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The Contribution of Artificial Intelligence Technologies in Refining the Arabic Language Skills of Its Native Speakers: Achieved and Possible

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Abstract

This study aims to shed light on the applications of Artificial Intelligence (AI) in improving Arabic language skills for speakers. It involves digitizing the language, developing computer programming, and adapting it to Arabic language learners to enhance the learning and teaching process. This study emphasizes the significance of implementing this project, as it can open up new horizons in educational curricula and teaching techniques. Moreover, it can contribute to spreading the use of the Arabic language and facilitating its acquisition, exchange, and dissemination globally, leading to positive outcomes on all levels. The current study also presents the most crucial benefits resulting from the digitization of the Arabic language, including supporting the self-learning strategy that has dominated most traditional methods. It also reinforces the status of the Arabic language in cognitive and scientific systems, blogs, and speech communication. One of the benefits is the easy acquisition and exchange of Arabic language skills, especially with the availability of various smartphone applications that have become indispensable in this era. Furthermore, the study addresses the significant challenges and difficulties facing this project and suggests appropriate solutions to overcome them. To what extent has the Arabic language benefited from this new digital transformation based on AI in the present era? And to what extent can the Arabic language rely on AI in the future so that its speakers can enhance their linguistic skills and proficiency in writing and speaking?

Keywords: *Artificial Intelligence; Arabic Language; Computing; Self-Learning; Enhancement; Development.*

Reason for Choosing the Title:

The main reason for selecting this topic is the aspiration to understand the extent to which artificial intelligence technologies contribute to refining the Arabic language skills among its native speakers. This stems from the importance of uniting efforts and ideas in all possible fields to help the Arabic language regain its esteemed position in the hearts and on the tongues of all its children in general, and among school students and university students in particular.

Among the reasons for choosing this title are the cognitive contents we planned to study in this research, as it is a title closely connected to the content of the research.

Importance of the Research:

One of the most significant contributions of this research in terms of study and analysis is identifying modern technical methods that enable artificial intelligence to contribute to refining the Arabic language skills, spreading interest in it, and facilitating its use among its native speakers. This includes modernizing the use of its derivational, morphological, lexical, and syntactic systems, which are linguistic systems that converge in the semantic and syntactic systems.

Research Methodology:

In this research, we follow the inductive, descriptive, and analytical methods to reach the supposed results:

- Inductive Method: Connected to surveying the phenomenon under study and collecting statistics that enable precise examination.

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- Descriptive Method: Allows for describing linguistic structures and the ways appropriate computational programming systems function to teach linguistic systems and modernize their use in communicative needs.

D. Previous Research: The issue of the contribution of artificial intelligence technologies in refining language skills in general has received considerable attention in scientific studies. However, the few research efforts concerning the Arabic language have focused mainly on teaching it to non-native speakers. Therefore, what distinguishes this research from others is its aim to focus exclusively on the contribution of artificial intelligence technologies in refining the Arabic language skills among its native speakers, and then presenting possible proposals to those concerned and capable of implementing them.

Among the previous researches that has addressed this topic:

"Artificial Intelligence and Computational Processing of the Arabic Language—Reality and Horizons" by Dr. Khalifa bin Al-Hadi Al-Misawi: In this research, he provided a descriptive and analytical reading of the current reality of the Arabic language in its relationship with artificial intelligence and computation, the extent of its benefit from this scientific field, as well as the possible horizons that will contribute to solving its current problems and challenges.

"Computational Processing of the Arabic Language Between Reality and Aspiration—Machine Translation as a Model" by Dr. Najwa Firan: She focused on the extent to which the Arabic language is amenable to computational processing and on the most important systems and software currently used in translation from and into Arabic.

"Computational Processing of the Arabic Language in Light of Information Renewal—The Linguistic Corpus Project by Professor Abdul Rahman Haj Saleh as a Model" by Dr. Ibrahim Boudaoud: He shed light on a pioneering procedural model in the field of computational processing of the Arabic language. The author aimed to create a digital ontological corpus, known as the "Linguistic Corpus Project," which is an achievement based on collecting linguistic patterns in their usage contexts. Subsequently, the prepared computational programs (analyzers) work on analyzing the linguistic material phonetically, lexically, and semantically, culminating in providing an applied model for the WordNet program to find semantic equivalents for dialectal forms in Algeria.

