



ARTIFICIAL INTELLIGENCE APPLICATIONS IN HUMAN RESOURCE MANAGEMENT

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Abstract:

The accelerated development of artificial intelligence (AI), especially the increasing application of machine learning (ML) algorithms in the field of human resource management (HRM), has led to significant changes in the HRM industry. Existing AI applications help HRM professionals in their daily activities and provide essential support for the overall business. The aim of this paper is to review some cutting-edge AI applications in HRM function with attention to the IBM talent management life cycle model.

Keywords:

Human Resource Management, Artificial Intelligence, Machine Learning, Talent Management Life Cycle.

INTRODUCTION

Applications of artificial intelligence (AI) in everyday life and work are no longer part of the distant future but the current reality. Machine learning (ML) algorithms already work extensively on the Internet, analysing big data and providing knowledge of user preferences to predict their future behaviours [1].

Furthermore, AI encompasses various areas, such as robotics, natural language processing (NLP), ML algorithms, computer vision, expert systems and others [2]. Since most of these elements (e.g. NLP, ML algorithms, etc) are nowadays harnessed and integrated in one robotic system, the broader term the system of artificial intelligence is being used [3].

Human capital is a vital resource in contemporary organization and the only asset that organization cannot legally possess [4]. Utilizing human capital requires not only the administrative function (i.e. employee records, attendance, vacations, sick leave, regulation of legal issues, etc.) but also knowledge of psychology (e.g. to recognize job saturation, the appropriate position for the employee, etc.), leadership skills and other so-called hard and soft skills [5].

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With the advent of artificial intelligence applications, human resources are gaining a new dimension, where the traditional is slowly moving to an intelligent (cognitive) approach.

2. ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING ALGORITHMS

Artificial Intelligence is a field of computing that deals with the development of machine intelligence, i.e. the systems that mimic the cognitive functions of the human mind with the goal of learning, understanding, adapting, predicting and functioning independently [6]. Cognition means conscious mental activity or the process of acquiring knowledge and understanding through thoughts, experiences and senses. It includes cognitive processes such as learning, memory, judgment, evaluation, problem-solving and decision making, from the existing knowledge to generate new ones [7].

One of the key fields of AI is machine learning. This represents a collection of algorithms and techniques that allow smart applications to learn and improve from experience without being explicitly programmed. Instead of coding, it is only necessary to apply some of the algorithms over a dataset and it will make its logic, such as finding correlations between data [8]. When it comes to the algorithm itself, it renders the structure of some mathematical model computed by programming language and implemented within certain application.

Application is deemed 'smart' because algorithm(s) are able to resolve some problems without human involvement, for example, predicting future behaviour, recognizing the potential threats, learning from experience, etc [9].

The term machine learning means that machines are developed to act like humans. For example, if we want a machine to recognize some object, we provide datasets where specific features are stored and labelled. These data are processed by specific algorithms, that make their own logic of learning, which creates the model of learning. Usually, we chose the algorithm that recognises objects with high accuracy that can be implemented within a given application. For example, an algorithm called Convolutional Neural Network is able to recognise human emotions with 98% of confidence [10].

All these algorithms can be classified into three groups as described by in Figure 1 [11]:

- ◆ Supervised learning algorithms, applied to labelled datasets in order to predict the output from the input data.
- ◆ Unsupervised learning algorithms, applied to datasets that cannot be labelled (e.g. stock market shares), to learn the inherent structure from the input data.
- ◆ Reinforcement learning algorithms, applied to no-predefined data, learn based on their mistakes, similar to when a person plays a game and avoids the mistakes he has made, in order to win or move to the next level.

