Chapter 12
Application of Machine Learning (ML) in Human Resource Management

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12.1 Introduction

Today, human resource management has evolved to a strategic function of an organization. The role of HR leaders in attracting, developing, and retaining talent is vital to the success of any business. For this, it was inevitable for the HRM (human resources management) to get transformed into digital, which radically altered the way the employees and the businesses work. Digital technology has completely reinvented and enhanced the processes and systems in various functions across the industries, and the HR function is no exception. In the last two decades, digital tools like online job boards, applicant tracking systems (ATS), professional networking sites, viz. LinkedIn, Facebook, and Twitter have significantly changed the HR dispensation right from a job posting or job application to recruitment and on boarding, employee engagement, performance management, and finally employee separation—capturing valuable insights during exit interview.

HR started replacing manual processes which are of repetitive in nature, with automations. The need is to connect all HR processes across the organization over a period of time for greater transparency and efficiency. However, digitalization of HRM should not simply be looked at only a makeover process. HR leaders must be sensitive to the fact that it entails a huge change, and employees must be hand-held throughout this change, failing which it is like a broken chain. Digital HR entails own challenges. It requires a considerable bandwidth of team members and has lot of potential to impact the organization's overall productivity. As per the report of the World Economic Forum, diversified workplaces would emerge in the industry due to mobile, cloud technology, big data, and computing power. In another 2 years, it predicts that AI (artificial intelligence), ML (machine learning), and advanced

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robotics drive the workforce increasingly. HRM is all about making decisions that directly influence organizations "competitiveness" (Walger et al., 2016; Lacombe & Tonelli, 2001). Indeed, the functions of the HR department have direct relevance to both the definition and implementation of organizational strategies. Its strategic role is evident in the necessary alignment between HR and organizational strategy, as well as in the fact that HR strategies, policies, and practices are always required (Wright & Snell, 1998; Lacombe & Tonelli, 2001; Bosquetti & Albuquerque, 2005). Management decisions made in the HR department affect the organization's entire value-creation process. HRM line managers play a central role because they are asked to face situations where taking complex (Fish & Hardy, 2015) and non-routine (refers to unique and non-repeated situations, such as creative problem-solving and decision-making) (Marcolin et al., 2016) decision is the norm. In many organizations, a myriad of HR-related tasks, such as filling out performance forms, interviewing candidates for employment, making salary increase recommendations, and breaking employment-related news to employees require HR managers to have the ability to act in a situation of opalescence (incomplete and asymmetric information) and with the employment of discretion (ability to choose between different options) (López-Cotarelo, 2011).

12.2 About Machine Learning

There is an increasing trend in automating jobs currently done by highly trained and experienced white-collar workers, thanks to the advance of ML and various forms of artificial intelligence. The broad idea that manual work can be carried out by machines is already familiar; as early as the nineteenth-century industrial revolution, the fear of "technological unemployment" induced English textile workers to destroy machines under the charismatic lead of Ned Ludd (Hobsbawm, 1968). Today, smarter machines can perform even more sophisticated tasks (McAfee & Brynjolfsson, 2014). Generally speaking, what makes workers vulnerable to automation is less whether their work is manual than whether it is repetitive and routinized. Machines that can already do many forms of routine manual labor are improving their performances in some routine cognitive tasks, too.

It is important, first of all, to formally define ML. One widely accepted definition is offered by Tom Mitchell: "*A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P, if its performance at tasks in T, as measured by P, improves with experience E*" (Mitchell, 1997).

In the academic world, the topic has been investigated since the 1950s (e.g., Samuel, 1959); however, ML has received more and more attention in the last few years mainly because of two factors. The first one is the availability of data. As we will see, ML algorithms are trained using data, and usually, the more data they receive as input, the better their output in terms of accuracy. The huge increase in the volume of data produced (including data from social networking sites,

smartphones, and devices belonging to the "Internet of things"), which has characterized the last few years, has therefore positively affected the adoption of ML techniques. The second factor is the availability of computational power. Although ML algorithms often require vastly expanded computational resources, during the last years, the availability of such resources has increased both in volume and flexibility (e.g., Amazon Elastic Compute Cloud, https://aws.amazon.com/ ec2), and such improvements have positively affected the trend toward ML adoption.

