AI Recruiter
Adding Intelligence to Digital Recruitment

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Abstract—AI Recruiter is our project which is designed to bring efficiency, transparency and reliability to the process of recruitment in an organization. It is basically an AI-powered chatbot with a set of AI algorithms and cloud hosted services that together provides an automated and highly time and cost saving system that aims to prove very useful during outreach, screening, assessment, and coordination phases of the hiring for a job and in getting highly suitable candidates out of the process. In this paper, we have presented a literature survey review with a detailed study of the various platforms and tools already being used in industry providing the potential and ease of AI. We also get into details of our project through the use of various visual diagrams to show the scope of our project, its uniqueness and how it is innovative in its own and better than existing solutions in unleashing the true potential of AI in the whole process of recruitment.

Index Terms—Digital Recruitment, Artificial Intelligence, Resume Parsing, Skill Visualization, Chat-bot, AI based interviews, IBM Personality Traits

I. INTRODUCTION

A. Why AI in HR ?

The use of AI in the recruitment process started around 2010 when with the development of networking platforms like Linkedin and Facebook, the number of jobs increased and the process of applying for them became easier. This led to the situation that even for few vacancies in an organisation, thousands of applications were submitted. Various company cases illustrate this growth, including:

- In 2013, Walmart, the largest private employer on the planet, received on average 23,000 applications for 600 positions when it opened a new store [2];
- In 2017, Johnson Johnson generated over 1 million applications for 28,000 positions [3]; and
- In 2017, Google generated an estimated 2 million applications for just 14,500 jobs [4], meaning that it was nearly 10 times more difficult to get a job at Google than to get into Harvard University.

As digitalization increased and the number of candidates per job vacancy increased, at the same time, the number of unqualified candidates rose. By an estimate, out of all the job applicants, 75% - 80% were unqualified for the position they applied for [5].

Going through all those applications and selecting the best candidates out of the crowd has become a tiresome and high cost job for recruiters leading to an increase in review time taken for each application. Research also began to demonstrate the difference that quality talent could make when intangible assets were the primary source of firm value [6]. A study of 600,000 researchers, entertainers, politicians, and athletes found that the very best of them were more than 400% more productive than the average among them [7]. In another study, McKinsey found that for complex jobs, the impact on performance was an astonishing 800% higher for top performers compared to the average performer [8]. At that time, organizations and researchers turned towards AI for a solution and many different applications were developed that provided power and assistance of AI for the recruiters and helped make their life easy.

B. Examples of use of AI in HR

One company that has trusted and delivered on AI-based recruitment process is DBS Bank. The DBS Talent Acquisition team created **JIM (Jobs Intelligence Maestro), a virtual recruitment bot powered by artificial intelligence** used to conduct candidate screening for those applying to be wealth planning managers, a high volume job in the consumer bank. Following the introduction of JIM in May 2018, DBS talent acquisition was able to:

1) shorten the screening time from **32 minutes per candidate to 8 minutes per candidate**,

2) improve completion rate of job application **from 85% to 97%**

3) **respond to 96% of all candidate queries through JIM**, allowing recruiters to spend more time sharing the culture and values of DBS with candidates. [9]

Hilton is another organization that identified and harnessed the potential of AI in their recruitment process. Sarah Smart, Vice President of Global Recruiting says, "By using artificial intelligence to source, screen and interview candidates, we have **increased our speed to hire by 85%**. We have also experienced other business benefits; such as increasing the diversity of our talent pool and enabling our recruiters to identify a high performing candidate faster. Having started our journey using AI in 2014, we see future use cases for

AI include improving new hire onboarding and providing internal talent mobility for Hilton employees." [9]
The detailed study of some of the primary players in this domain will be covered in further sections.

