisement plays an important role in hiring the best talent suitable for the company. Mujtaba et al. [20] propose a visualization tool for job advertisements that can help job seekers in their job search process and employers in creating a job posting preparation. This tool analyses the text in the job advertisements and matches the phrases in the advertisement to the occupational taxonomy of knowledge, skills, abilities, and other occupationrelated characteristics (KSAOs). The result is visualized using bD3.js, a JavaScript visualization library.

Chaudary et al. [21] developed an architecture to automate the process involved in Human Capital Management with regards to match the job posts with the right talent. The three main processes involved are clustering and categorising job postings and candidate profiles using machine learning algorithms, feature extraction using natural language processing and ranking the applicants suitable with the job posts using semantic web technologies.

| No. | Author (Year)                                      | Aim   | Method  | Findings   |
|-----|--|---|---|--|
| 1.  | Bellini et al.<br>[15]                             | To develop a job<br>posting search and<br>recommendations<br>platform called<br>GUapp for the Italian<br>public administration<br>department. | Recommender system based<br>on Latent Dirichlet<br>allocation and computes k-<br>nearest neighbors job<br>position most similar to user<br>profile. | Searching and recommendation<br>process becomes incremental<br>and then the user can add new<br>requirements at each stage of<br>the intraction.   |
| 2.  | Chou et al. [16]                                   | To develop a system<br>than apply to large job<br>fairs.  | Machine learning and text mining for big data.  | System conducts personal<br>competitiveness analysis,<br>personality trait analysis, and<br>gives job vacancy<br>recommendations according to<br>the electronic resumes<br>submitted by the job<br>applicants. And the system will<br>generate a talent<br>recommendation list for the<br>companies to choose their<br>potential candidates. |
| 3.  | Kino, Kuroki,<br>Machida,<br>Furuya, Takano<br>[9] | To improve the<br>quality of keywords<br>used in matching the<br>candidates and the<br>employers.   | Text Analysis Tool using<br>KH Coder  | The discovery of positive and negative keywords.   |
| 4.  | Mishra & Rathi<br>[10]                             | To overcome the cold<br>start and scalibility<br>issue between job<br>description and<br>candidate profile.                                   | Enhanced Deep Semantic<br>Structure Modelling<br>(DSSM) System  | The algorithm provides<br>satisfactory results when being<br>tested with a different dataset.<br>It managed to resolve the cold<br>start issue.  |

# Journal of Theoretical and Applied Information Technology <u>31<sup>st</sup> January 2022. Vol.100. No 2</u> © 2022 Little Lion Scientific

