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Artificial Intelligence Governance Strategy in the Indonesian Regulation System, Offensive or Defensive?

Indri Maria[1], Riswadi[2]
[1]*Universitas Borobudur, Indonesia*
[2]*Universitas Borobudur, Indonesia*

Corresponding Author: Indri Maria, E-mail; mariaindri10@gmail.com

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ABSTRACT

The Indonesian government unveiled its National Strategy on Artificial Intelligence (AI) in 2020, known as "Strategi Nasional Kecerdasan Artifisial". This comprehensive plan addresses various aspects of AI, including ethical considerations, policy frameworks, workforce development, data ecosystems, and infrastructure for AI advancement. It's important to note, however, that National Strategy serves as a guiding policy document rather than a legally enforceable set of regulations. However, this does not mean that the Indonesian government is absent from regulating AI technology. In Indonesia, there are currently applicable regulations relating to the use of AI, although not directly confronting AI Technology. This qualitative journal aimed to analyze comparative strategies for drafting government regulations in the era of Artificial Intelligence. This journal was prepared using a normative approach, with laws and other valid legal bases as sources. The data for writing this article were obtained from a document or library study by studying and analyzing library materials and related regulations related to research problems. In conclusion, we will compare offensive strategies that focus on driving positive outcomes, such as increased opportunity and profitability, and defensive strategies that aim to prevent negative outcomes and reduce risks. The government can develop a comprehensive strategy that enables both offensive and defensive objectives or choose between offensive and defensive strategies.

Keywords: *Artificial Intelligence, Defensive Strategies, Regulation System*

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INTRODUCTION

As an archipelagic nation with a substantial population, rich cultural heritage, and traditional knowledge, Indonesia holds a strategic position globally (Langer, 2021). The country's economy continues to grow year after year, presenting numerous opportunities for the implementation of Artificial Intelligence (AI). This cutting-edge technology has the potential to enhance business productivity, optimize human resource allocation, and drive innovation across various sectors (Borges, 2021). These sectors include finance, healthcare, education, agriculture, national defense, transportation, and maritime industries (Pelau, 2021).

Artificial intelligence also provides cost-effective solutions for overcoming infrastructure problems, providing effective social services, planning quality educational resources, helping governments formulate appropriate policies, building convenient digital markets, and assisting governments in providing the best services in sectors. Public (Markus, 2021).

Homero (2024) characterizes Artificial Intelligence (AI) as the concrete, real-world ability of non-biological machines or synthetic entities to execute tasks, solve problems, communicate, interact, and behave rationally in a manner comparable to biological humans (Eysenbach, 2023). The existence of AI may not be solely dependent on human intelligence, and its operationalization is founded on two key factors: performance level and autonomy level (Secinaro, 2021). A basic conceptual framework for AI is based on its performance levels, which encompass task execution, decision-making, and prediction capabilities, as well as its autonomy levels, which are determined by the extent of human input, interaction, or oversight required (Benzidia, 2021). Similar to humans, AI will exhibit varying degrees of intelligence based on its performance and autonomy capacities (Ghassemi, 2021).

Currently, Indonesia relies on Law (UU) Number 1 of 2024 for the Second Amendment to the Law on Information and Electronic Transactions (UU ITE) concerning Electronic Information and Transactions (C. Zhang, 2021). The ITE Law serves as a comprehensive legal framework governing various digital aspects. It sets forth regulations for safeguarding personal information and individual privacy, while also establishing legal guidelines pertaining to information and technology (Wang, 2023). This legislation encompasses a wide range of digital matters, providing a legal foundation for their governance (Pan, 2021).

However, the ITE Law is considered inadequate for dealing with various new crimes that have emerged along with developments. One of the main reasons for this is privacy concerns that lead to the misuse of AI technology (Bag, 2021). Beyond privacy issues, potential negative consequences of AI include algorithmic bias, workforce displacement, alterations in human interactions, worldwide regulatory challenges, enhanced cybersecurity threats, and the potential for AI-enabled terrorist activities (Alowais, 2023).