E. Research Plan

Introduction

Chapter One: Artificial Intelligence—Its Essence and Fields

- o Section One: Definition of Artificial Intelligence
- o Section Two: Fields of Artificial Intelligence

Chapter Two: Artificial Intelligence in the Reality of the Arabic Language

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- Conclusion and Recommendations

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Introduction

The digital revolution has changed the way people live and communicate, as well as their ways of conducting business. These modern technologies have indeed helped millions of people around the world live happier, healthier, and more productive lives. The increased interest in developing and encompassing these technologies stems from their penetration into new fields that include working to solve learning problems, knowledge representation, and reasoning, in addition to using them in developing presentation programs dedicated to understanding language, translation, and knowledge-based systems.

This overlap between informatics as a science and linguistic sciences has led to the emergence of what we currently call "language computing" or "computational linguistics." It is one of the interdisciplinary sciences resulting from the blending or interaction of two or more cognitive disciplines or scientific fields. It is among the first new sciences emerging from this interdisciplinary overlap, which laid the foundation for the emergence of the concept of artificial intelligence that appeared with the work on building machine translation programs from Russian to English.

Computational linguistics is considered an important starting point in projects aiming to modernize and develop the language, enhance its uses, and compute it. This is done by relying on computers and their various programs to process linguistic data and information. From here, artificial intelligence can play an important role in serving the Arabic language through:

- Programs for machine learning, whether written, spoken, or sign language like robots.[2]

- Using the Arabic language in introducing smart services such as future cars and smart homes.

These computational programs are an important pathway for its spread, enabling those responsible for them to activate language planning through:

- **Reforming the processing of linguistic structures and their phonetic systems and functions**, regulating writing and its rules, building dictionaries, protecting vocabulary, updating and expanding it by developing the derivational system to accommodate modern concepts and names, and supporting communication between native-speaking communities.

- **Supporting language policy** through decisions taken in the overall relationships between language and life that ensure the use of language in science learning and teaching.

The Arabic language is a natural language amenable to computation and automatic processing—like other natural languages. Rather, it is characterized by multiple features that can facilitate the process of computation, including:

- It is a **derivational language rich in vocabulary** and types of sentences expressing the same meaning in multiple formulations.

- **Components of the sentence and its verbal structures can move** within their context through advancement and delay.

[2] **The Robot** (with the "r" and "b" pronounced with a non-emphatic short "u"): An automated human/device programmed to perform routine tasks; it is an Arabized term from the English word "Robot." F. Abdul Rahim, ***Dictionary of Loanwords in Modern Arabic Language and Its Dialects*** (Damascus: Dar Al-Qalam, 1st ed., 1432 AH–2011 AD), Vol. 1, p. 113.

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- Its **semantic interpretive system expands** with various rhetorical aspects, most notably metaphor, simile, and metonymy, as well as other styles of the sciences of rhetoric and meanings.

- The **Arabic script is characterized by brevity** in the use of letters and the possession of a single letter of shapes that differ in the cases of connection and separation within the linear context.

- **Representing the grammatical system** in it with a linear phonetic system that has some characteristics of imagery; such as diacritical marks on the letters in particular, and the vowels and sukūn (vowellessness) on them in general. This results in the fact that the system of representing syllables composed of letters and vowels is more concise in terms of linear representation; the short syllable in Arabic is a letter followed by a vowel placed on it, not after it. Its phonetic representation system is a more concise linear representation system with less spread at the level of linear representation systems that govern other tongues or languages.

Chapter One: Artificial Intelligence

Its Essence and Fields

Section One: Definition of Artificial Intelligence

Human intelligence is natural and innate, resulting from the functioning of the nervous system and the coordination of the functions performed by its constituent organs. It is a gift bestowed by God upon humans to enable them to understand the laws of life and control them, and to conceive the system of existence in which humans live. As for **artificial intelligence** (AI)[3], it is considered a result of human intelligence itself, which humans have created to simulate their innate intelligence by using techniques provided by computer science. Therefore, scientists classify artificial intelligence as a branch of computer science, whose subject is computing the actions that humans perform mentally or manually, making them subject to automatic use.[4]

The emergence of artificial intelligence dates back to the fifties of the last century, where many theories, questions, and studies contributed to formulating the term "artificial intelligence," which was first coined by **John McCarthy** in 1956 at Dartmouth College in the United States. After this date, McCarthy and his colleague **Marvin Minsky** established an artificial intelligence laboratory at the Massachusetts Institute of Technology (MIT), and then this science spread in all universities around the world.[5]

John McCarthy—one of the leaders in artificial intelligence research for decades—emphasizes this concept, defining artificial intelligence as: "**The science and engineering of making intelligent machines, especially intelligent computer programs**," where it is based on creating devices and computer programs capable of thinking in the same way the human brain works and simulating human behaviors.[6]

Artificial intelligence is related to the ability to think exceptionally and analyze data more than it is related to a specific form or function. Although it has presented images of highly efficient robots resembling humans, it does not aim to replace them but rather to enhance human capabilities, making it a business asset of great value[7]. Despite this, this concept cannot be applied to any electronic piece that operates

[3] It is abbreviated using the first two letters "A.I."