www.jatit.org

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| No. | Author (Year)                               | Aim  | Method   | Findings  |
|-----|---|--|--|---|
| 5.  | Roy,<br>Chowdhary &<br>Bhatia [11]          | To develop an<br>automated resume<br>recommendation<br>system using different<br>classifiers.  | Random Forest<br>Multinomial Naïve Baiyes<br>Logistic Regression<br>Linear Support Vector<br>Machine (SVM) Classifier  | Linear SVM produces the<br>highest accuracy score<br>compared to the other methods.   |
| 6.  | Harish et al.<br>[17]                       | To develop and<br>validate the vocational<br>potential assessment<br>tool and counselling<br>module for persons<br>with severe mental<br>disorders (SMD).  | Vocational Potential<br>Assessment (VPA) tool<br>Vocational Counseling<br>Module   | The VPA is easy to be used<br>and it is also comprehensive<br>The Vocational Counseling<br>module provides framework<br>for vocational counselling.   |
| 7.  | Zhang, Kou,<br>Palomares, Yu<br>et al. [12] | To develop an<br>approach to stabilize<br>the Two-sided<br>Matching Decision<br>Making (TSMDM)<br>with incomplete fuzzy<br>preference relations<br>by considering the<br>dissapointment and<br>elation of matching<br>objects. | Stable Two-sided Matching<br>Decision Making<br>(TSMDM) with incomplete<br>fuzzy preference relations  | The method makes the process<br>of matching the objects to be<br>more flexibly and has more<br>extensive applications to deal<br>with TSMDM problems. The<br>approach considers satisfaction<br>degrees of matching objects<br>and stable matching conditions<br>simultaneously, which not only<br>can obtain stable two-sided<br>matching results, but also can<br>improve the satisfaction<br>degrees of matching objects |
| 8.  | Soni, Gomathi<br>& Adhyaru<br>[13]          | To identify the best<br>job seeker and the best<br>job applicant using<br>NLP.   | Natural Language Toolkit<br>(NLTK)   | The job portal is enhanced with<br>NLP to scan the entire job<br>seeker information and get all<br>relevant keywords related to<br>job.   |
| 9.  | Nützi et al. [18]                           | To develop and pretest<br>a comprehensive<br>occupation- and health<br>condition-specific job<br>matching tool for<br>vocational<br>rehabilitation of<br>persons with spinal<br>cord injury.                                   | Qualitative and quantitative<br>steps:(1) Conceptualization of<br>job matching.(2) Development of the<br>tool content involved<br>determining the<br>demands and<br>characteristics of<br>potentially suitable<br>occupations for persons<br>with spinal cord injury<br>(SCI). | The prototype tool able to<br>determine suitable target jobs<br>and interdisciplinary<br>intervention planning in<br>vocational rehabilitation and<br>promote sustainable return to<br>work.  |
| 10. | Giabelli et al.<br>[14]                     | To develop a<br>recommender system<br>that identifies a<br>suitable job starting<br>from a set of user's<br>skills.  | Recommender system based<br>on co-occurrence statistics<br>using Revealed<br>Comparative Advantage<br>and distributional semantics<br>through word embeddings.   | The generated<br>recommendations are validated<br>by labour market experts and<br>demonstrate a high precision in<br>identifying jobs and a high<br>correlation between<br>judgements of experts and the<br>rank of recommendation.   |
| 11. | Chou et. al                                 | To design a resume<br>evaluation system<br>based on text mining<br>for resume written in<br>Traditional Chinese  | Resume tranform into text<br>using python-docx and<br>pdfminer packages and will<br>process using NLP.   | The study develop an AI-based<br>interviewing system to reduce<br>the loss of talent because of<br>unfair treatment during the an<br>interview,   |
| 12. | Mujtaba et. Al                              | To propose a job<br>posting visualization<br>tool to assist<br>jobseekers in their job   | Semantic similarity<br>matching between KSAOs<br>for an occupation and<br>advertisement text are done  | Visualization tools for job<br>advertisement that analyzes the<br>text in job advertisement and<br>and match the phrases in the   |

# Journal of Theoretical and Applied Information Technology

31<sup>st</sup> January 2022. Vol.100. No 2 © 2022 Little Lion Scientific

www.jatit.org



E-ISSN: 1817-3195

| No  | Author (Year)       | Aim  | Method  | Findings  |
|-----|---------------------|--|---|---|
|     |                     | search process, and<br>recruiters in creating a<br>job posting<br>preparation<br>advertisement.  | using O*NET and natural<br>language processing. The<br>result is visualized using a<br>JavaScript visualization<br>library.   | advertisement to occupational<br>taxanomy of knowledge, skills,<br>abilities, and other occupation-<br>related characteristics<br>(KSAOs).  |
| 13. | Chaudhary et<br>al. | To develop an<br>architecture for<br>automated Human<br>Capital Management<br>(HCM) in matching<br>the job posts with the<br>right talent. | Knowledge Inference (KI)<br>module is derived using<br>ontology technique.<br>SPARQL queries used to<br>fetch relationship present<br>between input skills and KI<br>module. Knowledge-base is<br>developed by defining<br>relationships based on the<br>Jaccard Similarity between<br>skills on trusted sources.<br>Candidates profiles and job<br>posts is compare using<br>similarity measure and will<br>be ranked using ranking<br>module. | Automate the HCM process<br>and the module developed also<br>would be able to recommend<br>skills to acquire or learn by the<br>job seeker if they want to<br>consider a a specific job<br>profile. |

# 2.2 Job Matching Application Development for Visually Impaired

ISSN: 1992-8645

The work that visually impaired individuals can carry out is dependent on the work environment. Some of the requirements for a visually impaired person to secure a job can be different from the conventional application done by a typical person. Some job offer requires for the visually impaired person to walk a lot during the job, some may require strength, and others might require them to endure noise and flashing lights throughout the working hours.

