TALENT TECH LABS

TRENDS REPORT

A COMPREHENSIVE OUTLOOK ON MATCHING TECHNOLOGY

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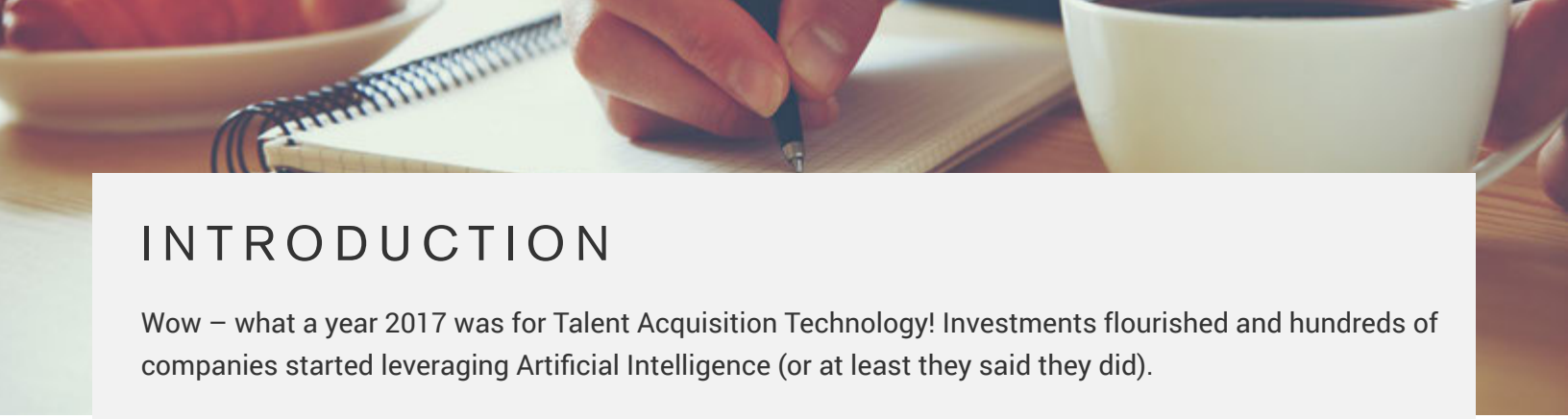


INTRODUCTION

Wow – what a year 2017 was for Talent Acquisition Technology! Investments flourished and hundreds of companies started leveraging Artificial Intelligence (or at least they said they did).

Over $1 billion was invested into HR Tech in 2017. We can't wait to see what 2018 has in store as we continue to cut through the Talent Acquisition Technology noise.

After studying the impact of AI on the space we learned some really interesting facts. The first is that over 73% of TA technology companies we surveyed are leveraging AI. The second and most interesting (to us at least) was that those who are leveraging AI are really only using Machine Learning and Natural Language Processing. Most are not yet applying Deep Learning and Neural Networks. You can read more in **our report here**.

What this meant to us is that while all this talk about AI might have been hotly hyped, we are actually seeing some really interesting Matching Technology in 2018 because both Natural Language Processing and Machine Learning lend themselves well to matching and prediction, so expect to see a significant advancement in Matching Technology performance.

We kick off this report with an article by Jamie Schneiderman, CEO and Founder of Career Spark. He estimated that 70% of people are in the wrong jobs and builds the case for candidate matching being tied to performance indicators for real success. Hence this piece: "How Success-Based Matching Takes the Guessing Out of Building High Performing Teams".

Next, we dive into the early beginnings of Matching Technology explained by Vinay Johar, CEO of RChilli, a résumé-parsing Matching Technology. Johar covers the facets behind Machine Learning from the early 1980s and explains how technology has evolved to provide matching algorithms today. He also explains modern challenges, such as the implications brought on from variances in job titles across different countries.

We then get an inside look at how Matching Technology actually works when matching algorithms are dissected by LinkedIn's Global Product Evangelist Sankar Venkatraman in "Candidate Matching Algorithms Explained". Sankar walks us through each step of the candidate Matching Technology behind LinkedIn Recruiter, which captures and translates data from member profiles, connections, interactions and content consumed to predict how likely a candidate will respond to their open role. In addition, LinkedIn's candidate-facing product helps job seekers find roles best suited for them. This complete rundown from Venkatraman brings clarity to how today's matching algorithms truly work behind the scenes.

You may be surprised to learn that Matching Technology wasn't always welcomed by the Talent Acquisition industry. Andreea Wade, CEO and Co-Founder of Opening.io, a candidate matching platform, explains the many challenges innovators faced in building Matching Technology and how they've come out on top. From its purpose, to how it's projected to change the way we view Artificial Intelligence (supporting our work, not replacing our work), Andreea provides deep insight into where Matching Technology is heading in "The Industry Pushback on Matching Technology & How It's Shaping the Future of AI in Talent Acquisition".

Next we go into a deep dive overview of Matching Technology, how its being applied with Watson by IBM. Hailey Herleman, Ph.D., Portfolio Executive, IBM Talent Acquisition Optimization gives us a first-hand explanation of IBM's Watson and how its set to evolve in the coming years.

Finally, we wrap up with an investor's insight into the current market of Matching Technology. Trevor Vas, CEO & Principal Consultant covers the top candidate matching vendors on the market as well as what Talent Acquisition buyers should look for in a solution.

So dive on in, and explore everything you need to know about Matching Technology for 2018!

THE CASE FOR MATCHING TECHNOLOGY: HOW SUCCESS-BASED MATCHING TAKES THE GUESSING OUT OF BUILDING HIGH PERFORMING TEAMS

JAMIE SCHNEIDERMAN, CEO AND FOUNDER OF CAREER SPARK

70% of people are in the wrong jobs. Yes, you read that right, 70%. That's 125 million people in North America alone. It's an epidemic!