[4] Khalifa bin Al-Hadi Al-Misawi, ***Artificial Intelligence and Computational Processing of the Arabic Language—Reality and Horizons***, Madarat Journal in Language and Literature issued by Madarat Center for Studies and Research, Tebessa, Algeria, Issue 5, 2021, p. 11.

[5] Same source, p. 14.

[6] Jamal Al-Dahshan, ***The Arabic Language and Artificial Intelligence***, a working paper presented at the Third International Scientific Conference of the Department of Arabic Language and Literature, 2019, p. 4.

[7] Oracle Cloud Infrastructure (OCI) Next Generation Cloud Company website, *What is Artificial Intelligence?*, n.d.; https://2u.pw/IWl6q.

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according to a specific algorithm to perform specific tasks. To apply this term to an electronic system, it must be able to **learn, collect data, analyze it, and make decisions** based on the analysis process in a way that simulates human thinking, which means it must have three main characteristics:

1. **The ability to learn**: acquiring information and setting rules for using this information.

2. **The ability to collect and analyze data** and information, and create relationships between them, aided by the increasing spread of Big Data.

3. **Making decisions** based on the process of information analysis.[8]

Section Two: Fields of Artificial Intelligence

In 2018, **Houlin Zhao**, the Secretary-General of the International Telecommunication Union (ITU), stated that artificial intelligence (AI) is developing rapidly and will occupy a wide field in daily human life, and that it has enormous potentials to achieve social benefits and interests. The increasing capacity of artificial intelligence, if properly harnessed, will accelerate progress in achieving the United Nations' Sustainable Development Goals (SDGs).[9]

Artificial intelligence has now become involved in many fields with various functions in real life, where significant achievements have been made, highlighting the importance of artificial intelligence and its ability to add great value to many sectors around the world. It also grants companies a significant competitive advantage.

Among the fields that have benefited from the development and increasing growth of artificial intelligence are:

1. **Pattern recognition**: such as faces, handwriting, voice tone, converting written text to readable and vice versa.

2. **Robotics industry**: one of the latest fields that artificial intelligence has entered. A robot is a mechanical device designed to perform the work generally done by humans. The invention of modern robots has led to the emergence of countless devices and machines that have replaced human labor. This term is also used for vehicles and other machines controlled remotely by a human operator.[10]

3. **Developing computer software**: such as chess programs on computers, video games, and children's toys.

4. **Developing computer applications in medical diagnosis**: in clinics and hospitals; artificial intelligence is used in healthcare in remote areas lacking such services through applications that rely on artificial intelligence to detect potential epidemics early, diagnose them through imaging for treatment.

5. **Developing search mechanisms** on computers via the internet.

6. **Developing stock trading systems**.

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[8] Rania Mohamed Taher Ahmed, ***The Impact of Artificial Intelligence on International Security***, Journal of Financial and Commercial Research, Vol. 23, Issue 3, July 2022, p. 233.

[9] ITU News Magazine, ***Artificial Intelligence for Good***, January 2018, p. 2

[10] "Robot," infoplease.com, retrieved 12/6/2017, edited; https://2u.pw/DZ1pv.

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7. **Developing cognitive simulations** using computers to test theories about how the human mind works and the functions it performs; such as recognizing familiar faces and activating memory.[11]

8. **Natural language processing**: through the creation of software capable of analyzing and simulating the understanding of natural languages.

9. **Scientific discoveries**: especially those aimed at serving humanity; such as the announcement by **Brad Smith**, President and Chief Legal Officer of Microsoft, about launching the **"AI for Earth"** program to protect the planet with data science and save the world from its ongoing crises, whether natural disasters or man-made. According to him, artificial intelligence and data science will save lives and alleviate suffering by supporting expertise in environmental sciences to predict their occurrence and deliver humanitarian aid to support ways to deal with them before and after they occur.[12]

10. **Law**: in criminal justice to assist in investigations and automate decision-making processes.[13]

11. **Agriculture**: in processing the excessive use of fertilizers, pesticides, and fungicides, lack of adequate irrigation for crops, and inability to predict demand for products; which improves crop production by detecting pests, anticipating crop prices, and providing useful advice in a timely manner.

12. **Transportation**: in assisting drivers in monitoring, improving traffic management, and delivery operations.