Bambang Ahmad Indarto (2024) explained, ambiguity regarding the legal status of AI may result in difficulties in determining liability and paying compensation in such

cases (Shi, 2021). Additionally, in a law enforcement context, if AI is used to monitor and analyze criminal activity, questions about privacy and fairness may arise because AI has no understanding of the social or ethical context that might influence decision making (Collins, 2021). Therefore, a clear and comprehensive legal framework is required to address these uncertainties and ensure that the use of AI in legal contexts occurs fairly and safely (Shastri, 2021).

Despite the positive and negative impacts of Artificial Intelligence, AI policy is becoming increasingly important to pay attention to. AICI, Artificial Intelligence Center Indonesia (2024), stated in its article, "AI Policy: Regulations and Implications," that with the rapid development of AI technology, appropriate regulations are needed to ensure safe, fair, and transparent use of AI. AI policy not only affects the technology industry but also has broad implications for society, the economy, and human rights (Misra, 2022).

Maciej Kuziemski and Gianluca Misuraca. (2020) published a journal about the effects of increasing the use of AI. This research discusses how the increasing use of AI has created major changes in the socio-economic context, affecting almost all aspects of life (Ahmed, 2022). However, the public sector faces a double dilemma. On the one hand, they have an obligation to protect their citizens from the potential dangers of algorithms, but on the other hand, there is a demand to increase their own efficiency by managing algorithms (Moor, 2023).

The safeguard mechanism, which emphasizes a human rights approach, will strengthen guarantees of protection for citizens, as well as a reference in encouraging the growth of the Artificial Intelligence industrial ecosystem (Angelov, 2021). Social Engineering theory by Roscoe Pound emphasizes the importance of law as a tool of control social to protect the interests of the state, society and individuals. In the context of AI, regulations that can help ensure this technology is used responsibly and not detrimental to the interests of society. With clear and firm regulations, the use of AI can be achieved monitored more effectively so that negative impacts can be minimized. This regulation is also important for providing legal certainty for developers and users of AI technology in Indonesia, as well as ensuring that technological innovation does not compromise individual security and rights (S. Ali, 2023)

The terms offensive and defensive strategies are often used in sports and business competitions. To better understand the concepts of offensive and defensive strategies, let us take a step back and draw an analogy from the world of sports. Imagine you are a soccer coach and you have limited resources and time to practice. To achieve success, you must strike a balance between offensive and defensive tactics. If you focus too much on defense, your offensive capabilities may be sacrificed (Velden, 2022)

In the realm of Business Competition strategy, Bruner, Goodnow, and Austin (1956) defined strategy as "[a] pattern of decisions in the acquisition, retention, and utilization of information that serves to meet certain objectives (i.e., to insure certain forms of outcome and to insure against certain others)" (p. 54). This definition

emphasizes how strategic choices in handling information contribute to achieving specific goals and avoiding undesired results.

Mark Z. A. Khei elaborates further on Bruner's theory. An offensive approach can be defined as a succession of choices aimed at proactively pursuing advantages or securing favorable results. On the other hand, a defensive approach consists of a series of decisions intended to reduce potential losses or protect against unfavorable outcomes (Cooper, 2023).

The aim of this study is to provide recommendations for the government's strategic steps to oversee the development of Artificial Intelligence. In this case, the government must provide comprehensive AI regulations regarding Artificial Intelligence (J. Zhang, 2021). Therefore, it is necessary to identify regulatory needs by involving relevant Ministries or Institutions, Associations and Business Stakeholders. In addition, there is a need to identify the risks that arise from the preparation of regulations so that good digital governance can be realized in Indonesia (Letaief, 2022).