They say the definition of insanity is doing the same thing over and over and expecting different results, yet that's exactly what's been happening in the "effort" to fix the problem.

WHY DOES IT MATTER? DOES IT IMPACT THE BOTTOM LINE?

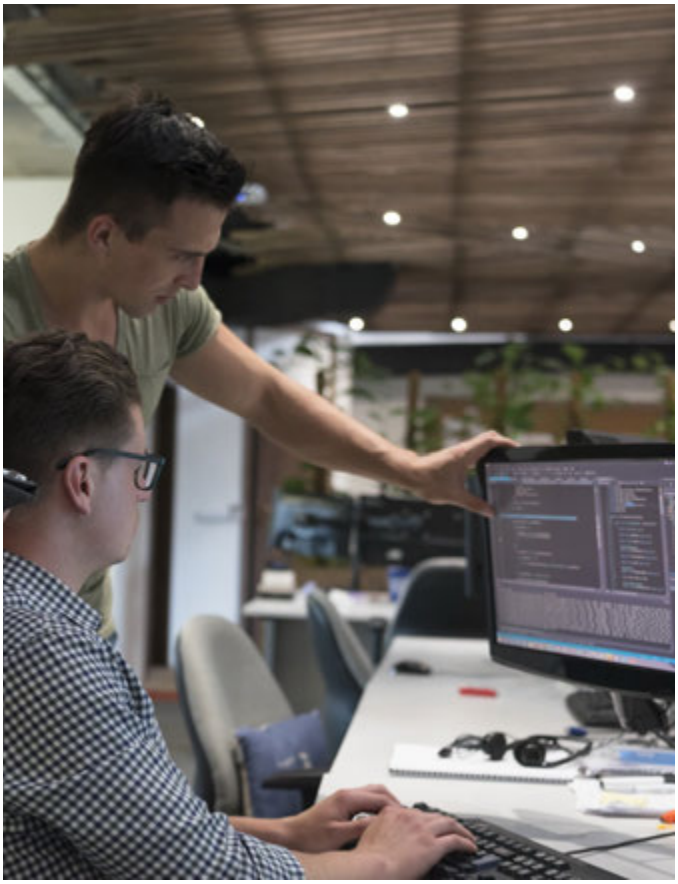
People represent the largest expense line on virtually every income statement and they ultimately drive the success (or failure) of every business. Finding and placing the right person in their right role is a crucial component of business success, and a thriving labor market. It's no surprise that successfully placing people in the right job results in happier, more fulfilled employees, better organizations and increased economic profitability. The opposite outcome, however, has significant negative consequences for both employees and employers. According to the U.S. Department of Labor, the price of a bad hire is at least 30% of the employee's first-year earnings and many other sources suggest the cost to be significantly higher. Using the conservative estimate provided by the U.S. Department of Labor, the total impact on the North American economy of having people in the wrong jobs is $1.9 trillion annually. So yes, it matters.

IF IT MATTERS, WHAT'S BEEN DONE ABOUT IT?

Companies have long struggled with the negative financial, morale and productivity impacts of performance issues and high turnover rates. Given the obvious importance of people and the continued issues related to placing them in the right job, one would think that this should be the top priority of every company. Unfortunately, the HR industry as a whole, has been undeniably and infuriatingly slow to evolve and adapt to resolve these serious gaps. For the past two decades virtually all of the technological development in the talent acquisition world has been focused on process improvement affecting the speed and efficiency of the hiring process while ignoring the real need; *putting the right people in the right roles.* Seems a bit insane, doesn't it?

IS MATCHING THE ANSWER?

The answer is yes and no. If putting the right people in the right roles is the single goal then "matching" has the potential to change everything. The problem is that the term is terribly overused and, in fact, most matching isn't very effective. To-date, matching typically refers to finding candidates who have specific keywords on a resume or in a profile (again focused on the process!). More advanced matching systems claim to employ Artificial Intelligence (AI) to select the right people. Unfortunately, AI, like all other technology is only as intelligent as the information it is learning from and right now, that information isn't very smart. So neither of these approaches fixes the problem. Why? Because the critical question to ask regarding all matching is: "Matching to what?" These solutions lack the necessary information needed to match the right people with the right jobs. The only type of solution that can truly impact results is Success-Based Matching.



WHAT IS SUCCESS-BASED MATCHING?

To properly put the right people in the right role, Matching Technology must compare against the true drivers of success in a job – what's actually working, not what some believe is working or what's on a job description. That information needs to be based on both what people have done and who they are. But to-date, companies don't do this. Leaders sit around a table and decide what they "believe" drives success. Or, even worse, they continue to recruit based on the same criteria they've always used, despite mixed results. Matching Technology has followed suit by simply finding the people with the criteria defined by organizations – even though there is little or no linkage between that criteria and high performance. Success-Based Matching uses real, objective data from organizations to first define success for each particular role in an organization and then match potential candidates against that model in a repeatable, scalable way.

HOW TO USE DATA TO BUILD A FORMULA FOR SUCCESS

It may sound like it would be an insurmountable amount of work to get organizational data for each role and figure out what drives success – but it isn't. Defining the criteria that links to success isn't a guessing game and can't be defined by just looking at someone's past performance. The answers exist within every organization and specifically within the top performers. If you know who is performing well then it's simply a matter of gathering and analyzing data from those people to determine which variables are driving their superior performance. Most organizations have much of that information already. In order to evolve the job Matching Technology companies must ensure that they are combining science and data to get an accurate read on who someone is and what they've done. This killer combo is critical for the development of predictive algorithms/machine learning to allow the job matching to evolve and optimize. It can be done!