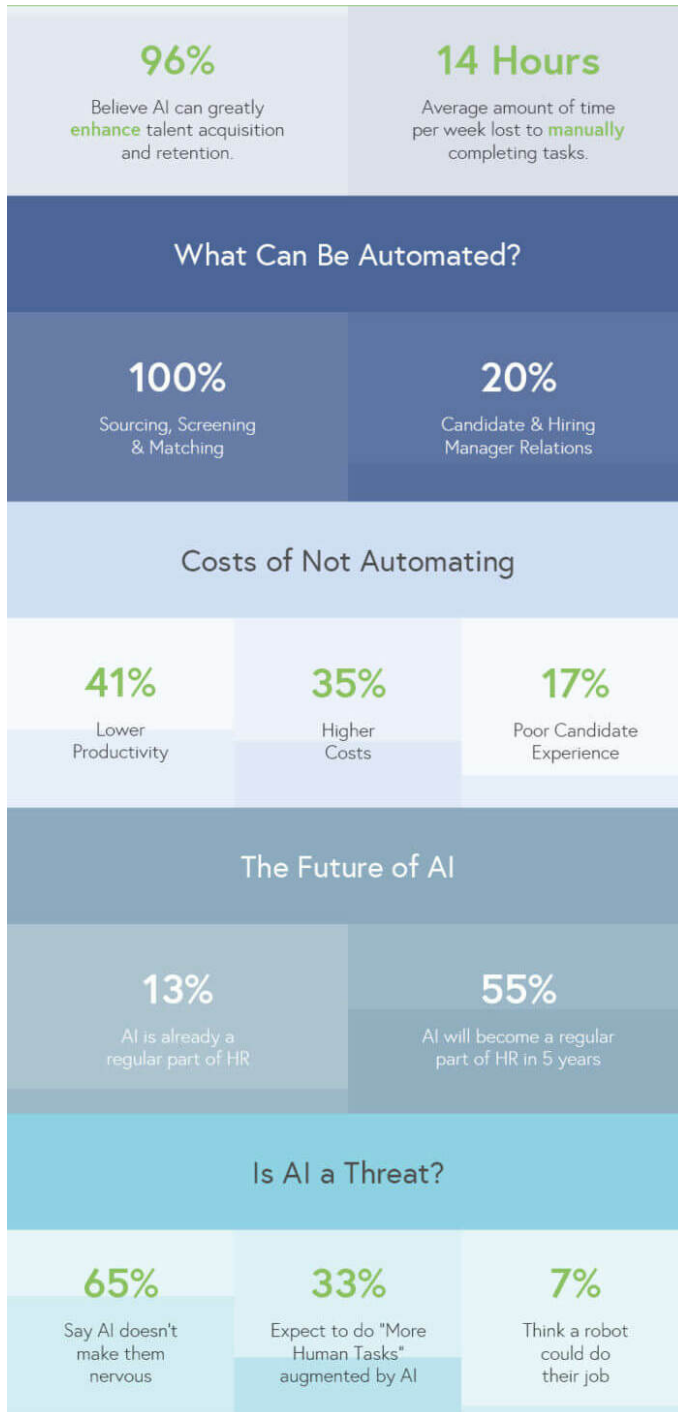## C. Revealing Stats On How Recruiters Feel About AI

Fig. 1. Stats related to AI in HR

- 96% of senior HR professionals believe AI has the potential to greatly enhance talent acquisition and retention;
- 13% of HR managers already see evidence of AI becoming a regular part of HR;
- 55% of HR managers see evidence of AI becoming a regular part of HR within the next five years;
- 14 hours a week is the average amount of time HR managers say they lose to manually completing tasks that could be automated;
- 41% of HR managers say not fully automating manual processes has led to lower productivity;
- 35% of HR managers say not fully automating manual processes has led to higher costs;
- 17% of HR managers say not fully automating manual processes has led to a poor candidate experience;
- 65% of HR managers say the thought of AI in HR does not make them nervous [10];

D. Introduction to AI Recruiter

Our project that we are presenting in this paper "AI Recruiter" is a project which is designed to provide power of AI to the whole pipeline of recruitment process of an organization. It is designed in such a manner that it acts as a bridge between the applicants and the recruitment dept of the organization. Objectives of AI Recruiter are -

- **TRANSPARENCY of the whole process** to each applicant with proper feedback at each level;
- **RELIABILITY of results** preventing any kind of bias or need of referral and everyone is ranked based on resume;
- **EFFICIENCY in selecting best candidates in minimum possible review time** thus saving the valuable time both for organization and applicant;

In this paper, we have provided the literature survey of various tools and platforms that are currently being used in this domain and that uses the potential of AI to automate and ease up various stages of the process. Each of the platforms has its own focus area and application in a specific stage of the whole recruitment process and no one is providing a complete solution over the process of outreach, screening, assessment, and coordination unlike our project.