Machine learning is the science of getting computers to learn and act like humans do and improve their learning over time in autonomous fashion, by feeding them data and information in the form of observations and real-world interactions. How it does is using lot of machine learning algorithms. The algorithm is grouped either by learning style (i.e., supervised learning, unsupervised learning, semi-supervised learning) or by similarity in form or function (i.e., classification, regression, decision tree, clustering, deep learning). Regardless of learning style or function, all combinations of machine learning algorithms consist of the following:

1. *Representation (a set of classifiers or the language that a computer understands)*
2. *Evaluation (aka objective/scoring function)*
3. *Optimization (search method; often the highest-scoring classifier, for example; there are both off-the-shelf and custom optimization methods used)*

Machine learning is a technique by which systems and machines (in the form of nuanced software programs) "learn" over time to speed up their future calculations and decisions and make them more successful. This is done by understanding and analyzing the patterns within previously made calculations and decisions. For example, the technology powers Amazon product recommendations, Google Maps, and the content that Facebook, Instagram, and Twitter display in social media feeds.

The technique boils down to a process that is simply about understanding data and statistics, a process where computer algorithms find patterns in data and then predict the probable outcomes. But this simple sounding process has over the years found increasing applications across various companies. From finance companies who use it to understand its client requirements better to tech giants using machine learning as a core driver of their operations, it is slowly becoming the bedrock of technological transformation across companies.

The benefit of utilizing machine learning is that it helps sieve through large chunks of data that many big companies generate, and by "learning" patterns, it helps make better decisions, many of which might seem counter-intuitive at first. And the benefits are seldom restricted to a single department within the company. When implemented correctly, machine learning can help companies solve problems and predict user behavior in ways that will help the organization grow. Machine learning is enabling companies to expand their top-line growth and optimize processes while improving employee engagement and increasing customer satisfaction.

12.3 Machine Learning and HR

Internally, machine learning can greatly assist the HR function. By using machine learning, many traditional activities like "talent acquisition" and "employee engagement" can be greatly improved. Machine learning can help quickly sift through thousands of job applications and shortlist candidates who have the credentials that are most likely to achieve success at the company. Thus, while also helping HR managers have access to continual insights into how their employees are feeling about their workplace and how engaged are they, a definite improvement over comparing engagement surveys.

Although the developments in computing power and cloud-based server capacity in the past 20 years has made it possible for machines to analyze data and make helpful predictions, its adoption within companies has been relatively slow. Talent restrictions along with skepticism of newer technology and inadequate management of data are some of the reasons that stop organizations from reaping the benefits of machine learning.

But if one was to move ahead of such problems, the potential benefits would be significant. By developing talent in-house and streamlining data collection and management, companies can improve their decision-making. To make a good machine learning system for their business, the following four factors are key:

1. An understanding of the machine learning process
2. An understanding of the different algorithms available and the kinds of problems to which they can be applied
3. Data (the more, the better)
4. Patience

12.4 Objectives and Methodology

The present study aims to find out how machine learning algorithms enable to generalize beyond the training samples, i.e., successfully interpret data that it has never "seen" before.

Machine learning also helps the HR staff to allocate more time and resources to all important human interactions and work on more strategic projects. They will be free of the time previously spent on the mundane repetitive but essential HR tasks that are required on a daily basis.

The present chapter uses descriptive research methodology and is based on secondary data as collected and collated from various literature reviews in the concerned subject area. Findings of the study is completely on the secondary data analysis and mostly theoretical in nature.

12.5 Capacity Building and Challenges

Building this capability in-house also would help companies have a greater control over the areas where machine learning algorithms are deployed to improve their efficacy. As more data is analyzed by the system, the prediction model improves. It also gives companies an agency over their machine learning journey. Learning service providers like plural sight already list courses that can help managers and their teams to learn more about machine learning and improve their skills.

