

Algerian Efforts in Computational Linguistics: Theory and Practice

The Linguistic Repertoire Project as a Model

جهود الجزائريين في اللسانيات الحاسوبية تنظيرون وتطبيقا
مشروع الذخيرة اللغوية أنموذجا

Reggani Mohammed*

Universty Ahmed Draieya of Adrar /

Algeria

مخبر المخطوطات الجزائرية في إفريقيا

med.reggani@gmail.com

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Abstract :

This research examines the efforts of Algerians in computational linguistics from both theoretical and practical perspectives. It attempts to examine the efforts of Abdel Rahman Haj Saleh through the Linguistic Repertoire Project. This latter has demonstrated the flexibility of the Arabic language and its potential for computing, machine processing and translation. This is very obvious especially in our contemporary world, where automation has become a rival to the human mind in storing and retrieving language as needed, whether spoken or written. Therefore, it has become imperative for Arab linguists and computer scientists in general to strive to serve Arabic today with automated computational services, with the aim of exploiting computers in the teaching and learning of the Arabic language.

Key Words:

Computational Linguistics – Linguistic Repertoire – Haj Saleh – Arabic Computing – Computational Linguistics.

الملخص:

يتناول هذا البحث جهود الجزائريين في اللسانيات الحاسوبية من الجانبين النظري والتطبيقي محاولا البحث الوقوف عند جهود عبد الرحمن حاج صالح من خلال مشروع الذخيرة اللغوية والذي أظهر مرونة اللغة العربية وقابليتها للحوسبة وللمعالجة الآلية والترجمة الآلية خاصة ونحن اليوم نعيش في عالمنا المعاصر تطورا مذهلا لدرجة أن الجهاز الآلي أضحي يُنافس عقل الإنسان في تخزينه للغة واسترجاعها لها بحسب الحاجة منطوقة كانت أم مكتوبة، فلماذا صار لزاما على اللسانيين والحاسوبيين العرب عموما السعي في خدمة العربية اليوم خدمة آلية حاسوبية بغية استغلال الحاسوب في عمليتي التعليم والتعلم للغة العربية.

الكلمات المفتاحية: اللسانيات الحاسوبية – الذخيرة اللغوية – حاج صالح – حوسبة العربية – علم اللغة الحاسوبي،

* Corresponding author:

1. Introduction :

The Arabic language is one of the enduring and eternal Semitic languages because the Holy Quran has undertaken to preserve it, and from it it derived its eternal life. Arabic has been able to keep pace with civilizational progress throughout history; as it was closely related to different civilizations through the Islamic conquests, and perhaps the non-Arabs are the ones who served Arabic the most. This is the best evidence that proves its universality and globalization throughout the ancient historical ages. In our current time, and due to technological progress and the emergence of the computer that has controlled all aspects of life, so it participates along with man in the fields of health, industry and trade, it has become necessary for the computer to share with us the language in order to achieve the process of communication on the one hand and language processing on the other hand. For this reason, an elite group of contemporary Arabs in all Arab countries, including Algeria, sought to do their utmost to reach a computerized Arabic language, or what is known as the computerization of the Arabic language. Abdul Rahman Haj Saleh Al-Jazaery is one of those who had a great imprint in the field of Arabic computational linguistics, and his imprint appeared in the linguistic repertoire project. Through this research paper, we will seek to address the following questions: What is computational linguistics? When did it emerge among Arabs and Algerians? Where do Abdel Rahman Al-Haj Saleh's efforts in linguistics in general lie? And to what extent have Algerian efforts in Arabic computational linguistics succeeded?

2. Computational linguistics and its origins among Arabs:

Before learning about the origins of this science among Arabs, we must consider the concept of computational linguistics. It is well known that this discipline is a branch of applied linguistics. Computational linguistics is also called computational language. These are two names for a single, modern science. Two definitions can be given to it: the first is based on its vocabulary, while the second is based on its structure.

2.1. I

2.1.1. Linguistics: In Arabic, it means the sciences of language. Abu al-Hasan Ali ibn Ismail ibn Sida (d. 458 AH) is considered the first to mention it in the Arabic dictionary and to link it to religious studies, which is "the sciences of religion." The first to revive its use in the modern era was Professor Abd al-Rahman al-Hajj al-Salih, since Algeria's independence, when he founded the Department of Linguistics in the Department of Arabic Language at the Faculty of Literature at the University of Algiers in 1963 (المبخت، ٢٠٢٠، صفحة ٢٦١).