These warnings and requirements are usually not listed in the normal job opening advertisements for the typical applicant, so here is where our work comes into the picture. For example, to work as a box maker, the individual should be able to ensure all labels are properly secure to product containers. Another example, for the product inspector, the individual should be capable to use visual standards to ensure the proper assembly and packaging of any given product. Hence, it is important for these people to know what skills and education are needed.

Location of the job offered by the employer also plays a big role for the visually impaired as the obstacles and challenges they face during travelling to work may differ from others. The automated process for the job matching suitable for the visually impaired is significant as it may be quite difficult for these individuals to access the details in the advertised job vacancy. Various online job tools help job seekers to find a suitable job. For example, Behavioural Insight Team, a company set up by the UK government, developed an application called "Applied", which will assist people in finding a job by answering five online questions. Applied does not require applicants to submit a curriculum vitae (CV) in this process, and it promotes the concept of biasness in selecting employment candidates [22].

For the visually impaired, many initiatives have been introduced to help people with disabilities in finding suitable jobs. Those initiatives can be employment clubs, workshops, work experience, and career counseling [23]. One of the initiatives identified is a platform called "CareerConnect" that American Printing House has developed for the Blind [24], which consists of employment information for job seekers who are blind or visually impaired. The website includes information on employment, career exploration tools, and help on job-seeking guidance for people with vision loss, and the professionals who work with them.

# 3. METHODOLOGY

## 3.1 What and Why?

A job matching system is supposed to be able to acquire meaningful and accurate job matching results from the input given by the users. A traditional matching program with predefined rules could perform the task intended for a job matching system but the results would be rigid and the system <u>31<sup>st</sup> January 2022. Vol.100. No 2</u> © 2022 Little Lion Scientific

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| ISSN: 1992-8645 | www.jatit.org | E-ISSN: 1817-3195 |  |
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could work incorrectly if the users are going beyond its scope.

However, this can be solved by having NLP in the system. NLP can train the system on multiple interactions and inputs that it comes in contact with. This will enable the system to produce results based on a contextual analysis similar to humans.

NLP based systems are capable of understanding the text structures, semantics, and speech phrases. Hence, it is able to analyse a large amount of unstructured data and understand the context of it. NLP also helps to make cost reduction by reducing manpower. Instead of having multiple recruiters to identify suitable candidates based on their qualifications and credentials, the NLP system could do the same task by replacing the recruiters. It also ensure higher user satisfaction as the job seekers could get instant results rather than waiting for days to hear back from their recruiters regarding their eligibility for a job.

Hence, this paper proposes a NLP powered job matching system for the visually impaired. The proposed system can be divided into three sections, the main program, the back-end, and a knowledge base. The main program will be a Web interface that allows both job seekers and potential employers to key in their relevant details. The backend will consist of an AI model that is generated and trained by a Python Script. This script is also responsible for processing the details provided by job seekers and producing an outcome by utilising the AI model mentioned above. The knowledge base is a crucial part of the architecture as it contains the necessary information required by the AI model as shown in Figure 1 to run. The architecture can also be divided into three layers: input layer, data processing layer, and output layer, as shown in Figure 3. Both the components and the different layers that utilise them will be explained in the next section.

## 3.2 Components

a. Users: There are two types of users in this system. The first will be visually impaired students who enter their details into the system to look for potential jobs that match them. The second will be the potential employers that post job openings in the system.

b. Artificial Neural Network (ANN): In our proposed model, we are using a Sequential model from Keras. It is one of the neural networks that have a multilayer perceptron. Hence, it is a feedforward ANN that helps to solve problems stochastically. For the initial prototype of the system, we have four different layers in the proposed ANN, an input layer, two hidden layers, and an output layer as shown in Figure 1.