This literature survey paper is an attempt to highlight the existing use of AI in recruitment and the innovation our platform aims to bring in this domain   industry. We have also described various unique features   visual workflow of our project and how it is unique at design level, at technology level, at economic level and at social level.

II. EXISTING SYSTEMS

A. MYA Chatbot

Focus Area - AI Conversational chatbot interface between applicant & recruiter
Mya Systems is a conversational AI platform for hiring teams that serves enterprises and agencies. Mya Systems, formerly known as FirstJob, was co-founded in 2012 by Eyal Grayevsky, CEO, and James Maddox, CTO. The San

Francisco-based company launched Mya, its conversational AI-recruiter, in July of 2016 to address major inefficiencies in recruiting and improve the process for both job candidates and recruiters. Mya quickly gained an A-list of customers and established itself as a leading A.I. solutions provider in the recruiting industry. The company has signed on four of the largest global recruiting agencies, 15 of the Fortune 100, and 40 of the Fortune 500.

The Mya chatbot is able to ask candidates factual questions to determine whether their profiles match the position requirements:

- Are you available at the internship start date and throughout the entire internship period?
- What year are you currently in and how long is your degree course?
- Do you need us to make any reasonable adjustments in order for you to be able to complete your application?
- Do you have any questions for me regarding the company culture, application process, or position details?

This type of bias-free, objective screening goes beyond resumes to intelligently streamline the search for new talents.

User-friendly, Mya is accessible via mobile phone anytime and anywhere. From the start, Mya presents itself as a chatbot. At the end of this first phase, qualified applicants are put in contact with recruiters. Especially valuable in a world where many job seekers do not have the necessary level of information regarding their application follow-up, this technology provides ongoing reminders and updates for a more considerate, more people-centric experience.

B. HireVue

Focus Area - Video Interviews and personality analysis based on it

HireVue is an enterprise video interviewing technology vendor that allows recruiters and hiring managers to screen candidates and conduct live interviews over the Internet. HireVue's products include game-based cognitive assessments and artificial intelligence (AI) driven assessments based on job-specific competencies.

Screening of candidates using HireVue requires that the candidate login to the HireVue talent interaction interface (which can be customized to match the hiring company's brand). Candidates then look into a webcam as the system records their answers to pre-set questions. Applicants can be interviewed using a desktop computer, laptop, smartphone or tablet.

Along with voice recognition and facial recognition software, HireVue uses a software ranking algorithm to determine which candidates are ideal for a specific job. An ideal candidate is defined by a combination of traits including body language, tone, and keywords. The interview data is then compared to approximately four million video interviews of top candidates in that specific role. HireVue's intelligent assessment service analyzes an average of 25,000 data points for a single fifteen-minute video interview.

C. Py Metrics

Focus Area - Psychometric games based candidate personality evaluation

Pymetrics is a series of behavior based neuroscience games that objectively measure cognitive, social and behavioral attributes. Pymetrics leverages advanced technology to help look beyond your resume and understand more about your natural strengths to identify which roles you are most likely to succeed in.

Candidates play a series of 12 games that measure the attributes that make you, you! There are no right or wrong answers - pymetrics focus on looking at how you approach problems, not specific solutions.

Py Metrics AI basically try to evaluate candidate on following criteria -:

- Attention
- Effort
- Fairness
- Decision Making
- Emotion
- Focus
- Generosity
- Learning
- Risk Tolerance

After playing the pymetrics games, the applicant receives a detailed, personalized report for the talents you already possess. Pymetrics gives everyone the opportunity to shine, beyond what's on paper.

D. Pando Logic

Focus Area - AI Based job advertising networking platform

PandoLogic is a programmatic recruitment advertising platform that enables employers to source quality applicants faster and more efficiently through the use of big data, artificial intelligence, and proprietary campaign algorithms that fully-automate and optimize the job advertising process from job classification and targeted distribution to budget allocation and dynamic bidding across diverse job categories.

