

Mechanisms of language computing and areas of its use

Mécanismes du langage informatique et domaines de son utilisation

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Abstract:

The invention of the computer in the twentieth century, the technology of this device developed over the years, a great development. As for the Arabs, Quranic and religious studies were a forerunner to the use of linguistic computing technology, as that was in the seventies, and the most famous of linking the computer to Arabic linguistic research Dr. Ibrahim Anis and his first work in the year 1971 AD at Kuwait University, where his idea was to use the computer to count the original letters of the Arabic language materials, and it is no secret to anyone that language is the primary means of transferring knowledge, and computer linguistics aims to transfer Arabic language skills and sciences from the paper field to the electronic field. , which saves time and effort. And it prompts us to ask, what are the linguistic dimensions of linguistic computing? What are the areas of use?

What are its mechanisms and benefits? In our research paper, we try to identify the phonetic, grammatical, and morphological linguistic dimensions... and others, and the areas of their use such as education, translation, language planning and dictionaries... Then we delve into their mechanisms and the benefits that we achieve by applying automated computing.

Keywords: computer, linguistics, translation, automatic corrector, distance education, linguistic computing

Résumé :

L'invention de l'ordinateur au XXe siècle, la technologie de cet appareil s'est développée au fil des années, un grand développement. En ce qui concerne les Arabes, les études coraniques et religieuses ont été précurseurs de l'utilisation de la technologie informatique linguistique, comme c'était le cas dans les années 70, et les plus célèbres ont relié l'ordinateur à la recherche linguistique arabe. Dr Ibrahim Anis et ses premiers travaux de l'année 1971 après JC à l'Université du Koweït, où son idée était d'utiliser l'ordinateur pour compter les lettres originales des documents en langue arabe, et ce n'est un secret pour personne que la langue est le principal moyen de transfert de connaissances et que la linguistique informatique vise à transférer la langue arabe. compétences et sciences du domaine papier au domaine électronique. , ce qui permet d'économiser du temps et des efforts. Et cela nous amène à nous demander quelles sont les dimensions linguistiques de l'informatique linguistique ?

Quels sont les domaines d'utilisation ? Quels sont ses mécanismes et ses avantages ?

Dans notre travail de recherche, nous essayons d'identifier les dimensions linguistiques phonétiques, grammaticales et morphologiques et autres, ainsi que les domaines de leur utilisation tels que l'éducation, la traduction, la planification linguistique et les dictionnaires. Ensuite, nous approfondissons leurs mécanismes et les avantages que nous obtenons en appliquant l'informatique automatisée.

Mots-clés : informatique, linguistique, traduction, correcteur automatique, enseignement à distance, informatique linguistique.

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Introduction

The computer and electronic devices in the twentieth century remain the most difficult thing for humans and helped them overcome many obstacles. The technology of this device has developed greatly over the years. As for the Arabs, Qur'anic and religious studies were the first to use linguistic computing technology, as that was in the seventies, and months from Linking the computer to Arabic linguistic research, Dr. Ibrahim Anis and his first work was in 1971 AD at the University of Kuwait, where his idea was to use the computer to count the original letters of Arabic language materials. It is no secret to anyone that language is the primary means of transmitting knowledge, and computational linguistics aims to Transferring Arabic language skills and sciences from the paper field to the electronic field, which saves time and effort. It prompts us to ask: What are the linguistic dimensions of linguistic computing? What are the areas of its use? What are its mechanisms and benefits? In our research paper, we try to identify the linguistic dimensions of phonetic, grammatical, morphological...etc., and the areas of their use such as education, translation, and automated dictionaries. Then we move on to their mechanisms and the benefits that we achieve by applying automated computing. Linguistic research was concerned with letters, vocabulary, and sentences produced by humans along with their meanings, but it has expanded to harness computing and new technologies for linguistic studies.

It also seeks to identify how the brain, or the so-called linguistic machine, works, trying to discover how it works in humans, but Penetration into this field of knowledge is full of obstacles and difficulties. The Arabic language must keep pace with the progress of civilization, and thanks to the efforts of linguists and rhetoricians, it has been able to communicate with all civilizations in their diversity. In the modern era, the computer is the symbol and primary means for most matters, whether material or moral, which makes the use of the Arabic language for the computer more than necessary, in order to save a lot of effort and time, and this is what motivated the cross-fertilization between the efforts of the linguist researcher and

the computer researcher, to research the problems of linguistics. Arabic computerization and software engineering that allow us to transfer linguistic studies from paper to computer. These projects are a new era in the world of linguistics and are called computerization of the Arabic language. We begin our research paper with the concept of linguistics because it is the focus of our research.