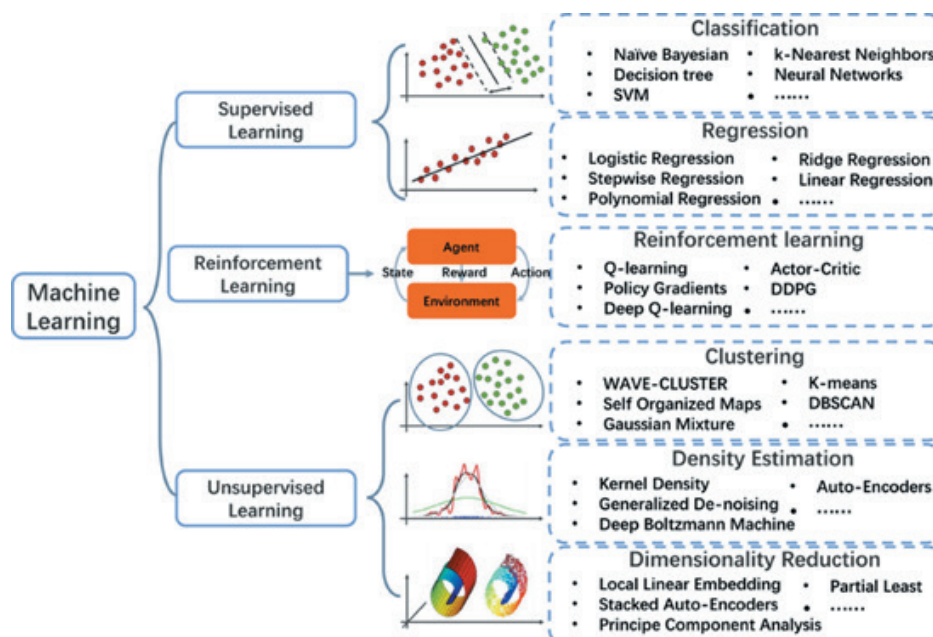


Figure 1 - Machine Learning algorithms [12]



3. ARTIFICIAL INTELLIGENCE APPLICATIONS IN HUMAN RESOURCE

The HRM sector is facing number of significant challenges today. The influence of the gig economy, cognitive computing, and especially virus pandemic, are changing existing business models, workforce demographics, patterns of work, socio-economic conditions, user experiences, creating new jobs, while simultaneously replacing old ones with robots or intelligent applications [9].

Currently, HRM is moving away from the usual human resources practices and is developing in the direction of automation, enhanced intelligence, robotics and artificial intelligence. These trends completely re-examine the entire HRM process in contemporary businesses. In addition, the integration of AI into human resources practices enables better analysis, prediction, and diagnosis to improve the overall decision making [13]. According to the Oracle and Future Workplace report [14], more than 50% of employees use some form of AI in their business, and more than 60% are optimistic and grateful having robotic co-workers, they can trust more than their managers [14].

According to research by the IBM Smarter Workforce Institute, the application of AI in HRM will solve business challenges, attract and develop new skills, improve worker experiences, provide analytical decision support, and enable more efficient allocation and use of HRM budget [13].

Artificial intelligence can be applied in a number of HRM areas including attraction, candidate recruitment, engagement, learning, rewarding, career management, retention and HRM support. In this paper, the IBM talent management life cycle is reviewed as a framework for presenting applications of AI technologies in HRM, because IBM is rendered a leading talent-centric and AI-powered organization [15]. IBM's HRM team, together with their client services experts, have developed these AI solutions including IBM Watson Candidate Assistant, IBM Watson Recruitment, IBM Watson Career Coach, Your Learning, and number of others, depict in Figure 2.

3.1. PHASE 1. ATTRACT: IMPROVING THE CANDIDATE'S EXPERIENCE

During this phase, AI can be used to identify high-quality candidates, even before they even thought of applying for the job. The aim of this phase is to gather as many potential candidates as possible who have the necessary skills for a certain position, and to encourage them to apply for a certain job by providing all the relevant information about the company, position, environment, advantages and other benefits [13].

One example is the use of specialized chatbots. Chatbots send messages at regular intervals, to intrigue and encourage candidates to ask questions about work and organization.



Figure 2 - IBM Talent Management Life Cycle [13]



Also, this technology speeds up the research process about the company, its reputation, analyses the comments of current or former employees on various forums, matches the candidate(s) skills with specific requirements in certain positions, creates a system of recommendations based on the candidate(s) biography, etc. According to expert advice, the list of high-ranking chatbots in 2020 includes XOR, Arya, Olivia, and number of others [16].