13. **Retail**: in applications that develop the user experience in purchasing products continuously by providing personal suggestions and browser-based searches, viewing products through images, predicting customer demand, improving inventory management, and managing delivery effectively.

14. **Energy**: in efficiently balancing energy and storing it in renewable energy systems, using smart meters to improve the affordability of solar energy.

15. **Manufacturing**: manifested in developing technical systems to make them adaptable, flexible, capable of making intelligent decisions in unexpected situations, and responding to them in engineering fields, supply chain management, production, maintenance, quality assurance, and warehouse storage.[14]

After this quick review of the most important sectors that have begun to reap the benefits of artificial intelligence for improvement, development, and growth, we wonder about the benefit of living languages from this great technical development—especially the Arabic language—after serious linguistic scientific studies have unanimously agreed on the necessity of defining the features of a linguistic strategy in the Arab world, and that the Arabic language, according to modern standards of eloquence and correctness, is the one with which Arabs deal with modern technologies. Since its computational processing is a fundamental starting point for the cultural entrance to formulating information, our pioneering scientists in serving it computationally have unanimously agreed on the necessity of building computers specific to it, and subjecting information technology to its service, not subjecting it forcibly to the pressures of this overwhelming technology.[15]

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[11] "Artificial Intelligence (A.I.)," britannica.com, retrieved 12/6/2017, edited.

[12] Microsoft Company website, n.d.; https://2u.pw/f7XuL.

[13] UNESCO Arabic website, *Artificial Intelligence and the Rule of Law—Building the Capacities of Workers in Judicial Systems*, n.d.; https://ar.unesco.org/artificial-intelligence/mooc-judges.

[14] "Artificial Intelligence UPSC Notes," BYJU'S, retrieved 6/27/2021, edited.

[15] Abdul Karim Khalifa, ***Arab Scientific Linguistic Academies and Linguistic Development***, Conference of the Academy of the Arabic Language in Cairo, 2004, p. 14.

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Chapter Two: Artificial Intelligence in the Reality of the Arabic Language

Section One: The Role of Artificial Intelligence in Language Teaching

It is difficult to separate humans from language; language is the tool of thought that plays a fundamental role in shaping human thought. The language of the nation is the basis of its thinking, the title of its identity, and the means for its interaction with the vast world while preserving its civilization and heritage. This leads to the civilizational development it hopes for when it imposes its language by the ability to absorb the vocabulary of development and modernity, through communication with the civilizations and cultures of other nations, with the availability of conditions for growth and development. The leading living languages in the world today are the fruit of strenuous efforts made by their scholars to develop them by all possible means, including exploiting artificial intelligence technologies in learning and mastering them until they have assumed a position worthy of what has been provided to them.

Developments in educational technology in general have reached an unprecedented level; artificial intelligence today plays a fundamental role in helping students and teachers improve and automate[16] learning and teaching tasks. With the advancement of artificial intelligence technologies, its contribution to the process of education and training has increased and significantly enhanced.

Among the outputs of artificial intelligence in confronting education issues in general are those used by the student to receive and understand new information by responding to the individual needs of the learner, usually called "intelligent tutoring systems," "adaptive learning platforms," "customized," or "differentiated," and they have capabilities such as:

1. **Organizing and arranging learning materials** based on the student's needs.

2. **Diagnosing strengths and weaknesses** or gaps in the student's knowledge.

3. **Providing automated feedback**.

4. **Facilitating collaboration among learners**.[17]

Similarly, artificial intelligence applications directed at teachers can reduce their workload by helping them gain new insights into student or class progress and innovate in their classrooms. This is through automating tasks such as assessment, detecting plagiarism, administration, or feedback, and facilitating different teaching methods or helping teachers organize students into small groups based on common characteristics. An example of this is the **"Classcharts"** application, a web service that is an interactive seating chart and student behavior tracker that allows for displaying longitudinal data related to student behavior and performance.[18]

The role of artificial intelligence in the field of languages is embodied in achieving two goals:

First: Making the people of the language—workers and officials—more compatible in a world shaped by artificial intelligence systems.

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[16] **Automation** (Arabized term)/**Automatic Operation**/**Teleprocessing**: A newly coined term referring to anything that operates automatically without human intervention. See: Ahmed Mukhtar Abdul Hamid Omar, *Dictionary of Contemporary Arabic Language* (Beirut: Alam Al-Kutub, 1st ed., 2008), entry (A.T.M.T), Vol. 1, p. 57; Wikipedia Encyclopedia https://2u.pw/65JSK.

[17] Juhaina Broubi and Massoud Dadoun, ***Artificial Intelligence in Learning and Teaching Foreign Languages—Learning Arabic on Duolingo as a Model***, p. 1204.