In terms of terminology: It is "the science that studies natural human languages in and for themselves, whether written or spoken, or only spoken." (حليلي، ١٩٩١، صفحة ١).

(١١) Abd al-Rahman al-Hajj al-Salih defines it as follows: "By linguistics, we mean what is now called in Western countries (linguistics), and what is meant by it is the objective scientific study of all phenomena of the human language through the study of the languages of each people, and in particular the common amount of laws to which these phenomena are subject, that is, the language as a tool for communication, and as a physical, psychological, and social phenomenon of general existence" (المبخوت، ٢٠٢٠، صفحة ٢٦٢). He elaborates further by saying, "It means the experimental and theoretical study of the "aforementioned phenomena to derive the laws that control them and explain them with a purely scientific explanation" 3 (المبخوت، ٢٠٢٠، صفحة ٢٦٢). He explains with an example that I follow to define how to study phenomena experimentally, by conducting field research in which the conditions of communication are directly observed, the extent of the prevalence of words in society, and the overlap of languages between societies, so that the researcher can analyze this data "with precise scientific means such as statistics with electronic brains, and physiological and physical analysis" (المبخوت، ٢٠٢٠، صفحة ٢٦٢). Here, his references to the computerization of language are clear, a definition of which will be discussed later in the discussion of computerization. Linguistics terms have been used in Arabic due to the multiplicity of translators, including "linguistics in terms of tongue, linguistics in terms of language, linguistics, linguistics sciences, linguistics in the physical aspect, modern linguistics, and linguistic studies" (نبييل، ١٩٨٨، صفحة ١٨).

2.1.2. Computational: "Computational refers to the computer; it is the name of a machine, such as "Fa'ul" (المبخوت، ٢٠٢٠، صفحة ٢٦٣). Computer is also "computer," the English term Arabized into Arabic. Computer includes the letter Kaf and the letter Baa, an electrical device for storing and analyzing the information entered into it, and for performing complex mathematical operations, etc.; Arabic "computer" and the plural is computers, the verb from it: to compute, to compute in process." (عبدالرحيم، ٢٠١٤م، صفحة ١٨٢).

2.2. Definition of Computational Linguistics in Considering its Structure:

It is the linguistics that "seeks to place human languages within mathematical formulas and frameworks, in order to approach this science that examines language as a computational information phenomenon that can be processed in electronic computers." (الوعر، ١٩٨٩م، صفحة ٢٥). In fact, it is "an interdisciplinary science that relates to linguistics in terms of linguistic theory, and to computer science in terms of applying mathematical and logical theories." (الغناتي، ٢٠٠٧، الصفحات ٨٤-٨٥).

Nihad Al-Musa (d. 1942 AH - 2022 AD) defines computational linguistics as "an interdisciplinary system between linguistics and computer science concerned with computing the linguistic faculty. It relates to the cognitive sciences and overlaps with the field of artificial intelligence." (الموسى، ٢٠٠٠م، صفحة ٥٣). In his definition, Nihad refers to the term "interdisciplinary" and to the intervention of artificial intelligence in human language by applying computer techniques through mathematical

geometry. Thus, it intersects with artificial intelligence, "which seeks to explain a human phenomenon by taking into account the linguistic and rhetorical aspects." And the terminological, specialized, and scientific, and taking into account the capabilities of the human mind through what it can produce and create" (بلعيد، ٢٠١٧-٢٠١٨م، صفحة ٢٠٦).

David Crystal (d. 1941) defines it in the Dictionary of Language and Phonetics as "a branch of linguistics in which computational concepts and techniques are applied to the processing of linguistic and phonetic functions, developing various research applications, including natural language processing, voice synthesis, voice perception, machine translation, contextual indexing, grammatical checking, and statistical measures" (صالح/حماد، ٢٠٢٠، صفحة ٩٦). Omar Mahdiwi (d. 05/03/1985) argues that it is "a scientific study of natural language from a computational perspective; and this study cannot be done Except by building computer programs for human language systems by standardizing and simulating the human brain's working system with the computer's working system (مهديوي، ٢٠١٨م-١٤٣٩هـ، صفحة ٢٨).

