Thoughts on the development of artificial intelligence combined with RPA

Xuan Zhang\textsuperscript{1*}, Zhanpeng Wen\textsuperscript{2}

\textsuperscript{1} School of Data Science, City University of Macao, Macao, 999078, China
\textsuperscript{2} School of Data Science, City University of Macao, Guangzhou, 510665, China
\textsuperscript{*}Corresponding author’s e-mail: D20091100189@cityu.mo

Abstract. As companies focus on digital innovation, robotic process automation (RPA), has attracted widespread attention in many different industries. The automation of repetitive tasks can increase efficiency while reducing human error. Robots will not be tired, will not be bored, and will perform tasks accurately to help their human counterparts improve and reduce their free energy to focus on higher-level tasks. In addition to simple RPA, intelligent automation can also be achieved by integrating machine learning and artificial intelligence with robotic process automation to automate repetitive tasks and increase human-like perception and prediction layers.

1. Introduction

In the past few decades, with the rise of various emerging IT technologies, business operations ushered in wave after wave of revolutions, ERP and shared services, which originated in the 1990s, greatly improved the operating efficiency of enterprises, while the vigorous development of labor outsourcing in 2000 further reduced operating costs. According to research, the global expenditure on robotic process automation software reached 680 million U.S. dollars in 2018, a year-on-year increase of 57%. By the end of 2018, 60% of enterprise organizations with revenues of more than 1 billion U.S. dollars deploy RPA tools; by 2019, as the adoption rate increases. And enterprise organization systems use this technology to achieve better business results, such as reducing costs, improving accuracy, and improving compliance. The average price of RPA will drop by 10% to 15%; expenditures are expected to reach US$2.4 billion by 2022. 85% of large and very large organizations will deploy some form of RPA\cite{1}.

Today, the main application areas of RPA include e-commerce, finance, taxation, banking, manufacturing, new retail, insurance, logistics, government, public security and other industries. It is often difficult for these organizations to integrate different elements such as financial and HR systems\cite{2}. They are turning to RPA solutions to automate existing manual tasks or processes, or to automate traditional system functions. In order to maintain competitiveness and efficiency, companies must now consider adding machine learning and artificial intelligence to traditional RPA to achieve intelligent automation\cite{3}. Automated auxiliary work composed of machine learning and artificial intelligence. Depending on the type of business, companies usually use one or more types of automation to improve efficiency and effectiveness. When moving from process-driven automation to more adaptable data-driven automation, although the form of training data, technology development, infrastructure and expertise will incur additional costs, there are potential benefits in terms of other insights and financial impact Can be greatly enlarged\cite{4}.
2. Overview of Robotic Process Automation

2.1. RPA technical architecture

(1) Process production tool: used for production process.

(2) Control node: used for scheduling and monitoring tasks, mainly composed of processes and timing.

(3) Robot: The process used to execute tasks regularly, see the figure 1.

![Figure 1: robot process](image)

2.2. Process

The process is actually the arrangement of actions. The actions here are scripts. The process can be understood as a collection of scripts, as shown in the figure 2

![Figure 2: script process](image)

2.3. Process production

(1) Based on coding: extremely flexible.

(2) Based on visualization: similar to the html5 production tool, dragging and dropping predefined action (script) blocks to form a process, simple operation but low flexibility.

(3) Record-based: Record the operation as it is, the simplest, but the error rate is higher.

2.4. Principle of operation

Take the "keystroke wizard" as an example[5]. This is a domestic software that is widely known in the game field. Its simple functions can help us complete some automated tasks. The basic working principle of the "keystroke wizard" is: firstly, an operation script is formed by recording the actions of the operator's mouse and keyboard, then the script is written by manual editing, and finally the process
(or batch) is executed. When the script action is executed, a new action will be generated according to
the new script operation, so that the user can use these script changes to complete some simple
operations and form automation. In theory, many repetitive tasks can be solved. This is an example
based on the principle of RPA. Compared with the current RPA, there is no essential difference in
logic. Today's RPA tools will have richer functions, more diverse and practical scenarios, a high degree
of customization, and more targeted.

3. RPA development stage

3.1. The first stage
The first generation of RPA simply assisted in manually completing some basic data entry and file
opening standardized desktop tasks. The entire work process cannot be separated from manual
intervention and cannot be performed automatically. The effect is often to assist individual employees
to improve work efficiency by a small margin.

3.2. The second stage
The second generation of RPA, this stage of RPA can partially liberate labor, and can automatically
complete part of the work process in the entire business process or a certain link of the work process.
Robots will never be bored with these repetitive tasks, and they will completely follow the schedule.
Instructions and rules to complete these tasks with the highest efficiency without manual intervention[6].

3.3. The third stage
The third generation of RPA can be understood as enhanced intelligent RPA. At this stage, RPA can
simply integrate perception technologies, try to partially acquire relevant external knowledge, and
automatically process unstructured data in target documents, such as invoice information (images) and
customers. Mail (text). However, the actions performed by RPA at this stage are consistent every time.
They will not "learn" from repeated executions, nor will they make self-improvements and seek better
solutions in daily programmatic work Strategy.

3.4. The fourth stage
The fourth generation of RPA, which combines perception technology (voice, human-computer
interaction, vision), cognitive technology (intelligent decision-making), and RPA technology to create
an intelligent assistant robot that can simulate humans for business decision-making and business
processing. The combination of RPA and artificial intelligence AI has a very wide range of
applications. On the one hand, it can handle simple and repetitive tasks such as posting emails, Excel
calculations, and organizing files; on the other hand, it can also complete the intelligent audit of
identity information, intelligent text OCR analysis, and customer service scenarios. Complicated
decision-making work such as auxiliary decision-making and automatic recommendation. The
intelligent assistant robot can learn the business processing experience (data) of humans. In complex
business scenarios, it can achieve a decision-making accuracy that is close to or surpassing humans. It
breaks the limitation that traditional RPA technology can only process business according to specific
rules and realizes in-depth business. Scene coverage.