[18] Ibid., pp. 1204–1205.

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Second: Providing great potentials by artificial intelligence to continuously improve and develop education and training.

The use of the nation's language in scientific writing and culture by specialists and non-specialist learners raises public awareness by transforming sciences into general culture, making citizens' thinking more organized, logical, upright, and independent[19]. The issue of education in the national language has taken on new dimensions and increasing importance due to globalization and the spread of information technology and what has accompanied it of the necessity to preserve cultural diversity, which has become threatened due to the dominance of the English language.

An example of using artificial intelligence to accelerate English language learning is the work of specialists from its native speakers in preparing technical programs that rely on language levels ascending from the lowest level. This has made it easier for learners and users of these technical programs to be exposed to appropriate learning levels based on their acquired information. Computer-assisted language learning tools range from simple grammar checking tools and verb conjugation tools to complex and rich language learning environments, automatic speech recognition, and enhanced artificial intelligence features. However, most intelligent computer-assisted language learning resources tend to focus on a specific single component of the language learning field where resources are not available to develop comprehensive systems.[20]

For example, we find a system for classifying the written expression of Swedish students based on the Common European Framework of Reference for Languages (CEFR), while we find that the artificial intelligence system for learning Irish focuses on simple sentences; therefore, in the coming years, we will witness the development of more comprehensive systems covering all areas of language learning.[21]

Section Two: Computational Processing of the Arabic Language

Globalization means a comprehensive media society in which knowledge, science, and languages spread, almost penetrating all borders, where language and culture are subjected to generalization, spread, and marketing, just like commercial and industrial goods. Therefore, we must arm ourselves with all the capabilities and means we have to face the challenges of existence under globalization, foremost among them the Arabic language, which is the most important means of communication among a vast population in one of the most active and dynamic regions of the world.

Since information and communication technology can play an effective role in spreading and advancing the Arabic language in the Arab world and all over the globe—i.e., on the tongues of its native and non-native speakers—this advancement imposes on us, the people of this language, the necessity of achieving vital matters from the outset, such as modernization, automation, computation, linking information networks among educational, academic, and research institutions, and integrating into global information networks.

These matters, being facts of our contemporary reality, have caused increasing pressures on scientific culture and the Arabic language, forming a strong incentive towards Arabization to generalize the rules of informational globalization. There is no doubt that computation can facilitate the Arabization process if there is an effective political will and programmed societal readiness that makes it an important part of the joints of the global information network.

[19] Suleiman Al-Tarawneh, ***The Arabic Language in the Twentieth Century***, The Twenty-Third Cultural Season, Jordan Academy of Arabic Language, 2005.

[20] Previous source, p. 1205.

[21] Ward, M., "ICALL's Relevance to CALL," in K. Borthwick, L. Bradley & S. Thouësny (Eds.), ***CALL in a Climate of Change—Adapting to Turbulent Global Conditions***, Short Papers from EUROCALL 2017, pp. 328–332; research-publishing.net.

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Research and studies in the field of linguistic technologies and joint studies between Arabic linguistic academies and educational institutions and computer scientists can pave the way for us to address the most important issues in this regard, including:

- **Automatic analysis of the Arabic language** at the morphological, syntactic, and semantic levels.[22]

- **Using computers to teach morphology, spelling correction, and addressing the issue of diacritics** in Arabic writing[23] so that everything written and published in Arabic in books, magazines, newspapers, advertisements, and publications is fully vowelized; letters are recorded along with their forms of movements and stillness.

- **Studying linguistic and technical issues posed by machine translation** from Arabic to foreign languages and vice versa.

- **Computing what has been written in Arabic in a complete corpus** that facilitates the achievement of a dictionary that addresses its history and meanings, starting from the oldest texts up to the present time through automatic search for words.

- **Establishing a unified dictionary** for the vocabulary of Arab public life.

- **Developing school dictionaries** directed at different stages of education.

- **Creating specialized Arabic dictionaries** in various sciences and literature.

By quickly reviewing what has been achieved in computational processing of the Arabic language, we find tangible achievements at the level of written language—and to a lesser extent at the level of spoken language—in terms of hardware and software after the Arabization of the Windows system. Essential achievements have been made in developing Arabic input and output units such as keyboards, printers, screens, word processing programs, and programs for reading Arabic texts automatically using optical character recognition (OCR). Also, an automatic morphological analyzer has been developed capable of analyzing any Arabic word into its derivational and inflectional elements, decomposing it from affixes and prefixes, and finding the root of the word. All this has enabled significant achievements, including spelling error detection systems and Arabic text search systems on a morphological basis, such as the one used in the first Qur'an program and building lexical databases in which morphology plays a fundamental role. The automatic morphological analyzer is also an essential component in dealing with Arabic texts at the sentence level.