The last two definitions meet at the point of automated processing of human language. Mahdavi adds the simulation of the human brain's working system with the computer system; That is, working to "give this machine a substitute for human sense in an attempt to complete its linguistic structure" (برهومة، ٢٠٠٥، صفحة ١٢٢). Computers do not possess a mind like humans, but the goal of computational linguistics is to "find the means that enable us to automatically process speech in all its aspects and for various purposes. This is achieved by building a database composed of mathematical linguistic patterns that are developed, edited, and codified by both the engineer and the linguist" (برهومة، ٢٠٠٥، صفحة ١٢١). Abdul Rahman Al-Hajj Al-Saleh asserts that "the biggest mistake that a researcher can face in this field is to believe that linguistic analysis, no matter how important, is secondary to mathematical formulation" (حاج صالح، ٢٠١٢، صفحة ٨٥ ج١).

3. The Origin of Computational Linguistics among the Arabs:

The first history of the emergence of this science in the West dates back to the 1950s, when the beginnings of machine translation appeared in America for military purposes. (In what is known as mechanical translation) (مهديوي، ٢٠١٨م-١٤٣٩هـ، صفحة ٢٦) and it was able to reach the stage of maturity in the late fifties, and this was evident through the penetration of Chomsky's transformational generative linguistic theory, and Zling Harris's (1909-1992 AD) compositional theory into the field of automatic processing of natural languages, so machine translation achieved great progress in translating scientific and technical texts.

As for the Arabs, it is mentioned that the first stage that Arabic computational linguistics went through was the statistics stage, which came as an idea that Dr. Ibrahim Anis (1906-1978 AD) approved after his visit to Kuwait University in 1971

AD. During the visit, he met Dr. Hilmi Musa (1933-2015 AD), Professor of Theoretical Physics at Kuwait University, so Anis presented his ideas related to computational linguistics to Hilmi, who in turn welcomed the idea of a census of the original letters of the Arabic language materials with the help of the computer and began implementing it after planning it. This was in the first half of 1971 AD, so that his effort and research bore fruit with the publication of the statistical study of the trilateral and non-trilateral roots of the Al-Sahah Dictionary by Al-Jawhari (d. 324 AH) (مهديوي، ٢٠١٨م_ ١٤٣٩هـ، صفحة ١٦) The results of the study, which was based on precise steps, came in the form of statistical tables for the roots of the language, its letters, the results of its origins, and the characteristics of its letters, coupled with a brief analytical study of the linguistic interpretation of what was included in those tables in the year 2000 AD (حلمي موسى، ١٩٧٨م، صفحة ١٠) This experience was followed at Kuwait University (also in the 1970s) by a number of statistical studies of the roots of the most famous linguistic dictionaries, including "Lisan al-Arab" by Ibn Manzur and "Taj al-Arus" by al-Zubaidi. This phase was called the linguistic statistics phase.

Since the 1980s, computational linguistics in the Arab world has witnessed increasing contributions on both the theoretical and applied levels. These efforts have diversified to include books, articles, research, bodies, and organizations (حلمي موسى). The book "The Arabic Language and the Computer" by Dr. Nabil Ali is considered the first book in computational linguistics, as the book was published in 1988 AD (بن حسن العارف، ٢٠٠٧، الصفحات ١٩-٢٠). As for the scientific research, most of it was written in Arabic and English, and its titles were comprehensive of all linguistic levels (phonetics, syntax, structure, semantics, and lexicon) and some language issues from a computational perspective, such as machine translation, term banks, language teaching, and artificial intelligence. The authors of these scientific research are many and come from different Arab regions (Eastern and Western), including Dr. Ahmed Al-Akhdar Ghazal (Morocco), Dr. Mazen Al-Waer (Syria), and Dr. Abdel Rahman Al-Hajj Al-Saleh (Algeria). The latter presented a vision for developing a linguistic model for the automated treatment of the Arabic language (بن حسن العارف، ٢٠٠٧، صفحة ٢٢). Mentioning these efforts calls us to point out that computational linguistics has "features in the Arab heritage, which prove the genius of the great linguist Al-Khalil bin Ahmed Al-Farahidi (d. 175H) in dealing with linguistic material according to a logical mathematical system in collecting entries in the dictionary "Al-Ain" (the first dictionary in Arabic). Al-Khalil relied in his dictionary on scientific mathematical systems such as the system of inversions of Arabic roots. (صالح/حماد، ٢٠٢٠، صفحة ١٠٠)

As for Algerian computational linguistics, its official beginnings appeared in the early 1960s with the establishment by the state of the "Institute of Linguistics" in 1964 by Ministerial Decree No. 30_66. The Linguistics Journal adopted the publication of its ideas and proposals. The institute sought to implement a set of

proposals and hypotheses in the field of linguistics. In 1980, scientific research in computational linguistics began to take its true course, with the discussion of the existence of a Majister's thesis in linguistics and its technology at the University of Algiers (حاج صالح، ٢٠١٢، صفحة ٨٦ ج١).