DOES THAT MEAN THAT TECHNOLOGY WILL TAKE THE PLACE OF TALENT ACQUISITION?

Of course not – data and technology are great enablers but they don't take the place of people. By employing a Success-Based Matching system, Talent Acquisition professionals can reduce time and effort on the wrong candidates and instead focus on candidates who have a much higher probability of being a successful hire. There are major people-wins that can be achieved simply by implementing an effective and predictive Success-Based Matching system that can provide precise and actionable insights in a fast and scalable way.

Continue down the bumpy path of relying solely on guesswork, opinions, bias and flimsy data to make the most important business decisions or recognize that the Talent Acquisition game has irrevocably changed… and finally for the better. Focusing on the right ingredients will give the HR industry the catalyst it needs to do this.

Jamie Schneiderman is the CEO and Founder of Career Spark, the leader in Success-Based Matching that helps organizations to understand what drives success and to easily and consistently select, develop, and promote top talent. He believes job performance depends on people working in roles they are built to succeed in. Jamie has spent over 20 years amassing knowledge at companies like Procter & Gamble, Coca-Cola and Rogers along with several technology start-ups. Jamie has a Commerce Degree from the University of British Columbia and an MBA from Harvard. He lives in Toronto, Canada, with his wife and two children.

MATCHING TECHNOLOGY: NOW TO NEXT

VINAY JOHAR, CEO OF RCHILLI

If resume parsing is a quick step towards streamlining your recruitment process, Matching Technology has taken it to the next level. Semantic search and matching algorithms understand the difference between a resume and a job description, and they find the right candidate through synonym matches based on the listed skills, education, experience, job title, and location.

However, the future of Matching Technology will be focusing more on behavioral matching than keyword-based matching. For example, many companies across the globe have already started using predictive analytics to identify job-changing behaviors in candidates. These behaviors can be identified and evaluated on social media. In fact, analyzing candidates' social media usage is becoming more prevalent as **91% of employers** are using social media to hire. Job seekers are on social media, employers are targeting job seekers on social media. It makes sense to cull data from these interactions to inform how likely a candidate is to be interested in a position with the company and how well they might fit based on their social media actions. All of this comes to fruition via Matching Technology.

THE IMPLICATIONS OF MATCHING TECHNOLOGY

Delivered in linux, semantic has a high cost. Making costs high for entrants to the Matching Technology market. In addition, matching is done with niche-specialization which means it is customized for different sectors. Since Matching Technology is a form of Machine Learning, this can make training the Matching Technology more difficult.

For example, depending upon geographical location, the same job title may mean something different. In the USA, a 'President' and 'CEO' are commonly used terms. However, in Australia, you will never hear such a term. Instead, a CEO is called a 'Managing Director'. Thus, a solution is needed to tackle with this problem within Matching Technology.

WHO CAN CONTRIBUTE TO THE TALENT ACQUISITION ECOSYSTEM?

Bringing such a change to these implications is a challenge for Matching Technology vendors. Those who can access the behavioral data and overcome hurdles in Machine Learning can become game changers in Matching Technology.

Vinay Johar is an IIT graduate who is passionate about making a difference through HR Technology. His passion led him to start his venture, RChilli which provides parsing, matching, and enrichment for recruitment management systems. RChilli aims to capture, manage, and analyze resume data to help businesses streamline their recruitment process. They facilitate smart talent acquisition through resume parsing, semantic search & match and resume enrichment.

CANDIDATE MATCHING ALGORITHMS EXPLAINED: HOW LINKEDIN MATCHES JOB SEEKERS WITH EMPLOYERS AND VICE VERSA

SANKAR VENKATRAMAN, GLOBAL PRODUCT EVANGELIST FOR LINKEDIN TALENT SOLUTIONS

Machine Learning (ML) and Artificial Intelligence (AI) - driven technological disruption is happening faster than ever before across industries, functions, and roles. With the availability of massive computing power and smarter algorithms, this trend will continue into the foreseeable future as AI establishes itself as a General-Purpose Technology, much like electricity has become an inextricable part of our world today. However, unlike previous technological revolutions experts predict that AI and automation will start by impacting Talent Acquisition and other white-collar professions before cascading to blue-collar roles.

WHAT DOES THIS MEAN FOR THE TALENT INDUSTRY?

Existing matching algorithms will become smarter in surfacing the right candidates to recruiters and showcasing relevant job openings to passive and active candidates. Meanwhile; Machine Learning, where new data learns from historical insights, will recommend more relevant job opportunities to those looking to switch professions or roles. Recruiters who spent hours parsing through resumes to find the right talent, will now have more time to focus on providing an improved candidate experience, as matching technologies do the hard work of finding the best candidate for their open roles.

THE ADVANTAGE OF DATA TO SCALE

One of the key parameters that is essential in building smarter algorithms is data and the ability for machines to learn from their predictions. LinkedIn's data on over 530 million members, 12 million jobs, standardized set of 50,000 skills and billions of weekly interactions on the platform positions them to provide deep insights on

a. the identity of the talent you are looking for,
b. the member's affinity towards your organization,
c. their intent in working for your company and
d. the potential of the hire to transform your business.

