Pathfinder Project Report

Mario Yepez-Olvera[#1], Zainab Khan[#2], Akshat Alpesh Shah[3], Sheethal Halandur Nagaraja[#4]

Software Engineering Department, San Jose State University

1 Washington Square, San Jose, CA

[1]mario.yepez@sjsu.edu

[2]zainab.khan@sjsu.edu

[3]akshatalpesh.shah@sjsu.edu

[4]sheethal.halandurnagaraja@sjsu.edu

***Abstract* — Pathfinder is the Cognitive Search Engine that uses IBM's Watson Personality Insights to determine a personality profile for job seekers. Through a mix of personality and skill set matching, Pathfinder attempts to find the best job for job seekers and candidates for job posters.**

***Keywords* — Job Search, IBM Watson, IBM Cloud, Mongo, Express, Angular, Node**

I. Introduction

In today's world one of the major problem we are facing is the gap between the hiring companies and the employees willing to work for these companies. Often the websites available match with keywords of skillset. No doubt skills are really a very important factor for hiring but even the personality and preferences should match. So, there is a solution to this problem which we try to mitigate as much as possible with the help of Pathfinder. Pathfinder is the Cognitive Search Engine that uses IBM's Watson Personality Insights to determine a personality profile for job seekers. Through a mix of personality and skill set matching, Pathfinder attempts to find the best job for job seekers and candidates for job posters.

II. Problem Statement

Major problem with most of the traditional job search websites is they only match job seekers and job posters at keyword level.So they fail to gauge the personality of the job seeker.Over time this leads to unhappy employees and increases attrition rate of company. Finding a career that best fits personality profile is considered as a important factor to professional success. People who excel in their careers are usually highly motivated and energized by their jobs because their career lets them take advantage of the natural preferences and strengths of their personality. Their job is not a chore to be endured but a vehicle to exercise their talents. They achieve the most important of things in job satisfaction: "a fit" with who they are.Also to hire an employee requires a lot of time and money and it costs even more to lose an employee.Therefore along with skill match it is very important for employers to hire a suitable person whose personality matches with the job requirements.This is where it becomes important for job search engines to ask important personality questions to job seeker, analyse their personality,ask job insight questions to job poster and match them through a mix of skill set and personality to choose right fit for the job

III. Ranking Candidates

A. IBM Watson Personality Insights

In order to use determine the personality profile of the candidate, IBM Watson Personality Insights was used. This API takes in a body of text and gives back a json object containing the percentile the person falls in.

"The Watson Personality Insights API predicts an individual's personality characteristics, needs and values to drive personalization. It extracts and analyzes a spectrum of personality attributes to give you insights into people and entities. Then, it guides users through highly personalized interactions based on those insights. The service outputs personality characteristics divided into three dimensions: The Big 5, values and needs."[5]

The documentation states that "It should contain words about every day experiences, thoughts, and responses."

The questions will prompt the reader to write about their everyday experiences and thoughts. The documentation guidelines state that it is ideal to provide at least 1200 words but 600 is acceptable. In order to achieve 1200 words, 6 questions were chosen and the candidate input for each question should be around 200 words.

Three of the questions are supposed to encourage the candidate to write about everyday experiences. The other three were taken from Arthur Aron of the Interpersonal Relationships Lab at Stony Brook University in New York, who published his results in "The Experimental Generation of Interpersonal Closeness" in Personality and Social Psychology Bulletin.[6]

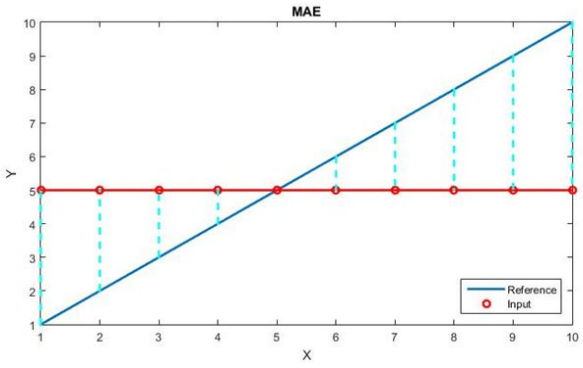
B. Matching personality

Given a personality profile of an ideal candidate which includes personality indexes such as Agreeableness, Conscientiousness, Openness, Introversion/Extroversion, Emotional Range etc; determine suitability of the candidate for the role and employer.

There are multiple ways to calculate the suitability. The most effective way to calculating such performance is to find out how much the applicant's profile overlaps with the employer's requirements. The profile generated by IBM Watson personality insights is numerical which allows mathematical calculation of suitability.

Two of the most common error metrics are MAE and RMSE:

What is MAE?
Mean Absolute Error is a measure of difference between two continuous or discrete functions.