Perhaps research into the progress of Algerian computational linguistics It leads us to examine the Algerian efforts in the field of applied linguistics in general, and computational linguistics in particular, because the areas of intersection are represented by "three basic sciences, as they share in the theoretical and cognitive formulation of the automated processing of natural languages" (مهدوي، ٢٠١٨م _ "linguistics, computer science and its technologies, and cognitive psychology, which in turn studies the human understanding of language" (مهدوي، ٢٠١٨م _ ١٤٣٩هـ، الصفحات ٢٩-٣٠). Computational linguistics attempts to fathom the structure of language at the phonetic, morphological, syntactic, and semantic levels. On the one hand, it is a linguistic science, and on the other hand, it is an applied computational science in terms of researching the possibility of processing this language automatically according to the linguistic structure. This science attempts to form a virtual computational structure for the language, by trying to understand how a rational speaker speaks the language, and then the device works to simulate human languages accurately, due to its lack of the characteristic of reason that distinguishes it from the rational speaker" (برهومة، ٢٠٠٥، صفحة ١١٩). Therefore, the areas of automatic language processing are represented in the following:

1. Automatic analysis of the human voice: investigating acoustic characteristics such as voiced and unvoiced speech.
2. Recognizing and analyzing spoken speech as written speech and vice versa, to assist the blind in reading, writing, and self-learning.
3. Recognizing voice-prints and utilizing them in criminal investigations, for example.
4. Automatic analysis of morphology by identifying word forms, derivations, and weights...
5. Machine translation from one language to another (صالح/حماد، ٢٠٢٠، الصفحات ١٠٨-١٠٩).
6. Spelling and grammatical correction.
7. Text examining and summarizing, based on basic information Muhammad bin Mabkhout points out that "one of the beauties of this science is that it has generated several new four-letter verbs in Arabic, such as "fa'lal hawasab" and "raqman" according to Professor Abd al-Rahman al-Hajj al-Salih; "kambat" according to Professor Mazen al-Wa'r; "kabtar" according to Professor Fakhreddine Qabawa; and "nawzum" and "nawsuq" according to Abdul-Ghani Abi al-Azm (المبخوت، ٢٠٢٠، صفحة ٢٦٦).

Computational linguistics is expressed in Arabic by several titles, including "language technology," "automated linguistics," "computational linguistics," "media linguistics," "rhythmic linguistics," "computational linguistics," "information

linguistics,"automated processing of natural languages,""linguistic engineering," and "linguistic engineering." (صفحة ٢٦٥، ٢٠٢٠، المبخوت).

As for Arabic computational linguistics, or Arabic computer linguistics, "it is founded by Ifrahar Deters' concept of linguistics, with the addition of two basic variables: "computational" and "Arabic," states, "Linguistics is the study of how language works, and thus Arabic linguistics is the study of how the Arabic language works. Considering the computational aspect, Arabic computational linguistics is the study of how the linguistic system works in Arabic using computational means and techniques, and research into how computational techniques can be employed in processing the Arabic language." (صفحة ٢٦، ٢٠٢٠، صالح/حماد).

4. The Arabic Linguistic Repertoire and its Computation Project (Selected Models):

This project arose from the idea of using the computer and exploiting its tremendous speed in processing data and its amazing ability to store billions of this data in its memory, to create an automated bank containing the most important things written in Arabic that have scientific, literary, historical and other value, and the most precious things that Arab thought has produced in the past and present, and what it will produce over the years (صفحة ٤٠٩ ج٢، ٢٠١٢، صالح). Hajj Saleh says: "I had the honor of presenting this project to the Arabization Conference held in Amman in 1986 AD, and the idea of the Arabic treasure and its many benefits for linguistic and scientific research in general and for the development and unification of terminology in particular. I tried to convince my fellow researchers of the importance of returning to the real use of the Arabic language and investing in current computer equipment and involving the largest number of scientific institutions to complete the project due to its distinction in dimensions that go beyond one institution, even one country. Then Algeria presented this project to the Executive Council of the Arab League, Cultural and Scientific Organization in December 1988 AD, and it approved." Its members are to adopt it within the limits of the organization's capabilities." (حاج صالح، ٢٠١٢، صفحة ٣٩٥ ج١).