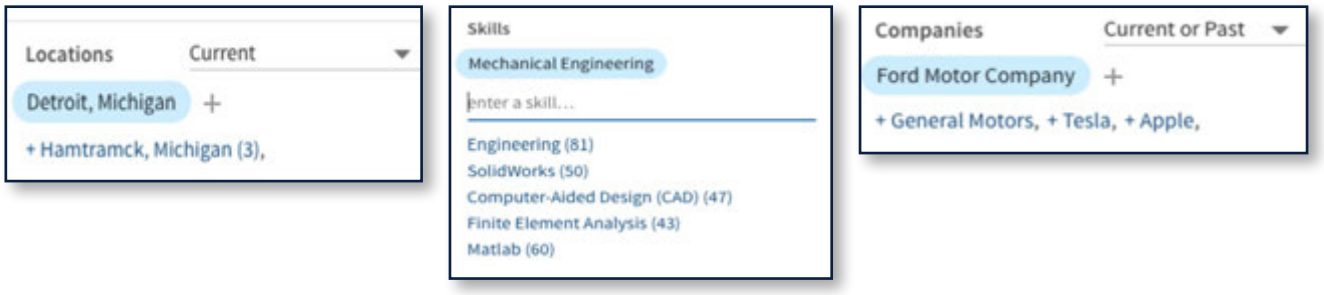
Today's solutions use proprietary matching technologies to deliver candidates that are the best fit for your organization based on explicit, implicit and inferred signals sent by members to recruiters. By capturing and translating ***member identity*** (data listed on member profiles such as skills, education, etc.), ***member actions*** (who are they connecting with, etc.) and ***member intentions*** (what content they are consuming) the solution is able to make more accurate predictions on a member's propensity to be open to an employer's roles and job opportunities.

HOW MATCHING TECHNOLOGY IMPROVES CANDIDATE SOURCING EFFICIENCIES

On the candidate sourcing front, LinkedIn Recruiter spotlights prioritized candidates based on their identity, affinity, and intent data. This is broadly accomplished via a two-step process:

- In the first step, a matching algorithm performs the Retrieval process - the job of getting the right set of candidates that meet the user's specified search criteria.

    - For example, recruiters can select from over 35 different filters to narrow down their search results. If a user selects 'Detroit, Michigan' from the location facet, 'Ford Motor Company' from the company facet, and 'Mechanical Engineering' from the skill facet, the engine will retrieve that set of candidates that match this specific set of input criteria.



- Once this retrieval process is complete, the candidate list is ranked. This ranking step prioritizes candidates based on their likelihood of being hired, by capturing explicit and implicit signals that candidates express on the platform. These would include signals such as whether the target member is an open candidate, if they follow the recruiter's company, and their activity level on solid sites.

- Other aspects that also go into the matching algorithms include query features such as the frequency of appearance of the search parameters (for instance a keyword) in a candidate's profile or recruiter-candidate features like the relationship between recruiter and the target candidate (for e.g. does the recruiter tend to prefer candidate from a particular industry or a company or a region etc.).

- LinkedIn's solution takes into account over 100 such signals to build relevance models and rank candidates.

- Once the signal assessment and weighting is done, the prioritized list of candidates (ranked based on decreasing weighting order) is presented to the searcher.

HOW MATCHING TECHNOLOGY RECOMMENDS RELEVANT JOBS TO SEEKERS

Before relevant jobs are presented to members, they pass through multiple matching, filtering and ranking stages, each of which is driven by our Machine Learning algorithms. During each stage, the relevant jobs for a member are narrowed down starting from an index of several million jobs on the platform down to a couple hundred of relevant jobs that are eventually ranked and recommended to the seeker.

- This process includes narrowing down the list of jobs based on the member's skills and career interests.

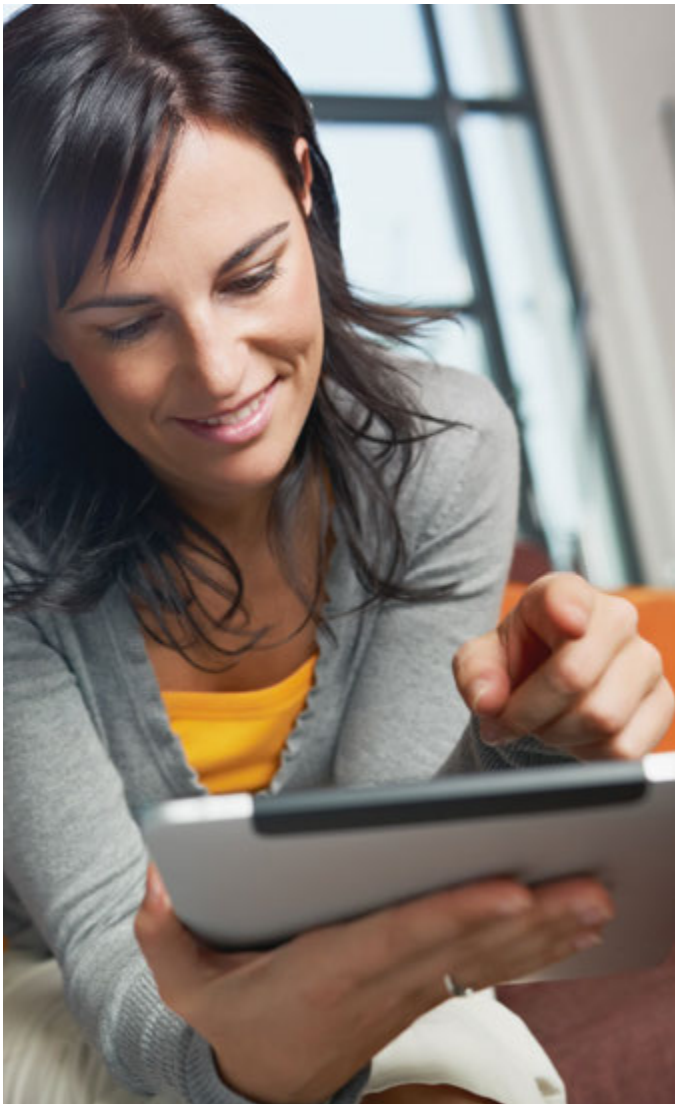
- We then match the member attributes to the job attributes (such as their explicit/implicit skills, title, company size, industry etc.)