AI combines machine learning and deep learning to have strong autonomous learning capabilities.
Its OCR, NLP, voice recognition and other technologies enable RPA to have cognitive capabilities and
can continuously correct its own behavior through big data, thereby having intelligent decision-
making and intelligent operations research capabilities. In the future, with the continuous development
of RPA technology and the continuous implementation of AI, the integration of the two parties will
become more rapid and in-depth, which will then evolve into the general trend of this industry[7].
4. Combining RPA with artificial intelligence

4.1. Extension of RPA technology

With the continuous superposition of AI technology. As shown in figure 3, robotic process automation technology continues to expand, and intelligent automation technology and advanced automation technology have emerged. Intelligent automation means that robots use reasoning and analysis information, learn new processing methods through mathematical analysis, and use artificial intelligence to complete human interactions, recording every action, transaction, interaction, and decision tree. It is generally suitable for auditing and inspection. The so-called advanced automation is the use of robots to meet predefined pathways, support complex calculations, and process unstructured data, such as image recognition; robots meet predefined pathways, support complex calculations, process actions and activity triggers, and are based on knowledge bases Content to automate the access and integration process to improve operational efficiency.

![Figure 3: extension of RPA technology](image)

4.2. The impact of RPA technology under artificial intelligence on all aspects of the process

(1) Acquisition: Traditional acquisition methods include paper documents or scanned documents, e-mail, language communication, external network acquisition, and digital interface. It can now be combined with deep learning or machine learning, image processing, text recognition (OCR), and the Internet of Things (LOT).

(2) Processing: The traditional processing methods are information proofreading, rule checking, query entry, paste copy, application or page switching. In the environment of artificial intelligence, not only RPA robot process automation can be used, but also natural language processing (NLP), BPM workflow engine, and rule engine can be combined.

(3) Decision-making: Traditional decision-making methods tend to be logical rules, data analysis, experience accumulation, multi-dimensional analysis, and perceptual judgment. Nowadays, recommendation engines, predictive analysis, streaming data processing, and big data analysis are added in all aspects.

(4) Supervision: The traditional supervision methods are information collection, comparison and analysis, rule verification, multi-dimensional analysis, optimization and improvement. Supervision under artificial intelligence uses more risk prediction, deep learning and machine learning, video analysis, and natural language processing.

4.3. Application of AI and RPA in internal audit
Internal audit first needs to identify problems through sampling tests. In a large data volume environment, many problems will be missed. At this time, real-time monitoring of full data is required. Secondly, we will understand the process and risks through interviews. At this time, interviews are limited by the interviewee's experience and subjective wishes, and it is difficult to obtain an objective and comprehensive understanding. At this time, risk identification based on data and evidence is required[8]. Then using internal structured data for historical analysis, we must combine machine learning to do predictive analysis, integrate external data, and warn of potential risks. In the end, audit activities require a large investment of time and cost, and are highly dependent on experts. However, it is now possible to automatically execute routine audit procedures and release resources through intelligent automation means[9]. Traditional internal auditing is resource-dependent and often focuses on post-event inspection. The next generation of internal auditing will apply technology to provide influential risk insights in a more timely manner.

Intelligent internal audit can be implemented in various ways, can integrate multiple tools, and implement flexible methods. For example, using artificial intelligence and RPA technology to quickly build an intelligent audit monitoring platform. The robot builds an analysis model, finds process abnormalities, system abnormalities, and behavioral abnormalities to perform robot-assisted cause analysis, and then conducts risk warning and abnormal handling. When business occurs, abnormal warning is performed at the same time, which changes the hindsight of traditional internal audit[10]. The intelligent monitoring platform is characterized by intelligent auditing, that is, 24-hour automatic monitoring of full data, timely detection of system abnormalities caused by rapid iteration, rapid adaptation to business rules and process changes, timely detection of new violations and fraud techniques, and automatic analysis of abnormal causes.

5. Conclusion
As a software robot, RPA is a "human", it should have eyes, ears, mouth, hands, and head. Using the current relatively mature technology in the field of artificial intelligence, RPA robots have these functions similar to humans: eyes, using OCR, image recognition, semantic recognition and other technologies, RPA robots can "read" printed and handwritten text to achieve functions such as invoice recognition, ID card recognition, bank card recognition, etc.; ears, using voice recognition technology, RPA robots Can "understand" human conversations, combined with semantic recognition technology can achieve functions such as meeting records (text), real-time translation; mouth, using speech synthesis technology, RPA robots can "speak", combined with speech recognition and semantic recognition technology can be Realize functions such as functional tour guides, intelligent shopping guides, etc.; hands and feet, using robotic arms, autonomous driving and other technologies, RPA robots can "act", combined with machine learning and other technologies to achieve such as unmanned driving, unmanned logistics, unmanned factories, etc. In the brain, using artificial intelligence technologies such as statistical analysis and machine learning, RPA robots are truly intelligent and can "think, learn and make decisions" like humans. At present, these individual technologies are relatively mature. RPA can string these scattered pearls into beautiful necklaces, which can be worn on the necks of companies at a price that customers can afford, so that they can participate in increasingly severe market competition with a more elegant attitude. So, seize the opportunity to achieve the future.

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