XOR recruitment software combines the latest advances in AI, machine learning and chatbot technology [17]. The software uses 100 languages with its algorithm, and is set up to turn a potential candidate into an employee. Recruitment chat, Arya, developed by Leoforce company [18], identifies top talents, comparing skills and building the relationship with the right candidate(s). The major strength of this chatbot is that during the conversation, it can fully see and understand the dilemmas and needs of the candidate(s).

Olivia chatbot, developed by Paradox company [19], is on the HRM market since the 1990s. It allows quick attraction of candidates by creating a personalized experience, collecting basic personal information (i.e. name, email, phone, previous positions or applications for the job), automatically scheduling interviews, managing recommendations, etc.

3.2. PHASE 2. HIRE: ENABLING PROPER STAFFING

The job of a recruiter is time-consuming, especially when there are multiple open positions with a load of documents from the candidates that need to be reviewed and their compatibility matched with job requirements.

In this phase, machine learning algorithms are used to analyse and sort jobs according to the priority, match candidate(s) skills, predict their future performance based on data collected during the job application process, and other [20]. Current AI applications used in this phase enable automatic reading of job application forms (CV, cover letter), testimonials, and other candidate(s) documents, and load, analyse and match these data with vacant position(s) within the HRM system.

In addition, AI referral analysis applications help identify relevant people inside or outside the company who have the best recommendations from own employees [21]. By reviewing current employee's work performance and analysing their recommendations, AI applications can sort the list of employees by significance based of their work track records and recommendations.

Many AI applications are available on the market. Talkpush is the chatbot that automates the hiring process, and is currently used by companies some Fortune 500 companies, such as Amazon, Walmart, McDonald's. Furthermore, IBM's Watson Recruitment (IWR) uses AI to gather labour market information and candidate(s) previous experiences in order to predict future work performance [22].

3.3. PHASE 3. ENGAGE: INCREASING EMPLOYEE MOTIVATION

AI applications are also used to analyse employee engagement and inform the management [23]. By analysing the data that employees enter daily, it is possible to predict their fatigue, job saturation, burnout, and other possible risks [24]. Furthermore, it predicts the employees' potential, their expectations, improvements, intention to change jobs, etc. Based on analysis of this data, personalized schedules are made and more productive conversations are held with employees to improve their experience, work performance and retain talented workers [25].

Engage at IBM assess social media content within the IBM itself, to identify key employee issues [13]. This AI application analyses unstructured data from annual reports, received recognitions and awards, comments of employees, etc., in order to motivate and better engage employees [26]. For example, when someone is praised by their team, the app notifies the manager to share the news with other employees, or post it on social media.

AI alert systems provide notifications to managers about their team members [27]. For example, if employee has been in the team for a long time, achieved certain competencies and is ready for promotion, the manager is noticed [8]. Similarly, a manager can also receive notification of employees who have a greater propensity to leave the company. In that case, manager can react quickly and propose preventive measures to further motivate employee(s) and get them back on track [28]. One of the ML algorithms often used for this type of analysis is Naive Bayes (based upon Bayes' probability theorem). The algorithm analyse and identify key characteristics of employees who have left the company and match it among the existing employees, assuming they may leave the organization in the foreseeable future if the management does not take any action [3].

AI applications that additionally influence the motivation of employees are chatbots that lead to an informal conversation with employees, follow their feelings, take



preventive and appropriate measures, answer everyday questions regarding, vacations, sick leave, workers' rights, etc [29]. Since these chatbots are available to employees on daily basis, they are better acquainted to the employee than HR staff. For example, some questions that chatbot regularly ask are: "Are you bothered or frustrated by something", "What do you want to achieve during the day" [13]. In conclusion, these applications are of great help in preventing employee dissatisfaction on time and thus resolving some organizational issues.