4.1. Definition of the Arabic Linguistic Treasure (The Arab Ammunition Project):

Hajj Saleh compared the term "the Arabic linguistic treasure" to its English translation, "The Treasure of the Arabic Language" (بلخوان، ٢٠٢٤، صفحة ٢٦٢). It is defined as: "A documented, objective, automated bank of dictionaries, texts, and studies, both ancient and modern, that concerns the actual use of the Arabic language across eras and countries by creating a unified basic structure that brings together literary, linguistic, and scientific production, both ancient and modern, in the form of a textual data bank drawn from what is actually used." (٢٠١٠م، بلعيد، في الأمن اللغوي، صفحة ١٧٦). Hajj Saleh himself defines it as: He said: "It is a bank of texts, not vocabulary. Moreover, these texts are not created by authors. Rather, they are texts from the living, formal, written or spoken language. The most important thing about

this is that this usage, which will be stored in the computer's memory as text, represents the use of Arabic throughout fifteen centuries in its most magnificent forms. It will then cover the entire Arab world in the best possible way that this intellectual production represents. (حاج صالح، ٢٠١٢، صفحة ٣٩٧).

.4.2. Project Objectives:

- The database as an automated information bank: The primary objective of this project is to enable Arab researchers, wherever they may be, to find various pieces of information based on the use of Arabic automatically and in a short time.

- The database as a source for various dictionaries and studies: Many dictionaries will be extracted from this database, including: an automated dictionary of commonly used Arabic words, an automated dictionary of scientific and technical terms in actual use, a dictionary of cultural terms (ancient and modern), a dictionary of geographical figures, a dictionary of foreign and coined terms, and a dictionary of Homonyms, synonyms, and antonyms, as well as the historical dictionary of the Arabic language. All words mentioned in these dictionaries are taken from actual usage, both ancient and modern, in addition to referring to words not mentioned in any text so that they are known. This is done by including all dictionaries and lists of terms developed by academies, scientific institutions, or individuals in the repository (حاج صالح، ٢٠١٢، صفحة ٣٩٦). **This project has many advantages and benefits, including:**

.4.2.1. Advantages of the Linguistic Repository Project:

- ✓ The advantages of the project are:
- ✓ It represents the actual usage of the Arabic language.
- ✓ Its comprehensiveness, covering this usage in all Arab countries, extending from the pre-Islamic era to the present day.
- ✓ Its representation of this usage through the presence of all important texts (written and spoken) in eloquent Arabic in all fields.
- ✓ Its reliance on the latest electronic devices which are computers.
- ✓ The ability to ask thousands of questions remotely and simultaneously across the world, displaying them on screen, and printing them on printers in a short time.

.2.2. Benefits of the Linguistic Repository Project:

As for the benefits of the project, Hajj Saleh summarized them as follows:

- Relying on all linguistic data in a specific field, based on the use of Arabic in both ancient and modern times.
- Relying on the scale of commonness and precision in the intended meaning in choosing words.
- Relying on this automated text bank to research the semantic evolution of Arabic words, thus enabling the development of an accurate historical dictionary of the Arabic language.

- The possibility of automatically indexing all Arabic texts of scientific and literary value, both those printed and those to be printed and published throughout the Arab world.
- Conducting comparative scientific studies in various fields on a specific set of scientific concepts.
- Regular research on the development of Arabic scientific thought based on the evolution of the semantics of scientific terms within semantic fields over time.
- The possibility of developing a comprehensive dictionary of the Arabic language in actual use, with a precise linguistic study devoted to each entry (حاج صالح، ٢٠١٢، . الصفحات ٣٩٨-٣٩٩ ج ١).