RESEARCH METHODOLOGY

According to Lexy J. Moleong (2000), qualitative methodology refers to a research approach that generates descriptive data, which includes written and verbal statements from individuals, as well as observations of their behavior (Campa, 2021). The methodology employed in this study was a normative approach, utilizing laws and other valid legal sources (U. Ali, 2021). Typically, normative legal research involves document analysis, drawing upon legal source materials such as regulations, judicial rulings, contracts, agreements, legal theories, and expert opinions from scholars (Ji, 2021). Normative legal research, also known as library-based research or document analysis, is equivalent to doctrinal legal research (Bauer, 2021). The data for writing this article is obtained from document or library study, by studying and analyzing library materials and related regulations related to research problems (Tu, 2021). The secondary data were presented by the Director General of Informatics Applications, Ministry of Communication and Informatics (MCI) Republic of Indonesia, Mr. Hokky Sitongkir, at the 12th Denpasar Discussion Forum, 206th Edition, September 25, 2024.

RESULT AND DISCUSSION

Offensive and defensive strategic approach related to Artificial Intelligence in Indonesia

From the opportunity to attend the 12th Denpasar Discussion Forum, 206th Edition, 25 September 2024 with Mr Hokky Sitongkir, Director General of Informatics Applications, Ministry of Communication and Informatics (MCI) Republic of Indonesia as speaker, he explained about the Indonesian digital ecosystem welcoming the era of Artificial Intelligence. First, Artificial Intelligence is offensive and creates various opportunities and possibilities, realized by maximizing the benefits of Artificial Intelligence applications, including human language processing by computers, personal

assistants, machine learning, cross-sector relationship efficiency, image recognition, and data analysis (Vrontis, 2022).

Second, Artificial Intelligence is Defensive, protecting the most valuable asset in the digital era, namely, data. Digital data are inclusive, integrity, availability, authenticity, non-Repudiation, compliance, privacy, digital forensics, and resilience.

In a significant step towards ethical Artificial Intelligence (AI) governance, UNESCO, in collaboration with Indonesia's Ministry of Communications and Informatics (KOMINFO) have completed the AI Readiness Assessment for Indonesia using UNESCO's Readiness Assessment Methodology (RAM) in October 2024. This milestone marks Indonesia as the first country in Southeast Asia to complete the RAM exercise, while it is currently being implemented in more than 60 countries globally (Ahmad, 2021).

Summarized from AI Readiness Assessment for Indonesia, UNESCO recommendations for Legal and Regulatory, note that Policymakers have aligned digital technology and AI regulations with global standards, but key details, like AI liability and reporting mechanisms, need clarification. Public participation should be strengthened to ensure proper implementation and adherence through effective monitoring and supervision. First, policymakers need updating AI existing Regulations, including the National Strategy on Artificial Intelligence. Regulations should be aligned with global AI standards, including UNESCO's Recommendation on Ethical AI. Second, incorporate missing concepts such as proportionality, "do no harm," and human oversight/accountability. Third, reflect advances in generative AI and increase public engagement in AI development.

Defensive Progress in law enforcement with government regulations regarding Artificial Intelligence in Indonesia

The Agency for the Assessment and Application of Technology Indonesia (BPPT), a government entity in Indonesia, unveiled the National Strategy on Artificial Intelligence in Indonesia (Stranas KA) in 2020. This comprehensive strategy encompasses ethical guidelines and policies for AI, initiatives to cultivate AI expertise, and frameworks for establishing data ecosystems and infrastructure essential for AI advancement. However, The National Strategy serves merely as a guideline for national policy and lacks the force of a legally binding document (Xu, 2021).