- Machine Learning algorithms continuously updates jobs in the list to ensure relevance and accuracy.

- This matching considers tens of thousands of features to provide a hyper-personalized estimate of the probability that a member will click on a job, given all the member's past actions, profile data and job description.

- Final step in the matching process involves discounting and boosting jobs based on job-details related attributes.

- For example, those that score below a certain relevance threshold or those previously dismissed by the member will be removed while jobs that have been recently posted will be boosted in the ranking.



As progressive companies like LinkedIn continue to enrich ever-growing member data with cutting-edge AI and Machine Learning capabilities, we believe the matching technologies will continue to get better. This will improve a recruiter's effectiveness, enhance candidate experience, and continue to improve the way recruitment is done in the future.

Sankar Venkatraman is the Global Product Evangelist for LinkedIn Talent Solutions. As part of this role, he is responsible for bringing the voice of the customer to the product development team and help connect talent with opportunity for LinkedIn's members. Sankar has a PhD from Rutgers University and an MBA from Cornell. He is based out of LinkedIn's Sunnyvale, CA office.

THE INDUSTRY PUSHBACK ON MATCHING TECHNOLOGY & HOW IT'S SHAPING THE FUTURE OF AI IN TALENT ACQUISITION

ANDREEA WADE, CEO AND CO-FOUNDER OF OPENING.IO

Powered by Machine Learning and Artificial Intelligence, the grail, purveyor of infinite abundance has started taking shape in the last couple of years, embodied in search and match technologies that are faster, smarter, and all seeing. I'll leave ''all knowing'' out, for now.

Opening.io has spent the last three years building algorithms that match people to jobs; a continuous loop of training and retraining of data models, a lot of reading, a lot of research papers followed by (re)engineering, continuous data cleaning and recalibrating of algorithms while throwing architectural challenges in the mix (because deploying AI is a topic within itself), all along listening to the voice of the customer. Machine Learning and AI are spoken of everywhere and yet only a small percentage of companies are doing hands-on research work, commercially deployed, validated and with quantifiable results.

The reason is simple: this is hard. And so, I'd like to share some insights into how we looked at the topic of matching so far and what's coming next for us and for the industry.

We set out to build matching technologies that work, do it in a way that won't disturb your existing processes, even better, bring matching to a one click or no click interaction (it just happens when it needs to happen, magically) – essentially, we wanted to bring matching from action – or more accurately, a long series of actions, to… intent.

TRANSFORMING MATCHING FROM ACTION TO INTENT

Bear with me, I'll explain. We live in company databases, ATSs, CRMs, on job boards and job platforms of all sorts, pretty much everywhere where there is candidate and job data and we currently perform four types of matching, with an additional one going live soon.

WE MATCH:

1. Candidates to jobs (search with a job description)...
2. but we also perform a reverse match (search with a candidate and get suitable jobs returned).
3. The third type of match is also our favorite, similarities matching (search with a candidate and get a list of similar candidates returned),
4. and the fourth type applies only to the tech industry: rankings (we rank IT industry professions based on 11 categories we have put together).
5. The fifth type of matching relates to job similarities and it will go live in January 2018.

While our core proposition is based on matching technologies, we are product people. We know that mapping our solution against the users' current problem versus mapping it against their goals and desired outcomes is the key to building something truly meaningful.

Opening.io has a Recruitment Management System but it is purposely underutilized (for now). We saw the usage of this technology embedded into your existing processes. And so, whether you are in your inbox or inside your existing ATS/CRM, you can surface a match by sending an email with a job description in its body and a job title in the subject line to a special email address we supply or by sending a CV attached to a blank email. 30 seconds later you have your shortlists in your inbox. Have an existing ATS? No problem, we link into your processes and make matching happen based on key actions you already take (I'll give an example shortly, below).

We've made use of the Recruitment Management Systems in situations where there was no technology to assists with the filtering of candidates. We partnered with CareerZoo, Ireland's largest and best tech/STEM job fair and we helped Fortune 500 companies, large corporates bring their time to hire down from 3 weeks to 48 hours. In this case, we replaced Excel and… weeks of data processing and searching.

But in cases where recruitment platform stacks exist, we jump in to complement and augment them. In the world of 'uber for xyz' we want to be 'Intel inside'.

We're working with Ireland's largest and most forward-thinking staffing agency. These guys have a seven-figure database that is powered by our Matching Technology, helping them extract additional value from their candidate and job database.

This case study (and just for context, these guys have a wide international presence, with 2017 revenues of €455 mil) is one of truly deep integration with an existing ATS; making use of how the data currently flows, we augment their search and match capabilities. The initial end goal is presenting a shortlist that is meaningful and that strips away noise without adding any.

CHALLENGES WITH MATCHING TECHNOLOGY

As you deep dive into the world of data you quickly realize that the measure of your output is directly proportional with the quality of your input. Bad data in, bad data out. And so, in the pursuit of the holy grail, we had to take a couple of steps back and look at the quality of data. For us, this meant several things: develop your own parsing and build intelligence that can augment existing data points – skills recommendations. We are currently in beta with our neural parser – and yes, we are using neural networks to extract data from CVs (for those a bit more technical, we're employing state of the art NN architectures to perform NER -named entity extraction- and understand text while operating at word and sub-word level). No dictionaries, we reconstruct every word – mental image of our data science team celebrating the extraction of a completely unknown Polish company name found in a Polish language resume.

Clean data, rich data, or data in general will always present challenges when in pursuit of finding the perfect match, constructing the perfect profile. Our work so far has been focused on understanding candidates and their skills, industries and requirements and thus eliminating bias. What comes in 2018 for us – and for those working in similar fields - is adapting to bias.