5. Computer-based Applied Models of the Arabic Heritage:

Hajj Saleh sought to develop a methodology for completing the Arabic Heritage Project, which required the use of an automated (computer) database that would be a comprehensive reference covering the entire heritage with this great distinction, with complete scientific and objective precision. It responds to any request at the speed of light and is based on rules and regulations aimed at controlling this automated bank, including:

- Complete comprehensiveness (in space and time).
- Integration of data into a single computerized text, organized and classified according to eras and disciplines.
- It has a website.
- It represents the actual use of the Arabic language, both ancient and modern.
- It is characterized by its rapid response to any question (حاج صالح، ٢٠١٢، صفحة ١٤٢ ج ٢).

This will result in many studies and the creation of many types of dictionaries, such as:

First: The historical dictionary: This already exists and is called the "Doha Historical Dictionary of the Arabic Language." It is hosted by the State of Qatar and launched by the Arab Center for Research and Policy Studies on May 25, 2013. Within three years, it will become one of the most prominent projects of the institute. It intends to complete it with a budget exceeding \$150 million. It will serve as a comprehensive linguistic corpus chronicling the Arabic language from the earliest times to the present day, and it is constantly being updated (حسام الدين تاوريرت، ٢٠٢٠، صفحة ٧٦). It is built on a structure represented by the Scientific Council, the Dictionary's Executive Board, computer processing teams, and specialized departments, who represent a select group from various Arab countries: (Qatar, Saudi Arabia, the Emirates, Kuwait, Oman, Yemen, Jordan, Palestine, Syria, Lebanon, Egypt, Iraq, Libya, Sudan, Tunisia, Algeria, Morocco and Mauritania. There are other collective and individual applied attempts at various models of Arabic corpora and dictionaries in various fields, including, but not limited to:

Second: In educational corpora, the Arabic Learner Corpus (ALC), contains a collection of texts and recordings totaling 282,732 words with repetition and 29,627 words without repetition. This collection comprises 1,585 items (written or recorded) produced by 942 students of 67 nationalities, divided into two stages: pre-university and university. The average length of the texts is 178 words. The corpus was created to provide researchers with a set of open-source data for use in linguistic research fields such as language teaching and learning. This data has also been used for several research purposes, such as linguistic error analysis, the compilation of student dictionaries, and dictionaries of common errors. (صالح/حماد، ٢٠٢٠، صفحة ١٧٤).

Third: In the indexed dictionary of linguistic terms, the dictionary A Mini-Index of Linguistic Terms:

This is an attempt by Dr. Tahi Bakhta (Hassiba Ben Bouali University, Chlef, Algeria). She created it in her doctoral thesis by selecting some linguistic terms that were used by Abdel Rahman Al-Haj Saleh in his research and studies, and applying them in this dictionary by providing equivalents for the term in French and English, as well as its synonyms in Arabic sources, with mention of the reference or source and the author. She provided an illustrative model of her work in an article of hers entitled "Linguistic Terms and the Arabic Linguistic Repository Project from the Perspective of Abdel Rahman Al-Haj Saleh," by presenting images that illustrate the search process for the term "repository" on pages (96-97). Among the features of the indexed dictionary of terms are:

According to her: the possibility of deleting, modifying, and adding, the ease of finding information related to the term, and saving effort and time (بختة، ٢٠٢٣، الصفحات ٩٥-٩٦-٩٧).

6. Conclusion:

After examining this paper, the research reached a set of results that can be summarized in the following points:

- 1) Algerian linguists have made their mark in various linguistic sciences.
- 2) Algerian linguists and researchers have been preoccupied with research in the field of computational linguistics, both theoretically and practically.
- 3) Dr. Abdul Rahman Al-Haj Saleh has a clear impact on computational linguistic research, as evidenced by his pioneering project entitled "Linguistic Repertoire."
- 4) The Algerian state has contributed to the establishment of Arabic computational linguistics. This contribution was evident in 1964 through Ministerial Decree No. 30-66, establishing the "Institute of Linguistics."

5) The complementary relationship between computational linguistics and educational linguistics is well established, given their mutual benefits and the facilitation of teaching and learning of all kinds.

6) The Arabic Linguistic Repertoire Project seeks to computerize Arabic. Therefore, linguists and computer scientists must work to revive and activate it. Perhaps the Doha Historical Dictionary is the best evidence of the success of its ideas and the potential for computerizing the Arabic language.

7) The Arabic language is in dire need of development in the field of automated processing, especially as we are now in the age of artificial intelligence.

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