It is the average vertical distance between input points and the reference function. It is calculated by averaging the sum of absolute difference between each pair of coordinates and is denoted by:

$$MAE = \frac{1}{n}\sum_{j=1}^{J} |\hat{y}_j - y_j|$$

What is RMSE?
Root Mean Squared Error is a measure of differences between the reference and input values. It accounts for individual differences between each point of the data and is commonly used in machine learning and data mining to train models by minimizing RMSE of the predicted model. It is calculated by square rooting the sum of average of square difference between each pair of coordinates. RMSE is denoted by:

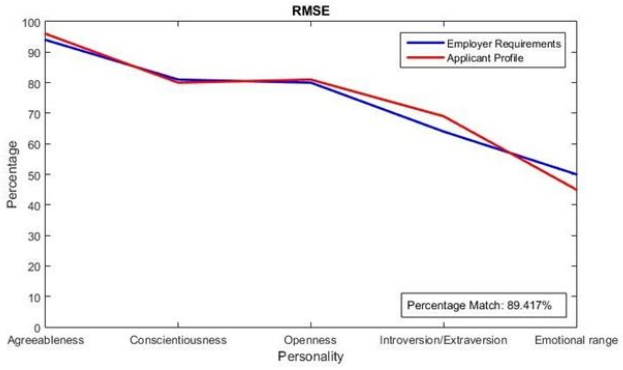
$$RMSE = \sqrt{\frac{1}{n}\sum_{j=1}^{J} (\hat{y}_j - y_j)^2}$$

Similarities between MAE and RMSE:

Both metrics calculate average model error which can range from 0 to ∞, and are indifferent to the direction of errors. Both metrics are inversely proportional to suitability, which means that lower values indicate lesser error; hence they are better.

Differences between MAE and RMSE:
For RMSE, taking the square root of average squared errors penalizes larger errors. As opposed to MAE, RMSE is very useful for applications in which higher error is particularly undesirable.
RMSE is more commonly used in machine learning because it increases the rate convergence which in result requires less training data.

Graphing the RMSE:



Calculating Suitability Percentage:
Since RMSE is a negatively oriented metric; it is converted into suitability percentage match by using the following formula:

$$Suitability\ Percentage = 100(1 - RMSE)$$

C. Skills match

The skills match was generated by taking the intersection of the candidate skill set and requested skill set. The number of skills present in both the candidate and job set was divided by the total number of skills present in the job skill set.

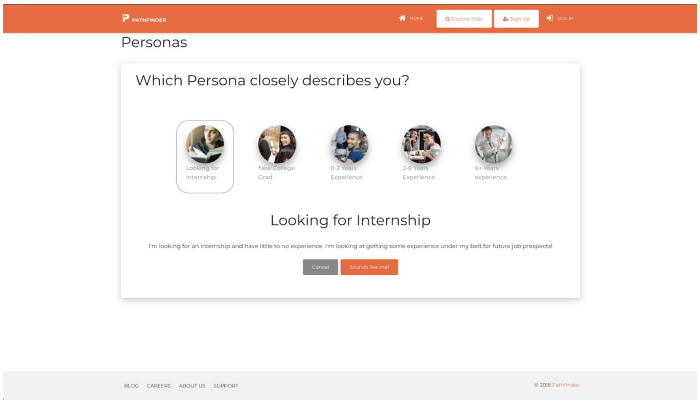
D. Ranking calculation

The number from the personality match and the skill match were taken and used to generate an overall ranking. The personality match was weighted at 0.2 and the skills match was weighted at 0.8.

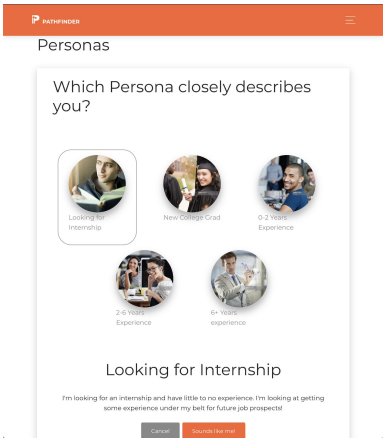
IV. Front End

The front end is one of the components that a lot of time was put into for this project. It is important to have a user interface that is both visually appealing and accessible for users. This was accomplished by using a mix of AngularJS, jQuery, and the Bootstrap 4 theme Now UI Kit.

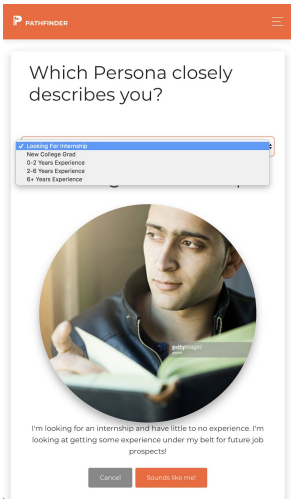
By using Bootstrap 4 we were able to develop a web application that is responsive and is easily accessible on mobile devices. For example, when picking a Persona the options are displayed in a different manner than when on a phone browser. Extensive testing was done on different sized windows and on actual phones to ensure the quality of the product.