The number of intents or results that the output layer can predict determines the number of neurons in the two hidden layers. The second hidden layer should have at least twice the number of neurons or intents in the output layer. The first hidden layer should have at least twice the number of neurons in the second layer. The hidden layers are used to process the information being fed by the job seekers. For the hidden layers, we are using Rectified Linear Unit (ReLU) as the activation function. ReLU is used for the first two layers due to its high training and validation accuracy.

Softmax is used as the activation function for the output layer due to its ability in predicting a multinomial probability distribution. To train the model, we implement Stochastic Gradient Descent (SGD) that turns the model into a NumPy array that will be saved as a '.h5' file to be used by the Python script.

c. Knowledge base: Knowledge base acts as the repository of data needed by the AI model to be trained and used. In the proposed architecture, the knowledge base contains information about jobs and their respective description and requirements. The information is stored as intents in JavaScript Object Notation (JSON) format. The intents stored in the knowledge base has objects and sub-objects in it, which helps to narrow down the result for the query issued by the user. For example, the tag 'software engineer' can be an object as shown in Figure 2. We can find patterns and responses (job requirements) related to the tag as the sub-objects. The ANN layer will access this intents to produce the result for the query entered by the users.

Apart from the skills required for a particular job, there are other important criteria that has to be included in the knowledge base as well. For example, there are many types of visually impaired people such as born blind, partially blind, blind by accident, and many more. Each type of visually impaired can perform different types of jobs. A born blind person might have exceptional echolocational skill that can make them an ideal candidate to be in navigating job. However, a person who was blind by accident might not perform the same job to the level of a fully blind person can do. This means, distinguishable features like these also have to be added as tags in the knowledge base to produce a much more narrowed down and accurate result.

#### Journal of Theoretical and Applied Information Technology 31<sup>st</sup> January 2022. Vol.100. No 2

© 2022 Little Lion Scientific

| ISSN: 1992-8645 | <u>www.jatit.org</u> | E-ISSN: 1817-3195 |
|-----------------|----------------------|-------------------|

d. Database: The database is used to record two types of information. First is the result that the visually impaired people get after they share their details in the system. Second is the job offers posted by potential employers. This information can be viewed through the Web interface.

e. Web interface: The Web interface is used as the main tool for the job seekers to use the system. A visually impaired student uses the screen readerfriendly Web interface to key in his or her details to get the prediction of the most suitable job for his or her credentials and the related job postings. It is really important for the Web interface to be screen reader-friendly as most of the visually impaired people depends on it due to the convenience and accessibility offered. An employer can also use the same Web interface to post jobs in the system to be searched and found by the visually impaired students.



Figure 1: ANN layers in NLP program

```
"intents": [
  {
  "tag": "Receptionist".
  "patterns": [ "Good command of languages", "Experience in Braille typing", "SPM graduate", "", "Good speaker" ],
   "responses": [ "Qualified to be receptionist" ],
  "context": [ "" ]
 },
  {
   "tag": "IT Support",
   "patterns": ["Experience in Braille typing", "Basic understanding of IT maintenance", "Degree in Computer Science",
"Degree in Information Technology", "Good communication skills" ]
   "responses": [ "Qualified to be receptionist" ],
   "context": [ "" ]
 },
 {
  "tag": "Exhibition Tour Guide",
  "patterns": [ "Excellent echolocational ability", "Good memory of paths", "Independent", "Quick learner"],
  "responses": [ "Qualified to be receptionist" ],
  "context": [ "" ]
 },
  {
  "tag": "Research Assistants",
  "patterns": ["Independent in conducting research", "Quick to learn", "Good in Braille reading and typing"],
  "responses": [ "Qualified to be receptionist" ],
   "context": [ "" ]
 },
```

Figure 2: Sample Intents stored in Knowledge Base

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Figure 3: Proposed Architecture for Job Recommendation Model