In addition to being aware of the potential benefits of machine learning, it is important to be aware of the pitfalls as well. The first is simply understanding of what kind of algorithm to use for the problem that needs to be solved. A clustering algorithm could be used to classify a restaurant customer as more likely to dine-in than take out, but it cannot be used to predict how raising menu prices would impact sales. Likewise, a regression algorithm would be able to address the effect of price changes on sales, but cannot predict one of a closed set of outcomes. Such clarity is key to reaping maximum benefits out of a machine learning algorithm.

There is also a risk of "overfitting" the data, which is simply training the system to understand a set of data so well that it loses the ability to generalize, learn, and make predictions based on new data. In this case, the model tends to make inconsistent predictions and becomes worthless.

Third, it is also important to know that there are limits to what machine learning can improve within the organization; some problems may just not be solvable with machine learning. Since the process of machine learning from data never ends, it is difficult to always predict which problems can be solved. This might lead to a situation where an organization chases a problem but never ends up developing a functional model. In this case, the solution is knowing when to quit trying.

Although machine learning has traditionally been within the domain of tech companies, the benefits of investing in its development are slowly accruing across various companies. If implemented with the right vision and expectations, machine learning can help companies make great strides in an environment which is becoming increasingly unpredictable.

The scale of the change in the HR function has been staggering and has witnessed an exceptional surge over the last few years. Global companies who have established a presence in India over the last decade have brought with them different perspectives and some new HR practices as well. Technology has significantly influenced the HR function. It has led to new business models coming into existence, allowing technology platform companies to make a significant impact. Competition has come not from within the known set of businesses but from different industries by leveraging technology. The velocity of change has posed unique challenges for the HR function, and HR professionals have seized the challenges and are equipping themselves to meet the needs. It has become quintessential to reimagine the way that we work. HR is already evolving from a process-centric function to be more agile. Leaders today are moving away from a "process" mindset, to a more "outcome"-based mindset.

In this digital era, an organization's competitiveness will depend on its talent readiness, skill-sets, and how it will bring in diversity of thought and perspectives for organizational excellence. Along with the digital age come opportunities, challenges, and trends for the HR function around the globe. Rapidly changing requirements for novel skill-sets in fields such as data science, AI, cloud, block chain, security, etc. signal a need for flexible recruiting practices that allow organizations to reach out to these fresh talent pools. How skills can be deployed in an agile manner within the organization or with its clients has become important. This also creates the need to build an enabling environment for constantly re-skilling talent. Skill will become the new currency, and skill-based wage differentiation will increase. This will also require a fundamental compensation redesign by HR.

Finally, there is an important shift in the expectations of the workforce as employees demand work experiences that are more personal, engaging, and authentic. Deploying new technology platforms to enhance the employee experience will hence get increased attention. Building on existing HR investments in technology and processes, including core HR platforms, cognitive solutions, for example, provide an opportunity to enhance employee experience, reduce costs, and increase the quality and accuracy of HR services through the discovery of new workforce insights. The focus should be on developing leadership skills in the new era which will also be a key area for HR.

As far as the outlook for the industry in 2018 is concerned, HR must act as a catalyst to leverage and deploy technology to enhance the overall employee experience. HR professionals will also have to focus on reducing costs, increase the quality and accuracy of HR services, and provide talent insights for business impact by deploying analytical platforms to discover new workforce insights.

Another key area is to focus on developing leadership skills that can succeed in the new cognitive era. Lastly, it is essential that HR professionals build more effective listening skills and pay heed to their employees on a continuous basis and keep taking corrective action as and when necessary.

12.6 Insights from HR Data

HR gathers vast amounts of data on all aspects of employee activity, but without some form of machine learning to digest and analyze this information and present usable reports, it will be near impossible to identify important trends, threats, and opportunities. The data needs to provide meaningful usable insights, and machine learning can do this. Workflows can be improved, training outcomes will be better understood, and hiring trends, sick days, and vacation requests can all be optimized through machine learning.