Their talent acquisition solutions connect publishers, employers, job board operators and job seekers across a shared talent network using the most advanced programmatic platform available. Since 2007, over 125,000 employers and more than 700 digital publishers have benefited from PandoLogic's programmatic solutions resulting in over 5.4 billion programmatic job campaigns based on more than 199 billion historical job performance data points.

Its programmatic job advertising platform, **pandoIQ**, intelligently automates and optimizes job advertising spend. Companies faced with complex hiring needs now can source quality applicants faster, smarter, and more efficiently with our unique proprietary technology. The platform features AI-enabled algorithms that use over 48 job attributes and more than 200 billion historical job performance data

points to predict the optimal job advertising campaign. Target relevant candidates across all the major search recruitment sites including Indeed, CraigsList, LinkedIn, Monster, CareerBuilder, ZipRecruiter and hundreds of others and spend accordingly. pandoIQ provides an end-to end job advertising solution that delivers a significant increase in job ad performance without any wasteful spending.

III. DETAILS OF THE PROJECT

AI Recruiter is a system designed and developed to assist organizations in their recruiting process. It connects both the recruiting team and the candidates in an efficient manner so that the whole process gets more robust and seamless.

AI recruiter is the combination of AI powered chatbot and backend AI algorithms that performs the following functions-

- Create first interaction with each candidate through some basic questions to capture and analyze his/her impression about the organization and job role.
- Screening and shortlisting of candidates based on their first interaction resumes is another important task done by it.
- AI recruiter will also interview the shortlisted candidates and try to bring out their key personality traits.
- Another task of importance is providing feedback to non-shortlisted candidates thus satisfying them too.

On the applicant end, it is an AI powered chatbot interface that aims at being useful for candidates to get to know about job updates, provide easy one touch solution to apply for them and act as an assistant during the whole recruitment process. Using the chatbot, applicants can ask their queries, apply for their desired jobs and can follow up the whole application till the feedback stage.

At the end of the organization, our project will help simplify the recruitment process in 2 levels

- **Level 1** is the shortlisting of the deserving candidates out of all the applicants based on the skills and experience of them. This level will use ML for resume parsing and visualization that will then help the AI powered ranking algorithm to find most suitable candidates.
- **Level 2** of the project deals with selecting the final candidates after having a personality evaluation video interview through chatbot itself and then creating a personality map of each candidate based on the **Big-5 model using IBM Personality Traits service**.

IV. UNIQUE FEATURES OF THE PROJECT

AI Recruiter is an innovative system that integrates the capabilities of all the existing systems has some extended unique features as follows -

- **First interaction before the application**
  The chatbot will first interact with the applicant before filling up the application so as to provide recruitment process guidance and create first impression analysis of the applicant towards the organization and the job role.

Questions - "Why do you want to apply for this role?", "What do you expect from the organization?" etc.

- **AI based visualization for resume based shortlisting**
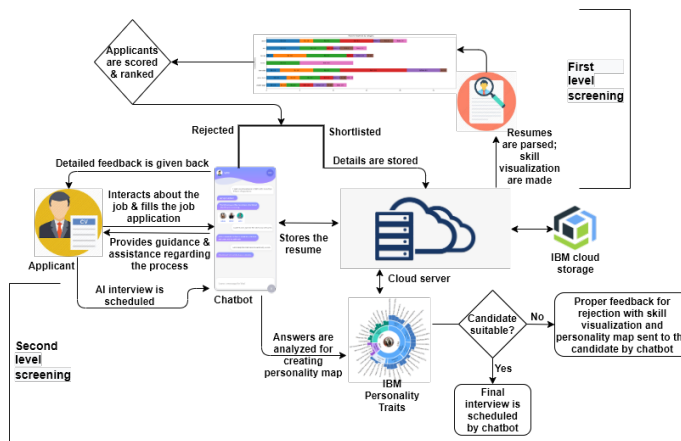 A visualization of the applicant's skills will be created using AI resume parsers and using it along with the first impression analysis, the system will shortlist the candidate.

- **Personality traits evaluation**
  Shortlisted candidates will be interviewed by the chatbot with more questions and some psychological games to build a personality traits map for each candidate and find out the most suitable candidates for further HR rounds.