CAN MATCHING TECHNOLOGY OVERCOME CANDIDATE BIAS?

'Does it learn?'. That's what adapting to bias means. It links to something called reinforcement learning which in turn links to… learning from human behavior.

When it comes to parsing, the system learns to construct and recognize company names for example. Or candidate names, human names. But the story of a machine learning from human input is the story of understanding, mapping and adapting to bias. And this is personalized. It's specific.

Today we can plug into an ATS and link into existing filters and tags and enrich our own match capabilities with extra data. We can, for example, remove candidates (that are otherwise a match) that have been placed yesterday from search results you are getting today. But we are not able to yet learn real-time that… you have a bias for people with brown eyes. This is the area of research we're focusing on now.

OVERCOMING PUSHBACK FROM THE TALENT ACQUISITION INDUSTRY

I'll let you on in a secret that affected all matching companies emerging in the last three years. We all went to our market and we said, 'here's this cool magical thing that will look at your existing or incoming candidates and filter them'. And the industry said 'meh, can you go and get me some new candidates'.

When running an AI first company, research will often drive the commercial output of your solution; we are solving problems that exist, in ways that don't. And so there will be push back, defined by what is known. Some of us stood our ground but most have been forced to go and do something about it, find, source passive candidates. Shared, private candidate pools have been brought to life by match tech companies. Still in its infancy, but it is happening.

FORECASTING MATCHING TECHNOLOGY: WHERE DOES IT GO NEXT?

The initial push back happened because the industry couldn't find their case for automation… but here's what's going to happen this year. The technologies and data available will finally click together. There is a bigger picture here, affecting all industries, not just that of recruitment. We are moving from systems of records to systems of engagement and this will disrupt processes, departments and entire business models. The AI tech stack will continue to veer off from traditional software stack (with considerable commercial impact) and the discussion on how AI will impact employment will shift from solely focusing on the elimination of jobs to how best to help the workforce accommodate to change. Here, we already see the usage of matching tech surfacing transferable skills, mapping them against potential career paths (something on our agenda too).

In short, in 2018 recruitment, AI will stand on its own two feet, moving away from simply a cost saving/ efficiently/automation tool to the facilitator of new business models and commercial outputs. 2018 will also bring us clear, quantifiable proof on how AI can augment human capabilities, the dialogue moving from it as a threat, to it as an enhancer and even perhaps savior. AI can help us navigate through a changing workforce, pinpointing where to best go next.

For us, 2018 is about moving from eliminating bias to adapting to bias as we plug into larger and more complex data points and also about building AI that builds its own success models based on an end goal that's pre-specified. In 2018, we will continue to build for intent.

Andreea is CEO and Co-Founder of **Opening.io**, a cognitive engine that provides matching, predicting, recommending and intelligent search technologies for the HR and Recruitment space. She has a background in programming, journalism, product management, business development and entrepreneurship. Andreea is a startup mentor, having mentored in all the major incubators and accelerators in Dublin but also London, Tel Aviv and Berlin. Andreea was involved in running the Irish wing of an EU funded accelerator, was the Head of Product Management in the largest Irish media trust and has previously founded companies, **opening.io** being her fourth venture.

MATCHING TECHNOLOGY: A SOLUTION TO GAIN CANDIDATE INTEL BY ASKING LESS

HAILEY HERLEMAN, PH.D., PORTFOLIO EXECUTIVE,
IBM TALENT ACQUISITION OPTIMIZATION

Matching Technology is hot in talent right now, for good reason. It provides an eloquent answer to a basic challenge we are all facing. How do we maximize decision-making accuracy about who to focus on in employment decisions (e.g. hire, promote, cross-train) while simultaneously enhancing the user experience for candidates and employees in ways that are required to compete for the best talent? We need more useful data about people, while asking less of the individual to provide it to us. How do we get more and ask less?

HOW DID WE GET HERE?

Matching Technology, like many hot technologies in Talent today, is rooted in a rich history of psychology, mathematics, and computing advancements. Psychologists, for centuries, have studied how to quantify human characteristics into numerical values, known today as psychometrics. The modern study of psychometrics for the purposes of employment decisions has foundations as far back as World War II. The first matching technologies were known more as assessments. They were administered on paper, scored by people, and decisions were made a few days or weeks later. As time has gone on, assessments are more accurate at reliably measuring human characteristics, and the mathematics behind them has advanced to combine different kinds of data about an individual or job. Computing power and accessibility has also evolved to administer assessments in unproctored internet based settings or even as games.

With all this advancement, the use of assessments in employment decision making has become widespread; however, the problem remains that people don't like to take tests. This fact has become an increasingly significant issue for many employers as, in the US and many other countries, we have remained at almost full employment for quite some time. To advance our businesses, we must compete for the best talent, and the best way to do that is to maximize the experience of employees and candidates.

HOW ARE WE SOLVING THIS PROBLEM TODAY?

The talent market today has experienced significant investment from large organizations and venture capitalists to solve this challenge so that our customers will compete for talent, and win. Today's technologies utilize a combination of big data management techniques, Machine Learning algorithms, Artificial Intelligence, and user centered design to provide fast and accurate insight into who best fits a job or organization.

Information about people can come from many places: assessments, video interviews, resumes, online social footprints, and more. That information can be combined by "out of the box" algorithms built to apply to any organization or by algorithms built specifically for an organization. Access to insight can be as simple as a numerical value of 1-100 assigned to each person and populated in the Applicant Tracking System (ATS) or other system to stack rank applicants or even prospects for decision making.