Human resources as a function has experienced significant changes in the last decade due to the evolution of technologies. Today, artificial intelligence (AI) and machine learning (ML) is reshaping the way companies hire, manage, and engage with their workforce. Advanced data-driven technology is rapidly making its way

into the HR industry as businesses are focusing more on creating an employee-oriented corporate culture. Recruitment is no more a tedious process for HR practitioners as it no longer entails time-consuming activities such as manually screening the resumes of the prospective candidates, making phone calls, or replying to candidates via emails. These mundane errands are now managed by smart technologies designed to replicate human conversation, thus enabling HR experts to contemplate the bigger picture.

According to the India Report of Deloitte's fifth Annual Global Human Capital Trends, 53% of companies are revamping their HR programs to deploy digital tools, while 22% have already leveraged AI to deliver HR solutions.

Today, employee engagement is crucial for every business agenda because it plays a key role in boosting productivity and helping businesses stay competitive in the market. Gone are the days when HR experts relied on burdensome annual surveys to evaluate employee engagement that often generated erroneous results. In order to redefine performance management, the progressive HR leader can count on real-time data to measure employee engagement and identify problem areas to improve work culture by predicting workforce trends. Moreover, real-time data enables HR experts to take prompt action in a personalized manner.

AI and machine learning (ML), the current buzzwords in technology, have significant implications for human resource management practices. AI breaks down and transforms data into a format that is easy to construe; ML, on the other hand, is an advanced form of AI that scans data to identify patterns and modifies program actions correspondingly.

The insights put forward by AI/ML generate suitable data to help HR practitioners retain and motivate existing employees and to also recruit new ones. Moreover, AI- and ML-powered suggestions utilize historical records to recommend the best solutions to resolve expected problems, thus helping HR leaders develop HRM programs based on smart data.

12.7 Impact of Machine Learning in HR

Nowadays, the understanding of the HR department has been changing. HR used to be about finding the right candidates, managing assessments, giving offers, and managing employee careers and exits.

Human resources today need to step up because the expectations have risen. The HR department has to be able to predict attrition and candidate success.

Before machine learning has come to the rescue, HR managed data in a manual and semi-automated manner. To create analytics, it is necessary to gather, store, and process data. All of the above needs to be done in a short period of time because the data would quickly become irrelevant as the situation is changing and the data needs updating.

Let us investigate what machine learning can contribute to HR.

12.7.1 Automation of Workflows

This was one of the first application of machine learning in HR. Scheduling is generally a painful and time-consuming task. Whether it is enhancing onboarding, scheduling interviews and follow-ups, performance reviews, training, testing, and handling the more common and repetitive HR queries, machine learning can take most of this tedious work away from the HR staff.

This will streamline the process and give the HR department more time to focus on the "bigger issues" at hand.

12.7.2 Attracting Top Talent

A range of machine learning applications are already being used by many companies to improve their chances of attracting suitable recruits. Companies such as Glassdoor and LinkedIn have effectively used machine learning to narrow searches and seek out suitable candidates based on advanced intelligent algorithms.

Another machine learning application used to find and attract top talent is a system developed by Phenom People. It combines keywords with machine learning to seek out prospects on a number of job platforms and social media sites.

FedEx and Johnstone and Johnstone are both successfully using machine learning products (Cloud Jobs) developed by Google to enhance communication with those seeking to work for them. It analyzes characteristics of potential applicants to show them positions that are a good match to their skills, experience, and personality. The same system also makes the positions more likely to be seen by suitable candidates.

12.7.3 Less Time, Reduced Bias, and Greater Accuracy in Recruiting

One of the most important yet extremely time-consuming functions of HR is recruiting. Properly applied machine learning technologies can save time through the use of predictive analysis to reduce time wasting in recruiting and make the process more reliable and accurate.

Machine learning can aid HR in managing the recruitment process from start to finish. It will streamline the process, reduce errors, and improve results.

While the human element is still required to get a feel for the candidate, machine learning will provide accurate and usable analytics to improve the effectiveness of recruitment. It will also help to eliminate human bias and other human elements that could be hindering your company from hiring suitable candidates.