In addition to the above, an automatic system for parsing Arabic sentences has been developed, enabling the development of another system that automatically vocalizes them, playing an important role in developing a program to convert Arabic texts into their spoken counterparts. The automatic parsing system has paved the way for entering several advanced fields of language technology, including machine translation systems. There are several encouraging initiatives in this regard[24]; efforts have also emerged to Arabize internet domain names—the latest of which is a working group formed by ESCWA (ADNTF) and a specialized group affiliated with the League of Arab States formed by the Preparatory Committee for the World Summit on the Information Society in Tunis—we will address these achievements in more detail in the third chapter.

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[22] Mohamed Hassan Abdel Aziz, ***The Arabic Language in the Twenty-First Century in Educational Institutions in the Arab Republic of Egypt—Reality, Challenges, and Future Outlook***, The Twenty-Third Cultural Conference of the Jordan Academy of Arabic Language, Academy Publications, 2005, p. 139.

[23] Huda Salem Abdullah Al-Taha, ***The Morphological System of Arabic in Light of Computational Linguistics***, PhD dissertation, University of Jordan, 2005, p. 28.

[24] Nabil Ali and Nadia Hijazi, ***The Digital Divide***, World of Knowledge, Issue 318, 2005, p. 359.

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Despite these technical developments, efforts aimed at developing the automatic processing of the Arabic language face several problems, the most important of which are:

- **The lack of necessary financial support for the private sector** initiating in this field; developing companies of Arabic language technologies are obliged to conduct costly academic research in linguistics, mathematics, and morphology, which can only be afforded by large companies, scientific research centers, and universities.[25]

- **The scarcity of academic research centers**—theoretical and applied—in the field of computational linguistics.

- **The scattering of Arab efforts**—theoretical and applied—as each researcher and organization works in isolation, in addition to the limited spread of studies in this field, which hardly go beyond some seminars and conferences[26], with the absence of a prevalent phenomenon in the field of computer Arabization, which is bibliographic study to inventory research to avoid repetition.[27]

- **The lack of correlation between theoretical and applied studies** in computational linguistics due to the separation between the perspective of the linguistic researcher and the application of the computational technician, despite the utmost necessity for the computational technician to possess a minimum level of linguistic knowledge because automatic processing can only deal with precise, controlled, and complete data.[28]

In conclusion, we affirm the necessity of combining, organizing, developing, and integrating efforts in the automatic processing of the Arabic language to face the information explosion, given the symbolic forces—including language—that play a role in shaping the form of modern human society.

The Arabic language has become in dire need of a new perspective that revisits all aspects of the linguistic system after culture has become the focus of information technology, especially since language is the natural source from which this technology derives the foundations of its artificial intelligence and the central ideas in programming languages.[29]

Furthermore, languages whose words lack certain precisely defined concepts cannot enable their native speakers to comprehend their semantic systems or utilize the mechanisms of their grammatical rules.

Chapter Three: Some Artificial Intelligence Technologies

Contributing to Refining Arabic Language Skills

The trajectory of artificial intelligence that focuses on language processing falls under what is known as linguistic engineering. This is a science concerned with processing natural languages using computers, encompassing terminological sciences, machine translation, text exploration, opinion extraction, working on corpora and their computational processing, and focusing on search engines. This science requires combining two competencies—a linguistic competence and a computational competence—through which

[25] Nihad Al-Mousa, ***Arabic Towards a New Description in Light of Computational Linguistics***, Arab Institution for Studies and Publishing, 1st ed., 2000, p. 53.

[26] Hossam Al-Khatib, ***Arabic in the Information Age—Stormy Challenges and Modest Confrontation***, Arabization Journal, Arab Center for Arabization, Translation, Authorship, and Publishing, Issue 15, p. 83.

[27] Nabil Ali, ***The Arabic Language and Computers***, World of Thought, Vol. 18, Issue 13, 1987, p. 71.

[28] Marwan Al-Bawab and Mohamed Al-Tayan, ***The Method of Processing the Arabic Language in Informatics (Word and Sentence)—The Use of the Arabic Language in Informatics***, Arab Organization for Education, Culture, and Science and Culture Department, Tunisia, Second Conference on Computational Linguistics, 1996, p. 360.

[29] Dr. Ali Al-Qasimi, ***Language Planning—The Appropriate Age for Teaching Foreign Languages***, Conference of the Academy of the Arabic Language, 2005.