1- Linguistics: “It is the science that is concerned with human linguistic studies in and of itself, whether in its spoken or written system. It aims to describe the language system, limit its constants, and control its variables, and then treat linguistic phenomena in its various branches and fields and at its various phonetic, morphological, grammatical, semantic, contextual, and lexical levels... as it is concerned with With the most precise linguistic units, both minor and major, it explains the structures of the language, describes its general rules, and controls the multiple relationships and functions between the linguistic units. (Walid Al-Anati & Khaled Al-Jabr, 2007, p. 13) As for computing, it is the second part of the term, which is concerned with automated media and computer technologies and the programs they employ.

We know computing as: Computational Linguistics: “It is concerned with employing the computer, with its mathematical mathematical and statistical operations and precise algorithms, and its enormous storage capacity and speed of production and implementation, in the service of language. David Crystal defined computational linguistics as:” a branch of linguistic studies that employs techniques and concepts. Computational and mechanical with the aim of clarifying linguistic problems” (Salah Al-Najem, 2021) It is worth first getting to know computational linguistics as a term consisting of two terms.

1-2- Computational Linguistics: There have been many definitions regarding it, including: “It is the scientific study of natural language from a computer perspective, and this study can only be done by building computer programs for human language systems by standardizing and simulating the human brain’s working system to the computer’s working systems,” (Mahdioui. omar, 2008, p. 17) Machine imitation of the human mind is the furthest we can reach. As Abdel Qader Abdel Jalil defines it in his saying, “Computational linguistics is one of the branches of applied linguistics concerned with making use of computer data in studying multiple linguistic issues such as: monitoring linguistic phenomena according to their levels, phonetic, morphological, grammatical, rhetorical, and prosodic, and conducting statistical operations, dictionary making, and machine translation.

and language teaching.” (Abdul Jalil, 2002, p. 181) As Nihad Al-Mousa defines it as “the scientific study of the linguistic system at all its levels from a computer perspective, its goal is the application of computer models to the linguistic faculty” (Al-Moussa, 2000, p. 53). Computer-based linguistic study is one of the most recent Arab studies, and this requires

application based on procedural tools, from different sciences on the language system, intermingled with computing technology and algorithmic applications, which makes this combined specialization difficult for those navigating it, but these barriers have not prevented contemporary Arab researchers.

Linguists use computer technologies to serve Arabic linguistic studies, phonetically, morphologically, grammatically, lexically, and semantically, seeking the assistance of computer software engineers in order to adapt the language and make it easy for humans to use in various fields, as well as to address various difficult issues. We see that the interests of computational linguistics go beyond the concept of technical employment to process complex linguistic phenomena and describe all their levels in the computer so that it is easy for us to use them in automated processing. Rather, it aims to demonstrate some language issues that were studied by the ancient Arabs and which have remained a matter of controversy even among modern scholars, such as the theory of grammatical factors.

Which motivates researchers to employ the Arabic language in the computer, and this requires the unification of several experimental sciences to form the computer language, and from here we consider that this field is applied, the language is subject to application due to the overlap of a number of sciences in its field.

Since this science is concerned with language, it investigates language as a natural means that we embody in the computer, and the principles of this science of linguistics are centered around all its levels: phonetic, morphological, syntactic, and semantic, and from computer science, artificial intelligence, logic, and mathematical sequences, where these branches are harmonized and composed to form principles Computational linguistics. The human tries to imitate the natural language of humans with a computer language that is skillfully led by the computer and communicates with the human skillfully.

It is correct to call it a robot brain. Since it combined linguistics and the computer, the term is computational linguistics, which is "translating the language into mathematical symbols that the computer understands, or preparing the natural language as the language of communication with the computer." Which leads to the computer performing many of the linguistic activities that humans perform, with the difference in time and cost" (Samir Sharif, 2005, p. 563) When language interacts with the computer, "language is based on mathematical thinking, on the same level as human languages and computer language.

As for human languages, they contain a significant amount of mathematical phenomena, and mathematics has a rational, symbolic, and abstract nature, as is known, and language is built on symbols and contains abstraction." The mental is what is clear to every researcher" (Al-Arif, 2007, p. 78)

2- Areas of exploitation of language computing: Computational linguistics is widely applied in multiple fields at the level of linguistic dimensions, which has achieved great achievements, including:

2-1-Electronic dictionary industry: Building an electronic dictionary requires an encrypted database and a great knowledge of all levels of the language individually, syntactically, and semantics with great accuracy, as well as tools and applications, to arrange the collected material and facilitate searching in it. It must also be comprehensive and general, because the linguistic program designed for automatic processing should not fail to find any information, regardless of its type or agreement, because any error in the entered information would leak into the rest of the sentence's vocabulary, or say: the entire text. Hence, it obstructs the process of the program's operation" (Al-Arif, 2007, p. 90) as the information must be compatible with the lexical entry that we want to process electronically, and from the above we note the exploitation of computer programs and techniques in the manufacture of electronic dictionaries. Man always seeks to expand the circle of storing lexical and terminological banks so that the path to reaching meanings and connotations is easy, but this requires intensified efforts and cooperation between scholars in various Arab countries.