Desktop View



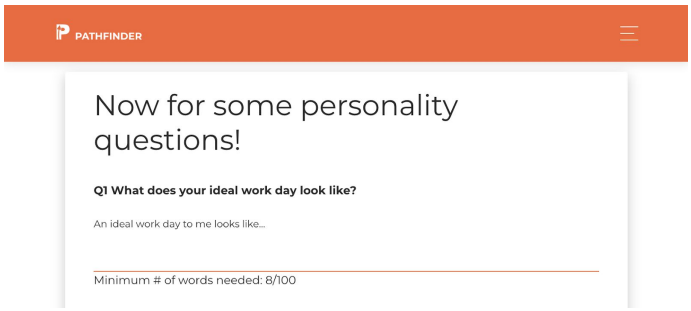
Tablet View



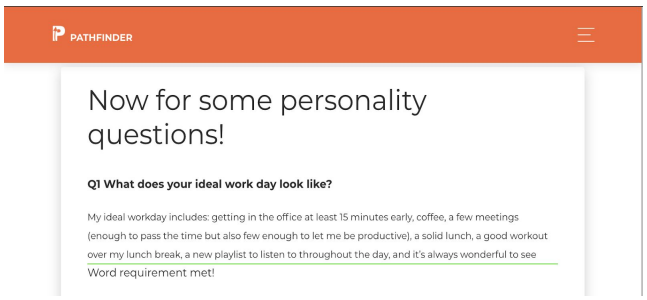
Mobile View

Through the use of Angular we were able to generate dynamic web pages. The forms for the personality questions as well as resume pages for job seekers were generated dynamically each with custom validation. To improve the User Experience we made sure to provide the proper visual cues to let users know that they've satisfied the requirements and help with navigation.

For example we enforced a 100 minimum requirement when answering the personality questions. As part of the validation we show users how many words they've already input and how many are left. When the word requirement is satisfied the application lets the user know that they've fulfilled it.



Form Element When Word Requirement Not Met



Form Element When Word Requirement Is Met

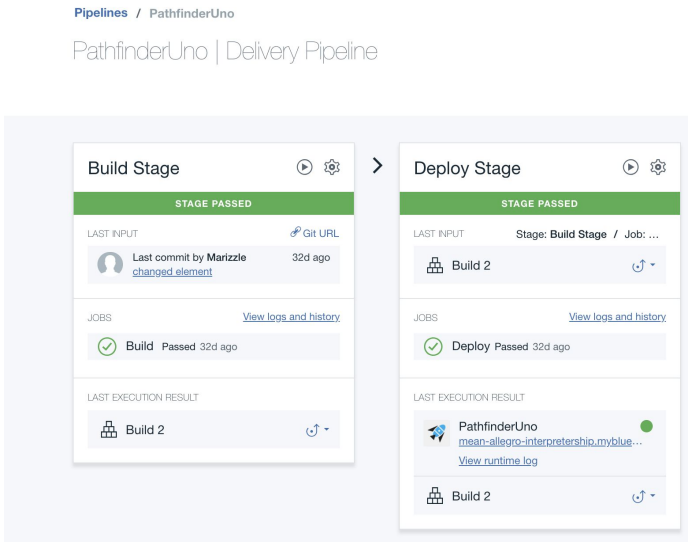
V. Back End

Architecture

The back end for our Pathfinder application relied on MongoDB, ExpressJS, and NodeJS. The base of the project we went with IBM-Cloud's github repository 'nodejs-MEAN-stack' which allowed us to quickly and easily deploy and configure our application on the IBM-Cloud.

The application is set up as a Cloud Foundry app that uses the 'SDK for Node.js' buildpack. This allowed us to easily monitor the usage of our application and view the runtime logs in realtime to allow us to debug any faults that we found. This application is connected to a 'Compose for MongoDB' instance that is also on the IBM Cloud.

We enabled Continuous Delivery and ToolChains for this application which actually allowed us to use the class Github repository when building the application. We have the ability to commit code and through the Delivery Pipeline build the code that was in our repo and easily deploy the application.



Delivery Pipeline

VI. Conclusions

In conclusion, the job searching process in its current state can be improved and Pathfinder attempts to break through by using personality insights. Through the use of IBM's services we were able to quickly develop and deploy a responsive web application on the cloud. There is definitely room for improvement and perhaps over the summer this idea will be revisited and improved. Watch this space.

Live Version: https://pathfinderuno.mybluemix.net/#/

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[6]https://www.psychologytoday.com/us/basics/personality]