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the researcher performs automatic language processing by subjecting linguistic phenomena to automatic interpretation.[30]

Undoubtedly, the Arabic language has benefited to some extent from artificial intelligence, which now encompasses all areas of life, through a number of computer programs that provide a set of instructions and data in the electronic section that it follows to execute its tasks.[31]

Adapting and customizing open-source free software for Arabic is a feasible matter that allows increasing local capabilities in the field of Arabized open-source software. This enables us to widely disseminate Arabic applications in fields such as e-government, e-learning and education, e-commerce, and others, thereby advancing the development of the Arabic language to serve important fields with a wide and renewed spectrum[32]. Among these computer programs are:

The Saudi Voice Bank:

This bank works on developing a database for automatic Arabic language processing, such as developing a computer system for automatic reading and outputting written texts in an audio form. This Arabic automatic bank contains a technological system for placing diacritical marks on letters[33], which significantly facilitates the work of researchers and indexers in the process of digitized verification and other tasks.

Technological Incubators:

Since 2003, in Arab countries, the Arab Digital Content Initiative was launched with the project of enhancing the Arab digital content industry through what is known as technological incubators, which were launched in 2007. Additionally, efforts by the Arab Digital Language Group in the field of artificial intelligence, supervised by Mohamed Zayed in Morocco, adopt research in creating a unified dictionary of modern technologies in Arabic.[34]

This Arab digital content comes in several forms, including what is written in Arabic letters on the internet, or recorded in Arabic voices, even images that indicate their Arabic source from texts, video clips, pictures, television programs, radio programs, and others.

Technological incubators aim to bridge the technical gap that our Arabic language suffers from, embodied in the absence of good scanners—except for the OCR[35] system—that allow converting texts and manuscripts photographed by cameras or scanners into digital texts that can be opened with an electronic publisher. It is worth noting that many languages now possess such high-quality technical devices that allow, within minutes and completely automatically, opening the book or manuscript, photographing it page by

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[30] Khalifa bin Al-Hadi Al-Misawi, ***Artificial Intelligence and Computational Processing of the Arabic Language—Reality and Horizons***, p. 17.

[31] Antoine Botros, ***Computer Encyclopedia***, Lebanon Library, Beirut, 1st ed., 1991, p. 11.

[32] Mansour Farah, ***The Digital Divide in Arab Societies and Its Impact on the Arabic Language***, Journal of the Algerian Academy of the Arabic Language, Issue 6, p. 107.

[33] Mohamed Al-Tafrouti, *The Future of the Arabic Language and Intellectual Property Rights in the Age of Digitization*; http://azhar-ali.com/go.

[34] Abu Al-Hajjaj Mohamed Bashir, ***Automatic Processing of the Arabic Language—Current Efforts and Future Challenges***; almadenahnews.com.

[35] **Optical Character Recognition (OCR)**: The electronic or mechanical conversion of images of handwritten, typewritten, or printed text into machine-encoded text—whether from a scanned document, a photo of a document, a scene photo (e.g., text on signs and billboards in a landscape photo), or subtitle text superimposed on an image (e.g., television broadcasts); https://en.wikipedia.org/wiki/Optical_character_recognition.

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page, and passing the automatic optical reader over it to convert it into a digitized text before archiving it and launching it into the global space to reach the world in the blink of an eye.[36]

The Digital Arabic Content Program:

This program is a set of applications that process, store, and display information in the Arabic language. It includes the required software to prepare applications that electronically suit the Arabic language.

The content of the Digital Arabic Content Program includes all information available in Arabic in digital form—that is, everything that is digitally circulated from readable, visual, or audible information. It aims to bridge the gap between Arabic speakers and ensure the availability of digital content in Arabic—among its features is the ability to convert English letters to Arabic words to facilitate typing in Arabic.[37] The importance of this program arises from two factors:

First: Disseminating the content and its rapid arrival to the recipient.

Second: The density of digital content, which has become one of the most important factors expressing culture and civilization globally.[38]

These advanced computer programs and others undoubtedly provide us with a bright picture of what can be achieved if efforts are intensified and integrated in the field of using artificial intelligence to serve the Arabic language in refining its skills among its native speakers. This great goal requires us to direct more attention to developing the infrastructure to suit the requirements of how to benefit from artificial intelligence technologies in developing and learning the Arabic language. Some scholars interested in this matter have put forward a set of proposals to achieve this:[39]

Writing Correction: Developing automatic writing correction programs through these technologies by injecting correct Arabic materials, raising the level to stylistic correction to ensure the correctness of structures like spelling, simulating spelling correction with an interactive program that corrects the way Arabic letters are drawn from right to left and from top to bottom.