Nevertheless, this doesn't imply that the Indonesian authorities are powerless in regulating Artificial Intelligence technology. Currently, Indonesia has existing laws and regulations in place that address the utilization of Artificial Intelligence, including:

1. Law Number 11 of 2008, Law on Information and Electronic Transactions (UU ITE) concerning Electronic Information and Transactions
2. Law Number 14 of 2008, Law on Public Information Disclosure (UU KIP)
3. Law Number 28 of 2014 concerning Copyright (UU Hak Cipta)
4. Law Number 27 of 2022 concerning Personal Data Protection (UU PDP)
5. Government Regulation Number 39 of 2019 about Indonesia One Data (PP SDI)

6. Government Regulation Number 71 of 2019 concerning Implementation of Electronic Systems and Transactions (PP PSTE),
7. Regulation of the Minister of Communication and Informatics Number 5 of 2020 concerning Private Scope Electronic System Operators (Permen PSE),
8. Regulation of the Minister of Communication and Informatics Number 3 of 2021 concerning Business Activity Standards and Product Standards in the Implementation of Risk-Based Business Licensing in the Post, Telecommunication, and Electronic Transaction System Sector,
9. Minister of Communication and Informatics Circular Number 9 of 2023 Concerning the Ethics of Artificial Intelligence.

The Financial Services Authority (OJK) has taken steps to govern the application of Artificial Intelligence. In collaboration with industry groups AFSI, AFPI, and ALUDI, OJK tasked the Indonesian Financial Technology Association (AFTECH) with developing and implementing ethical guidelines for responsible and trustworthy AI use in the fintech sector. These guidelines were unveiled in early December 2023. Additionally, OJK is drafting regulations for digital services provided by commercial banks, which incorporate the principle of responsible innovation in adopting new technologies, including AI (Lund, 2023).

Looking at the regulations mentioned previously, it can be concluded that data is the most valuable asset in the digital era, and these regulations are protective. OJK protects financial data, Personal Data Protection Law protects personal data, ITE Law protects electronic transaction data, Copyright Law protects copyright, and creations are registered as data. However, from all regulations above, Minister of Communication and Informatics Circular Number 9 of 2023 Concerning the Ethics of Artificial Intelligence, is the most related with Artificial Intelligence, and has rules to protect personal data protection beside Personal Data Protection Law (Pavlik, 2023).

What if we look at examples of defensive regulations from other countries? Recently, the European Union has released the latest iteration of its AI Act, which is set to be implemented in 2024. According to Matt Kosinski from IBM, this legislation adopts a risk-based approach to regulation, applying varying rules to AI systems based on the level of threat they pose to human rights, health, and safety (Ayers, 2023). As the world's first comprehensive regulatory framework for AI applications, the European Union AI Act completely prohibits certain uses of AI while imposing stringent security and transparency requirements on others. The law also establishes specific guidelines for the design, training, and deployment of general-purpose AI models, such as those underlying ChatGPT and Google Gemini. Violations of this act can result in substantial penalties, with fines reaching up to EUR 35,000,000 or 7% of a company's global annual revenue.

Offensive Progress in law enforcement with government regulations regarding Artificial Intelligence in Indonesia

If we want to find keywords for offensive strategies. Opportunity, Promotion, and profitable are suitable keywords. The opportunity to exploit the positive impact of Artificial Intelligence applications is reflected in new job opportunities. Therefore, the first offensive strategy is related to increasing human resources, especially talent development. Talent development encourages technology illiteracy, not only for young generations, but especially for the baby boomers generation (Puntoni, 2021).

Regarding human resources, example of government regulation that has been implemented is Regulation of the Minister of Manpower of the Republic of Indonesia number 299 of 2020 concerning The Standard of Indonesian National Work Competency, category of information and communication for the main classes of programming activities, computer consultancy, and activities related to the ITU (YBDI) field of expertise in artificial intelligence, a subfield of data science (Ameen, 2021).
There is also the Regulation of the Minister of Manpower of the Republic of Indonesia No. 123 of 2021 concerning The Standard of Indonesian National Work Competency, for the information and communication category, the main classes of programming activities, computer consultancy, and activities related to ITU (YBDI) in the field of artificial intelligence expertise, the knowledge-based systems subfield. Second offensive strategy that needs experimentation and research is related to investment in AI Standards Implementation (Hwang, 2022). Government and private sector to fund transparency, explainability, and ethical AI practices. Also, Incentives and disincentives approach for companies adopting ethical AI standards, opposite from sanctions and fines that are usually implemented in defensive regulations, incentive. Third, Regulatory Sandbox for AI Innovation, Adopt sandbox models from other sectors (e.g., digital health) to promote responsible AI development (Li, 2021).