At IBM we have created a tool called **IBM Watson Recruitment**. It brings the computing power of Watson together with our team of top mathematicians and behavioral scientists to ensure our clients are selecting top candidates while maximizing the candidate experience. This tool is built to handle even the most complex organizations with industry leading data management and customization of approach down to the job family level within an organization, as well as a seamless integration into your ATS. This sort of approach allows us to enhance the candidate experience, increase the accuracy of decision making, and do all of that at the massive scale and complexity our clients require.

WHERE ARE WE GOING NEXT?

Revolutionary new technology always has challenges at the start that get worked out over time, and Matching Technology is no exception.

- First, some of the original challenges in the field remain important to monitor. Just because you get mathematical results from Matching Technology, that doesn't inherently make them accurate, fair, or predictive. Partners will vary in how they approach challenges around quantifying individual and job characteristics in a way that is accurate and fair. It is critical, if you are considering implementing Matching Technology, that you ask detailed questions about where the matching number came from, how it is calculated, and how fairness is being ensured. Some partners, IBM included, are tackling these challenges in creative and compelling ways and I believe that over time we will arrive at some commonly accepted practices among Matching Technology providers. Today the field is too new for such consensus, so these questions are even more critical to ask.

- Second, as a field we are still working through where Matching Technology best fits in the Talent Acquisition process. Should matching be on the front end to narrow down the pool and then only the top candidates take additional assessments or interviews? Should all candidates provide all data points required and then Matching Technology create an overall score for the individual to be recommended to the hiring manager? From my view, over the next year or so these answers will emerge; however, organizations will likely vary in what fits their goals best.

- Finally, data limitations are always a consideration in mathematics based solutions such as Matching Technology. The accuracy of the output will always, no matter how sophisticated our methods become, be dependent on the quality and richness of the input data. If we are going to base matching scores on resume inputs then candidates need to be putting consistent, relevant data into resumes and that may not be realistic. If we are going to base matching scores on social footprints, then we need to be very disciplined about what parts of that footprint are considered and how rich those are in terms of relevant data. As Matching Technology is new, the base datasets are still being fully defined and built. We have plenty of room still to optimize the inputs and therefore optimize the outputs.

WHAT WILL THE NEXT THREE YEARS BRING?

There is still room for additional disruption in this space, and from my view it is likely. At IBM, we have been thinking about how to utilize similar matching technologies to ensure prospects apply for their best fit job to start. The goal of these solutions is to create a world where almost every applicant matches the job well, so the Matching Technology in selection becomes a piece of an overall Matching Technology strategy. Other vendors are personalizing experiences with the application process in ways that more traditional tools may be more desirable to applicants. For example, if assessment vendors can truly make tests fun, job relevant, games then they will feel less like tests and may become more agreeable to applicants, making passive matching less necessary. Still others in the market are evolving matching algorithms to include voice and video in ways that may make the data set available on each person massively rich and easier to obtain so Matching Technology will not just be new technology but the cornerstone of talent acquisition.

Overall, Matching Technology is solving a critical challenge for Talent Acquisition today and its doing so in a way that is rooted in a deep history of psychology, mathematics, and computing and evolving into a cutting-edge technology for today's organizations. While the technology is new there will be challenges, as there are with any new technology. I, for one, am excited to see where the future takes us and I couldn't be more excited about the future for my Talent Acquisition clients. I suppose that makes me a great match for my current career!

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INVESTOR HIGHLIGHT: AN EVALUATION OF THE CURRENT MATCHING TECHNOLOGY MARKET

TREVOR VAS, CEO & PRINCIPAL CONSULTANT

Talent Acquisition (TA) has come full circle over the last 10 years. The hiring process has evolved from a science to an art and back to science again and this is thanks, in no small part, to technology. When I started recruiting in 1994, the predominant way of hiring was matching a position brief to prospective candidates using key words and then calling them up for a chat. This entailed storing candidates in a database where the resumes were indexed, extracting the keywords from the position brief and using these as search terms to identify candidates who had the highest word count match. The types of products that were used by recruiters then included tools such as Resumix, ISYS and Burning Glass (which has evolved over time).

That was how the industry operated for many years until marketing came along. Employer branding, recruitment marketing, candidate is king – these became buzzwords amongst TA practitioners and employers. Hiring is not so much waiting for candidates to send in their resumes but more about organisations enhancing the candidate experience to attract more people to want to work for them. Digital technologies such as social media and the Internet became important tools for reaching out to candidates and matching tools were somewhat relegated to backseat during the hiring process.

But another shift is now upon us. Developments in technology have really picked up speed during the past two years and the tools for hiring and matching candidates to positions began improving by leaps and bounds to now include semantic search functions which adds the context missing from the pure keyword searching process we had before. A TA practitioner is now able to parse the position description into these tools and the Matching Technology will search the Internet including LI, Google and many other platforms to identify potential candidates who meet the position brief criteria more accurately.

Currently, I see four distinct types of technologies that can undertake, to varying degrees, this level of candidate matching. Typically, they shorten the sourcing process and produce results that a TA practitioner would have only got after initial sourcing and gaining referrals to the type of candidates the hiring manager would like to consider.

THEY ARE:

1. **Sourcing Tools** such as Hiretual, Text Kernel and Glance. These technologies will search a range of platforms to give you a list of potentially suitable candidates.
2. **CRM Tools** such as Livehire that will provide talent pools of candidates and enable you to create talent communities suitable for your organisation. These technologies also have matching technologies and also allow the candidate to self-select in or match themselves.
3. **Marketing Tool**s such as Smashfly that provides an enterprise recruitment marketing platform that uses a CRM to enable you to build relationships with your candidates.
4. **Applicant Tracking Solutions** such as Avature contain a range of features on one platform including sourcing, recruiting and some Talent Management.