#### 3.3 Input Layer

The visually impaired job seekers have direct access only to the Web interface. This process happens in the input layer where the job seekers key in details such as their personal details, educational qualification, and skills. The details are entered into a Web form and passed to our Python script that works in the back-end. The python script will lemmatize the words given by the user and feed them to the ANN's input layer with the help of the NLTK library. No computations are done in the ANN's input layer. The same process is applied for the employers to post job openings. They can enter the details of the job opening through a different Web form in the Web interface. However, instead of passing the information to the Python script, the information passes the information to the data processing layer and is stored in the local database. This is because employers do not need to use the ANN model to post the job openings in the system. Hence, both types of users only interact with the system directly in the input layer. Once they key in the details, the rest of the process is automated by the system in the rest of the layers.

#### 3.4 Data Processing Layer

The model is trained earlier with the dataset (assuming around 50 outputs) provided in the

knowledge base. A giant nested list that contains a bag of words for each of the documents is created. Once the data is fed into the input layer, it moves to the next layer, which is the hidden layer. Hidden layers perform all the computations required on the data entered through the input layer and passes it to the output layer. Hidden Layer 1 will consist of 200 neurons that use the ReLu function to add nonlinearity into the output of a neuron and pass to the next hidden layer. The Hidden Layer 2 will consist of 100 neurons and uses the ReLu function to calculate the weighted sum further and add bias. Since we only have two hidden layers, the data processed in the second layer is passed to the final layer, the output layer.

The output layer of ANN brings up the data computed by the previous layers and presents it to the job seekers. The softmax function is used in this layer to normalize the output of the network and to represent the probability distribution over n different classes. To simplify it, a job seeker who has a degree and experience in Software Engineering will get the job "Software Engineer" as the best match for his credentials entered into the system earlier. Then the output is sent to the local database by using Python's MySQL connector library before it is displayed to the user with an automated PHP query. 31<sup>st</sup> January 2022. Vol.100. No 2 © 2022 Little Lion Scientific

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#### 3.5 Output Layer

The output layer is the final layer in the architecture. The visually impaired people get the result for the job that matches their qualifications and experiences. Any relevant jobs that are related to the result that they get will be displayed to them. The job seekers can choose and apply from the list of the matched jobs presented to them. The entire transaction or information and result related to the job seekers will be stored in the system's local database for the purpose of reference and tracking. The job application will be emailed directly to the employer who posted the job advertisement.

Since, the job list is displayed to the job seekers based on their skills and qualifications, the employers receive the job application from the most suitable and ideal job seekers. The employer can then proceed to contact the most qualified applicants and contact them through their email. This also offers transparency, as well as less administrative work by non-profit organisations (NGOs) that usually help visually impaired job seekers in hunting their suitable job.

#### 4. CONCLUSION

This paper presents the work to match job descriptions with job vacancies, focusing on visually impaired people. Our work has presented a proposed architecture that has a job matching and posting system for visually impaired people and potential employers. We plan to utilize a Pythonpowered NLP program to work with our screen reader-friendly Web interface to enable the job seekers to get the most suitable job match for their profile. The NLP program will be hosted through an API service and connected to the Web interface. The results from this study may assist in the development of an automated program to help visually impaired people identify future job that suits their work characteristics, personality, and character, as well as their requirements.

As for our future works, the resulting architecture in this study will be used as input to the job opportunities recommendation system that the target community can use. It is expected that the system may empower the lives of visually impaired people by providing the platform for them to search on and apply for jobs like how sighted people typically do.

#### ACKNOWLEDGEMENT

This study was funded by Universiti Tenaga Nasional under the BOLD Research Grant 2021 (J510050002/2021043). The authors would like to thank Innovation & Research Management Centre (iRMC) UNITEN for fund management. Finally, we are grateful to all the parties that has participated and helped us throughout this research project.

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31<sup>st</sup> January 2022. Vol.100. No 2 © 2022 Little Lion Scientific



#### ISSN: 1992-8645

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