CONCLUSION

Governments should balance these two strategies for both offensive and defensive options. We do not need to be afraid of artificial intelligence; we can increase the use of artificial intelligence in our daily lives, but that does not mean we are not alert to its negative impacts. Avoid rushed or overly restrictive laws; mitigate risks and ensure safety while fostering innovation. The first strategy, establishing regulations at the ministerial level, such as ministerial regulations, could be an option in the medium term, developing higher regulatory formats such as presidential regulations or special laws on Artificial Intelligence.

The latest Indonesia regulation related with Artificial Intelligence, The Ministry of Communication and Informatics (MCI) Republic of Indonesia Circular Letter of the Minister of Communication and Information Number 9 of 2023 concerning the Ethics of Artificial Intelligence can be used as a guideline for public sector and private sector stakeholders who utilize AI technology to carry out their activities. However, this circular letter is not sufficient for legal force regulation. As a follow-up to the

publication of the Ministerial Circular, a strategic step is required to oversee the development of Artificial Intelligence.

The ethical framework outlined in the Minister of Communication and Informatics Circular Letter above should be interpreted as an initial stage in developing and strengthening Artificial Intelligence governance, which is then followed by the establishment of a regulatory framework. The development of this regulation is an important step in identifying an appropriate regulatory model for this technology. We don't need to make new regulations, but strengthen existing laws, example: Personal Data Protection Law with AI specific protections and transparency mechanism. By emphasizing the defensive nature of regulations, there should be sanctions and fines implemented, as exemplified by the European Union AI Act.

Second, if we look at neighboring countries, namely Singapore, which is advanced in the field of technology, Singapore itself does not have special regulations for AI governance. Rather than issuing sweeping AI regulations covering all industries, Singapore is taking a sectoral approach, with individual ministries, authorities, and commissions issuing guidelines and regulations. The Indonesian government can form an agency that specifically handles coordination between the government, industry, and other stakeholders related to artificial intelligence. This agency also researches the development of Artificial Intelligence, issuing guidelines for each type of industry, and the ministry that oversees that industry.

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REFERENCES

Ahmad, T. (2021). Artificial intelligence in sustainable energy industry: Status Quo, challenges and opportunities. *Journal of Cleaner Production*, *289*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.jclepro.2021.125834

Ahmed, I. (2022). From Artificial Intelligence to Explainable Artificial Intelligence in Industry 4.0: A Survey on What, How, and Where. *IEEE Transactions on Industrial Informatics*, *18*(8), 5031–5042. https://doi.org/10.1109/TII.2022.3146552

Ali, S. (2023). Explainable Artificial Intelligence (XAI): What we know and what is left to attain Trustworthy Artificial Intelligence. *Information Fusion*, *99*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.inffus.2023.101805

Ali, U. (2021). Review of urban building energy modeling (UBEM) approaches, methods and tools using qualitative and quantitative analysis. *Energy and*

Buildings, *246*(Query date: 2024-12-01 09:57:11). https://doi.org/10.1016/j.enbuild.2021.111073

Alowais, S. A. (2023). Revolutionizing healthcare: The role of artificial intelligence in clinical practice. *BMC Medical Education*, *23*(1). https://doi.org/10.1186/s12909-023-04698-z

Ameen, N. (2021). Customer experiences in the age of artificial intelligence. *Computers in Human Behavior*, *114*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.chb.2020.106548

Angelov, P. P. (2021). Explainable artificial intelligence: An analytical review. *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*, *11*(5). https://doi.org/10.1002/widm.1424