FMCG giant Unilever uses a combination of machine learning platforms and techniques to screen the vast amount of applications they receive. Candidates go through three rounds of machine learning-based "interviews" and assessments before meeting a human for the first time for the final interview. The result was a saving of more than 50,000 h of time spent on recruiting and reduced the time to hire new recruits from 4 months to 4 weeks.

Many start-ups are also using machine learning to speed the process up as well as remove bias from the system.

12.7.4 Applicant Tracking and Assessment

Machine learning applications are able to track new applications as they come through the system to streamline the process and save time and money. This process also helps to reduce bias and eliminate human error.

Citigroup is an example of a large corporation using machine learning to get top recruits that will be a good fit for the group. The machine learning system they use is Koru, and it analyzes and interoperates data from a range of online tests.

Using predictive analytics, it is able to determine if the person is a suitable candidate for the job and a good fit for the company. Other companies such as Reebok, Deutsche Bank, and Airbnb are using the same technology. Feedback has been extremely positive.

12.7.5 Personalization

Given the changing nature of the large amount of "new generations" entering the workforce, personalization has become an important part of attracting, hiring, and retaining top talent.

Machine learning is better able to understand the unique needs of different individuals and create personalized training, rewards, and recognition as well as incentive programs for each individual.

12.7.6 Forward Planning and Efficiency Improvements

Machine learning can better understand the data to provide usable insights that will help HR with predicting turnover trends, communication issues, project progress, employee engagement, and a host of other crucial developments and issues. This will enable them to gain an early awareness of any problems and take remedial action before these issues become major problems.

12.7.7 Attrition Detection and Understanding

Finding and hiring top talent is an essential function of HR. Retaining that talent depends on more than just the HR department, but it is important for them to predict, understand, and manage attrition rates.

Machine learning will be able to provide valuable insights into these factors allowing HR and management to deal with this more effectively and quickly.

The prediction functionality will enable them to plan ahead before they face skill gaps. More importantly, by understanding the data around staff turnover, they will be in a better position to take corrective action and make the necessary changes to minimize the problem.

12.7.8 Measure and Understand Employee Engagement

Again, another popular buzzword at the moment is employee engagement and rightfully so. Numerous studies have been conducted and although the exact figure varies, most show that on average, fewer than 70% of current employees are engaged in their work. This is an alarming statistic.

Machine learning is able to process the data in order to measure and understand this far better than a team of human would. These insights can prove invaluable in increasing productivity and reducing staff turnover rates. Solutions have already been developed by companies like Workometry and Glint that are in use by a number of top companies. These software systems measure, analyze, and report on employee engagement and general feelings related to their work. Data is collected from a range of sources, many of which were not easy to extract any meaningful information from the past.

12.7.9 Individual Skill Management/ Performance Development

While machine learning is proving invaluable in finding, attracting and hiring the best candidates for the position, it is also useful in developing new recruits as well as existing staff.

12.8 Conclusion

The examples we have discussed above are all already in use in some shape or form. Clearly, there is still much development to be done, and this is happening at an amazing rate. The human element of HR will never disappear but machine learning can guide and assist to ensure the functions of these departments are streamlined and faster while strategic and day-to-day decisions will be more accurate. These are exciting times in the HR industry, and it is important that those involved are aware of the solutions already working as well as new trends that continue to develop. Improving recruitment, training, development, and retention will have a profoundly positive effect on a company's bottom line. Those companies that are slow to adapt and adopt the new opportunities provided by machine learning will soon find themselves at a competitive disadvantage while those using them successfully will flourish. Change is the only constant. And it is technology that is at the forefront of driving change at the modern-day workplace.

Machine learning would prove to be of great advantage. Machine learning expertise would impact HR domain significantly. It would lead to better decision-making due to behavior tracking. But as of now, machine learning cannot replace human resources completely. It can be applied as a tool only. It is not only helping people to do their jobs but also can replace them where it is needed to give HR employees more time to focus on more important tasks. Machine learning can bring a better future to the HR world.

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