3.4. PHASE 4. RETAIN: SMARTER COMPENSATION PLANNING

Decision on how to compensate employees requires careful consideration and analysis of many factors. In addition to work performance, compensable factors include the current market price of a particular skill, how demanding the skills are, what the need for that skill is, and whether it is better to reward strong work performance as the base salary or to include bonus scheme. The advent of AI applications to support the compensation system has significantly reduced the time for the preparation of compensation plans and consequently reduced the possibility of bias in the compensation process. One AI application available in the market is the Beqom compensation management application [30].

3.5. PHASE 5. DEVELOP: PERSONALIZED LEARNING AND TESTING

AI applications on employee learning and development are designed to accelerate the acquisition of skills both by employees and organizations as a whole. By making learning available when and where it is needed, AI helps to acquire the strategic skills of the organization.

The company should know what skills employees possess and at what level of expertise. With built-in AI algorithms, the system will automatically detect skills level of an employee and create personalized, agile and adaptive learning programs to meet the individual needs. Concurrently, employees' feedback on business is considered. Analysis of learning history is assessed as an indicator of each employee propensity to learn, which becomes just as important as a employee's current skills, as the lifespan of skills naturally continues to decline over time.

Bernard [31] stated that AI applications for learning and development enable: a) Personalized learning path depending on learning style, role at work, existing plan

for developing skills and future goals while proactively directs towards the missing skills, b) Assigning tasks and engaging in projects that are based on employee skills, c) Pairing learning content based on the individual needs of employees, d) Learning chatbots that are accessible to employees as additional support, e) Adaptive testing, etc.

3.6. PHASE 6. GROW: CAREER DEVELOPMENT

Career Coaching is a powerful way to create a more meaningful work experience for employees and can lead to high motivation and engagement, higher productivity, as well as improved overall job performance [32]. It is usually time-intensive, expensive and has generally been reserved for employees who either perform poorly or for individuals who represent great potential for the company [33].

IBM [32] has developed the Watson Career Coach (WCC) which enables the following:

- ◆ Personal career counselling: answers the FAQ about career and provides guidelines that are tailored to the career aspirations of the individual;
- ◆ Explores future career opportunities: advising employees on new job opportunities that match their skills, interests and desired career path;
- ◆ Move towards a career path: helping employees to map the path of their career by showing them what, in a given role, they will do next;
- ◆ Discovers new learning opportunities: preparing employees for their future growth and development, offering them learning opportunities that match their desired career paths.

3.7. PHASE 7. SERVE: 24/7 INTERACTION WITH EMPLOYEES

AI application most frequently used in HRM are chatbots [34]. They must be available for 24/7 in real-time, and deliver customized support and interventions through brief conversations with employees [35]. However, the most significant advent in nowadays AI applications is the ability of chatbots to constantly learn from employees' feedback and thus improve their responses over time [26].



4. CONCLUSION

This paper presents the existing AI applications in HRM that are used today by all the sizes of businesses. Large companies already implemented HRM systems, such as SAP, Microsoft, Salesforce, and many others [9]. For a number of small and medium-sized enterprises, these HRM systems are quite expensive so they usually use smaller web AI applications. These AI applications are more agile and cheaper, while developed using modern technologies, but they can only cover some parts of the HRM business and are generally not integrated with other business functions within the company.

HRM information systems today are mainly divided into "Operational" that support everyday human resources operations and "Analytical" that provide help in decision making processes. Whatever is the capability of current HRM information systems, they implement modern technologies such as AI, Big Data, IoT and others.

Although AI is currently mostly used for repetitive administrative jobs, it is slowly utilized in jobs that require determination and expertise, especially when it comes to making business decisions about certain issues [36]. However, considering the HRM role and business objectives, it is expected that future AI applications will require a multidisciplinary approach in the areas of administration, psychology, management, etc.

Many people are worried that AI systems may completely replace humans and reshape the nature of labour and market itself. However, there are comforting voices that in the future AI will very much depend on human skills. Some of these skills (so-called 5C) regarded as a crucial differentiators of people versus machines in the future, are listed by Eubanks [25] – these are: Creativity, Curiosity, Collaboration, Compassion and Critical thinking.

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