A more detailed outline of these technologies is set out in the table below:

NAME OF TECHNOLOGY	WHAT THE VENDOR SAYS IT DOES	MAIN CATEGORY
Hiretual	Hiretual is a complete sourcing solution for recruiters, by recruiters. Its smart boolean builder, contacts, search over 20+ platforms, will make your sourcing 10x faster.	Sourcing
Text Kernel	Textkernel offers the highest quality multilingual CV parsing and semantic search tools. Together with our solutions for sourcing, lead generation, matching, and labour market statistics, they accelerate the process of matching supply with demand on the jobs market.	Sourcing
Glance.ai	Glance.ai is a sourcing tool that helps recruiters by building Boolean Code and then enabling them to execute the code to identify and source candidates.	Sourcing
Burning Glass Technologies	Burning Glass' LENS suite provides the resume parsing, searching, and matching technology. LENS can parse resumes in 14 languages, it can pick up and parse details in than 50 specific geographies.	Sourcing
SmashFly	SmashFly's platform provides one technology solution for employer branding, marketing, sourcing, nurture and analytics needs.	Marketing
LiveHire	LiveHire is a talent technology company that creates Talent Communities. It facilitates the matching of people and employers throughout their careers and the whole of organisation.	Talent Pooling/ CRM
Avature	Is an Applicant Tracking Solution that includes Sourcing, CRM and On-boarding. It also includes some Talent Management elements such as Employee Engagement, Internal Mobility, Performance Management and Succession Planning.	Applicant Tracking Solution

As the use of these matching technologies become more prevalent and candidate sourcing moves online, I see a shift away from resumes and these matching technologies will evolve to offer a more comprehensive suite of service that includes not only matching functions, but also the ability to:

- Identify candidates who have achieved specified accomplishments
- Verify and validate these accomplishment
- Provide some insight or score analytics on the accomplishment based on the level of complexity, seniority and based on brand of the organisation
- Match the candidate's ability to fit with your team based on your existing or desired cultural criteria

A point to note is these are all available in some shape or form now but the overall integration of them into a single tool is not yet available to my knowledge, and, to which I believe, is the next step towards disrupting the TA space.

CHALLENGES AHEAD

Technologies are great, they are like new toys which can give you renewed interest and stimulus in recruitment. However, TA practitioners should also be mindful about some of the challenges that lie ahead for those who rely on them. Some of the main hurdles that I foresee are:

- Convincing hiring managers that the methodology used has a scientific basis that has provided a result that has comprehensively covered the market and any benchmarking of candidates is accurate
- Creating time to try and test new technologies and conduct A-B testing to select technologies that work optimally
- Using extra time gained to add value in terms of market intelligence on brand or talent management advice that can help the hiring managers gain synergy from teams
- Not over complicating the reporting to hiring managers where your information does not add value and even hurt your position
- Getting an understanding of the position brief so that you can readily understand if the technology is supplying false positive (that are candidates who look good but do not fit) results on candidates

Having said that, there are several benefits to TA practitioners for using these matching technologies as well. On the obvious side, the main benefit is that you can stay relevant and be able to add value going forward, which is very important to a person's career. Some other benefits include:

- Standing out from your peers by providing quality candidates faster than the competition
- Having a valid benchmark from the technology to help a TA practitioner to identify star performers
- Being able to substantiate that you are able to cover the market and find quality candidates
- Winning candidates' confidence by being transparent about the technology you have used to identify them (you may raise your eyebrow to this but I can verify this is what occurs for me)

Happy matching!

Trevor has extensive experience in the Recruitment, Information Technology and Finance industries. His ability to innovate within industries and move to the top of each field has been achieved by first setting a vision, and then delivering the vision with precision, energy, passion, creativity and most of all, persistence.

Trevor established Human Capital Management Solutions (HCMS) in 2000, Insidejob in 2005 and the Australasian Talent Conference (ATC) in 2007. HCMS realised a vision to create a unique and independent consulting business to revolutionise recruitment practices. Insidejob recruits corporate recruitment professionals and provides unique capability-based recruiter assessments and training programs. The ATC offers industry-leading thinking to assist HCMS and other organisations provide creative solutions.

MATCHING TECHNOLOGY OUTLOOK

If we gather anything from this report, it's that Matching Technology is evolving at the most opportune time in Talent Acquisition. A business function that has focused so much on the speed and efficiency of recruitment and the hiring process is now in need of placing the right people in the right roles. We mentioned that for the past two decades, much of the technological development in Talent Acquisition has focused on process improvement, speed and efficiency, but now it's time for TA Technology to focus on results. Because the earliest stages of Artificial Intelligence lend themselves so well to Machine Learning and Matching Algorithms, the increase of Matching Technology in existing and new solutions is more prominent than ever.

Looking back, we discussed how Matching Technology was not always welcomed by Talent Acquisition, and we can conclude it's because so much focus was on process improvement. Today's job seeker is technologically savvy and the vast amounts of data available on social media is a segue into how Matching Technology can be used. Pulling intel from resumes, social profiles and even behaviors and interactions on social networks, like LinkedIn, is possible with today's Matching Technology. Because job seekers have vast amounts of information and data ready to be scraped and employers have a need to connect the dots between this intel and open roles they need filled, Matching Technology is set to be the hot technology of 2018.

Challenges Talent Acquisition Technology innovators face include variances in taxonomies across different countries as well as cost barriers to even entering the market in the first place. Robust Matching Technology in today's landscape must account for differences in geographies but must also be able to comprehend a candidate or employer's intent. Up until now, TA Tech has been built with actions in mind, but the TA Tech of tomorrow must focus on intention to be successful in matching.

While many technologies today use matching and the benefits to employers for implementing these technologies are endless, the truth is we're just in the early innings of what Matching will do.