Ayers, J. W. (2023). Comparing Physician and Artificial Intelligence Chatbot Responses to Patient Questions Posted to a Public Social Media Forum. *JAMA Internal Medicine*, *183*(6), 589–596. https://doi.org/10.1001/jamainternmed.2023.1838

Bag, S. (2021). Role of institutional pressures and resources in the adoption of big data analytics powered artificial intelligence, sustainable manufacturing practices and circular economy capabilities. *Technological Forecasting and Social Change*, *163*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.techfore.2020.120420

Bauer, G. R. (2021). Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods. *SSM - Population Health*, *14*(Query date: 2024-12-01 09:57:11). https://doi.org/10.1016/j.ssmph.2021.100798

Benzidia, S. (2021). The impact of big data analytics and artificial intelligence on green supply chain process integration and hospital environmental performance. *Technological Forecasting and Social Change*, *165*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.techfore.2020.120557

Borges, A. F. S. (2021). The strategic use of artificial intelligence in the digital era: Systematic literature review and future research directions. *International Journal of Information Management*, *57*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.ijinfomgt.2020.102225

Campa, F. (2021). Assessment of body composition in athletes: A narrative review of available methods with special reference to quantitative and qualitative bioimpedance analysis. *Nutrients*, *13*(5). https://doi.org/10.3390/nu13051620

Collins, G. S. (2021). Protocol for development of a reporting guideline (TRIPOD-AI) and risk of bias tool (PROBAST-AI) for diagnostic and prognostic prediction model studies based on artificial intelligence. *BMJ Open*, *11*(7). https://doi.org/10.1136/bmjopen-2020-048008

Cooper, G. (2023). Examining Science Education in ChatGPT: An Exploratory Study of Generative Artificial Intelligence. *Journal of Science Education and Technology*, *32*(3), 444–452. https://doi.org/10.1007/s10956-023-10039-y

Eysenbach, G. (2023). The Role of ChatGPT, Generative Language Models, and Artificial Intelligence in Medical Education: A Conversation With ChatGPT and a Call for Papers. *JMIR Medical Education*, *9*(Query date: 2024-12-06 09:15:39). https://doi.org/10.2196/46885

Ghassemi, M. (2021). The false hope of current approaches to explainable artificial intelligence in health care. *The Lancet Digital Health*, *3*(11). https://doi.org/10.1016/S2589-7500(21)00208-9

Hwang, G. J. (2022). Definition, roles, and potential research issues of the metaverse in education: An artificial intelligence perspective. *Computers and Education: Artificial Intelligence*, *3*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.caeai.2022.100082

Ji, H. (2021). Qualitative and quantitative recognition method of drug-producing chemicals based on SnO2 gas sensor with dynamic measurement and PCA weak separation. *Sensors and Actuators B: Chemical*, *348*(Query date: 2024-12-01 09:57:11). https://doi.org/10.1016/j.snb.2021.130698

Langer, M. (2021). What do we want from Explainable Artificial Intelligence (XAI)? – A stakeholder perspective on XAI and a conceptual model guiding interdisciplinary XAI research. *Artificial Intelligence*, *296*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.artint.2021.103473

Letaief, K. B. (2022). Edge Artificial Intelligence for 6G: Vision, Enabling Technologies, and Applications. *IEEE Journal on Selected Areas in Communications*, *40*(1), 5–36. https://doi.org/10.1109/JSAC.2021.3126076

Li, J. P. O. (2021). Digital technology, tele-medicine and artificial intelligence in ophthalmology: A global perspective. *Progress in Retinal and Eye Research*, *82*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.preteyeres.2020.100900

Lund, B. D. (2023). ChatGPT and a new academic reality: Artificial Intelligence-written research papers and the ethics of the large language models in scholarly publishing. *Journal of the Association for Information Science and Technology*, *74*(5), 570–581. https://doi.org/10.1002/asi.24750