- **Feedback for non-shortlisted candidates**
  The chatbot will give proper feedback to all the non-shortlisted candidates by providing them their skill visualizations and personality traits map highlighting the reasons for their rejection.

These features will add an innovative factor to the whole integrated system and will also make the whole process fair, transparent and trustworthy.

V. WORKFLOW OF THE PROJECT

The Chatbot will be the conversational interface between the company and the applicant. It will assist the applicant by giving JD, overview of process, follow-up on application status and proper timed feedback. Applicants can directly fill their application through the chatbot. All the collected details and resumes will go to the cloud storage.

In Level I Screening, all the resumes will go through

Fig. 2. Workflow of AI Recruiter

a **resume visualizer** Will parse all the resumes and create a visualization map of skills and experience. Based on the visualization map, **ranking algorithm** will shortlist most suitable candidates synchronizing the map with job role's qualifications. Shortlisted candidates will go for the next level of screening and will be notified about that. Non-shortlisted candidates will get proper feedback via chatbot regarding their

shortcomings and suggestions for improvement.

For Level II Screening, shortlisted candidates can schedule an interview in the desired slot, and then can have a video interview based on some neuroscience questions. All the answers of the candidate will go through the Speech-to-Text module and then that text is fed to **IBM Personality Traits**. The output will be a personality map of that person. Maps of all the candidates will be compared to already existing samples of similar job roles and finally **recommendation algorithms** will suggest the final group of candidates to the company.

Since AI is not 100% reliable, we are also adding the provision of adding a **little human bias in Level II Screening using Google's What-If tool**.

VI. ENTITIES OF THE PROJECT AND THEIR RELATIONSHIP

Entity of a project is anything that is interacting or participating in a system. In our project, there are 3 main entities. These entities with their relationships are as follows -
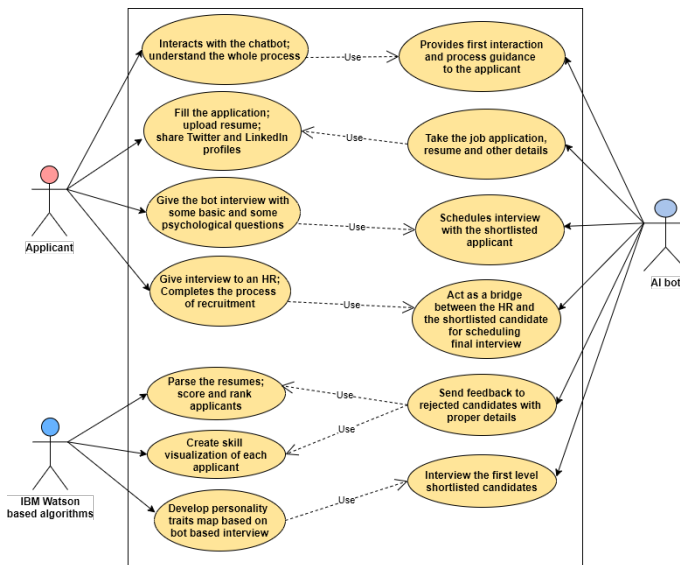

Fig. 3. Use case diagram of AI Recruiter

- **Applicant**
  - Can interact with chatbot, and seeks its assistance.
  - Fill application form, submit resume, take follow-up on application status.
  - Get proper feedback from the system with suggestions for improvement.
  - Select slot for interview, and give interview through chatbot.
- **AI Chatbot**
  - Provides assistance to the applicants for the whole process of recruitment.
  - Take applications and pass it on to cloud based server.
  - Acts as bridge between the applicants and the recruiters and provide a medium of communication between the two.

- Help schedule interviews by the shortlisted candidates in desired slots.
- Take video interviews of candidates, convert speech-to-text and pass it on to cloud server.
- Provide proper feedback to the candidates rejected with suggestions of improvement.

- **AI based backend**
  - *resumeVisualizer.py* will parse all the resumes and create visualization map out of it selecting relevant skills and experiences.
  - *screening1.py* will rank resumes perform shortlisting.
  - *screening2.py* develop personality map based on interview answers.

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