Interactive Literature: Employing these modern technologies in presenting literature in a modern way that brings together words, meanings, structure, and imagery by providing eloquent poetic clips suitable for virtual reality glasses, and preparing an interactive digital diwan that allows the researcher to display old and modern poems on any specified topic, or for those searching for poems with the same opening line, or searching by rhyme. This service may be provided today by search engines, but the researcher does not guarantee finding them in one place, nor the correctness of the verses and the accuracy of attributing them to the author. Therefore, most people refrain from documenting verses from global search networks and prefer printed diwans.

Linguistic Bargaining: Implementing an experimental school program where a specific topic is defined, then speed reading begins with the aim of collecting as many vocabulary words about it—perhaps hundreds of original and derivative terms. Then writing on the specified topic is requested using those words. Thus, learners can convert ideas into words and write in the language they think in. This is very useful in supporting the knowledge economy in which the world competes today.

Digital Dictionary: Converting original linguistic dictionaries into interactive electronic ones that are not scanned copies in PDF format. The supervisors should be interested in correctly uploading linguistic

[36] Previous source; almadenahnews.com.

[37] Scientific Research Electronic Site (YAMLI); yamli.com.

[38] Al-Yaseer Forums for Libraries and Information Technology; alyaseer.net.

[39] Khairiya Al-Almaie, *Proposals for Employing Artificial Intelligence in Serving the Arabic Language*, 2019; http://nashiri.net/index.php/articles/literature-and-art/6295-2019-12-20-14-53-13.

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materials under the supervision of a specialized linguistic scientific team, organizing the possibility of searching for words and their meanings, or the word and its synonyms in one place.

Knowledge Representation: This idea serves the proposal of interactive reading correction. When we represent words knowledgeably according to computer codes (0/1), we must represent them from a correct linguistic standpoint following the smallest phonological unit (phoneme). Thus, syllables can be adopted by distributing logical units and developing them into an interactive reading corrector in a manner consistent with Arabic rules, not as is common in automatic reading.

Automatic Translation: This comes as a completion of the idea of the digital dictionary. If someone writes the word "صَرَخَ" (he shouted) and has the automatic translation option activated, they may receive the suggestion "ضَجَّ" (he clamored) because it is more precise. If someone writes a text and needs to clarify the meaning of a word, they can point to it for the meaning to appear. This serves language learners in the elementary stage who can read words visually and need to understand their meanings.

These ideas and others support each other to implement more than one vital linguistic process at the same time, and then reach an Arabic knowledge economy that enriches the global library and contributes to facilitating the learning of the Arabic language for its native speakers through modern technical programs and methods that are now within the reach of both adults and children—perhaps children are better at them.

Conclusions

Based on the consensus that artificial intelligence is currently witnessing rapid development and increasing application in various fields, where the use of its technologies is not limited to manufacturing or service delivery but goes beyond that to improve and develop education in style and tools, we present some recommendations that would develop and enhance the learning and teaching of the Arabic language in preparation for strengthening its skills among its native speakers:

1. **Training Human Resources:** Training human cadres in precise digital technological and engineering works, even if it takes a lot of time and effort, in order to advance our Arab heritage and revive it with the spirit of the era we live in by launching a number of Arab search engines[40] that are concerned with publishing heritage books and manuscripts that are digitally verified and indexed.
2. **Formulating a Unified Language Policy:** Developing a unified language policy at the Arab world level, in which the Union of Arab Academies contributes, and linguists and others from educators, psychologists, sociologists, biologists, and computer scientists are invited to participate.
3. **Parallel Efforts in Language Development and Computation:** Efforts to develop the Arabic language should parallel its computational efforts through communication and convergence between theoretical linguistic research and computational application, because automatic processing requires dealing with precise, controlled, and complete data.
4. **Active Participation in International Organizations' Efforts:** Actively participating in the efforts of international organizations—foremost among them UNESCO—and global civil society organizations defending linguistic diversity and protecting national languages.
5. **Collaboration Between Research Centers and Major Companies:** Cooperation of scientific research centers and universities with major companies to encourage the private sector to invest in the field of Arabic language technology by preparing models of economic feasibility studies that prove the investment attractiveness of this high-return technological field.

[40] Islam Online, ***Al-Warraq—The Largest Search Engine Including a Heritage Library and a Verified One***, Quran Library, Al-Warraq Gatherings, Sakhr, Ajeeb...

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6. **Establishing Internet Sites for Language Institutions:** Creating websites on the internet for all institutions concerned with the Arabic language and linking them with a special network through which rapid access can be achieved, decisions can be made and disseminated as soon as they are taken.[41]

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