Markus, A. F. (2021). The role of explainability in creating trustworthy artificial intelligence for health care: A comprehensive survey of the terminology, design choices, and evaluation strategies. *Journal of Biomedical Informatics*, *113*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.jbi.2020.103655

Misra, N. N. (2022). IoT, Big Data, and Artificial Intelligence in Agriculture and Food Industry. *IEEE Internet of Things Journal*, *9*(9), 6305–6324. https://doi.org/10.1109/JIOT.2020.2998584

Moor, M. (2023). Foundation models for generalist medical artificial intelligence. *Nature*, *616*(7956), 259–265. https://doi.org/10.1038/s41586-023-05881-4

Pan, Y. (2021). Roles of artificial intelligence in construction engineering and management: A critical review and future trends. *Automation in Construction*, *122*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.autcon.2020.103517

Pavlik, J. V. (2023). Collaborating With ChatGPT: Considering the Implications of Generative Artificial Intelligence for Journalism and Media Education. *Journalism and Mass Communication Educator*, *78*(1), 84–93. https://doi.org/10.1177/10776958221149577

Pelau, C. (2021). What makes an AI device human-like? The role of interaction quality, empathy and perceived psychological anthropomorphic characteristics in the acceptance of artificial intelligence in the service industry. *Computers in Human Behavior*, *122*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.chb.2021.106855

Puntoni, S. (2021). Consumers and Artificial Intelligence: An Experiential Perspective. *Journal of Marketing*, *85*(1), 131–151. https://doi.org/10.1177/0022242920953847

Secinaro, S. (2021). The role of artificial intelligence in healthcare: A structured literature review. *BMC Medical Informatics and Decision Making*, *21*(1). https://doi.org/10.1186/s12911-021-01488-9

Shastri, B. J. (2021). Photonics for artificial intelligence and neuromorphic computing. *Nature Photonics*, *15*(2), 102–114. https://doi.org/10.1038/s41566-020-00754-y

Shi, F. (2021). Review of Artificial Intelligence Techniques in Imaging Data Acquisition, Segmentation, and Diagnosis for COVID-19. *IEEE Reviews in Biomedical Engineering*, *14*(Query date: 2024-12-06 09:15:39), 4–15. https://doi.org/10.1109/RBME.2020.2987975

Tu, S. (2021). Diagnostic accuracy of quantitative flow ratio for assessment of coronary stenosis significance from a single angiographic view: A novel method based on bifurcation fractal law. *Catheterization and Cardiovascular Interventions*, *97*(Query date: 2024-12-01 09:57:11), 1040–1047. https://doi.org/10.1002/ccd.29592

Velden, B. H. M. van der. (2022). Explainable artificial intelligence (XAI) in deep learning-based medical image analysis. *Medical Image Analysis*, *79*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.media.2022.102470

Vrontis, D. (2022). Artificial intelligence, robotics, advanced technologies and human resource management: A systematic review. *International Journal of Human Resource Management*, *33*(6), 1237–1266. https://doi.org/10.1080/09585192.2020.1871398

Wang, H. (2023). Scientific discovery in the age of artificial intelligence. *Nature*, *620*(7972), 47–60. https://doi.org/10.1038/s41586-023-06221-2

Xu, Y. (2021). Artificial intelligence: A powerful paradigm for scientific research. *Innovation*, *2*(4). https://doi.org/10.1016/j.xinn.2021.100179

Zhang, C. (2021). Study on artificial intelligence: The state of the art and future prospects. *Journal of Industrial Information Integration*, *23*(Query date: 2024-12-06 09:15:39). https://doi.org/10.1016/j.jii.2021.100224

Zhang, J. (2021). Empowering Things with Intelligence: A Survey of the Progress, Challenges, and Opportunities in Artificial Intelligence of Things. *IEEE Internet of Things Journal*, *8*(10), 7789–7817. https://doi.org/10.1109/JIOT.2020.3039359