2-2- Documentation: Al-Youbi considers it "a form of bibliographic work that uses multiple means, such as indexes, abstracts, and bibliographic articles, in addition to other traditional means and methods, such as classification and indexing, in order to make information easily accessible and easy to access as well." It is processing documents and the information contained in them in order to make it easier for the researcher to access them and retrieve them whenever he wants. An applied example of this is programs for automatic classification of files, or programs for classifying works according to keywords, authors, or topics. Accordingly, "computer linguistic programs aim to document information." that come to the human mind." With the spread of the use of computers, the individual has become able to access many books, encyclopedias, and information with the push of a button in front of his computer. This stores a huge amount of information, regardless of its size, and also contributes to facilitating the exchange of scientific developments between nations.

2-3- Machine translation: Translation is the transfer of texts, whatever they are, from the source language to the target language. Translation applications and programs are considered one of the most important works in computational linguistics, and Al-Youbi defines it as: "Analyzing the original text and transferring its elements from the language to which it will be translated, then generating this text based on the analysis and transfer" (Youbi Belkacem, 1999, p. 52) and just as "a learner of the Arabic language who is a non-native speaker needs a description of the rules that a native speaker of the language may not need, it is self-evident that a computer needs a description of the Arabic rules that the human mind equipped with innate ability may not need" (Ali Nabil, 1988, p. 1) With this statement, the goal of translation is to build a theory of transfer from the original language to the target language, but we must take into account the specificity of the target language in its contexts, uses, and culture. As an example of this, we present the translation of the following sentence from the Arabic language to the French language:

The news warmed my heart. This new story makes me happy This is because the Arab climate is hot, so the thing that makes them happy is cold water, while in Europe the climate is cold, so the thing that makes them happy is staying in front of the heater, and this is taking into account the cultural context.

But machine translation needs continuous updating due to the large number of contexts, linguistic import and other factors, and therefore the translation bank must be constantly expanded, as the translator "who works on the machine translation program" constantly suggests similar words and constructions in different contexts until the program reaches a translation at its highest levels, meaning it approaches... Meaning is the original text, where the subjecting of the translated text to pragmatic, contextual, and cultural filtering is due to "the human intervention required to organize the text before it is translated, or refine it after it is translated," (Nabi lAli, 1994, p. 359) because designing a computer program that enters the spoken verbal event and turns it into text Maktoob requires attention to those places in which meanings change with changing cultures, as well as the characteristics of phonemes affected by what surrounds them at the level of the word, and if we move to the level of the sentence, we need to pay attention to the phonemes that are pronounced and not written, such as tanween." (Muhammad Bakka, 2005, p. 139) Therefore.

the translation requires tremendous efforts to be produced in The Best looking. The success of the machine translation process also requires the combination of the experience of linguists and linguists who are proficient in the language, with the experience of computer programming engineers who design programs and systems to employ the language in a way that keeps pace with the requirements of the age of speed and advanced technology in various fields, especially language, since it is our means of communication.

As we mentioned previously, translation is "an effective means of employing scientific and technical knowledge in Arab society, because most of the knowledge has been produced, published, and preserved in the English language, and to access it, the role of translation and its institutions must be activated. Thus, machine translation from other languages into Arabic or vice versa is considered a way." To fill the scientific gap resulting from the inflation of global cultural production compared to its Arab counterpart," (Mahdioui. omar, 2008, p. 36) and therefore we must intensify translation efforts and disseminate science in the language of the Qur'an.

2- 4 - Writing and composing texts: Structural studies in general have involved textual starting points included in the hypotheses on which their research is based. Where he defines the text, he says, "In some cases, the major linguistic units, that is, the units larger than the sentence, give structures similar to those existing between their smaller units, that is, those lower than the level of the sentence, and these are structures that are at the core of linguistic study in particular," and it is difficult for the computer to differentiate between the structures. Major and minor, but efforts remain in place in this regard. "Although the main feature of the ongoing textual linguistic studies is the multiplicity of definitions and concepts that researchers in this field have tried to formulate for the text, without any of them being free from criticism, guidance, or redressing it" (Hassan Behairy, 1997, p. 99), but its cross-fertilization with computational linguistics will make the matter easier. "On the author," which is a natural thing in this modern specialty in which research is still ongoing, on the one hand, and due to the diversity of its scholars' walks of life and the diversity of their specializations and interests in researching it, on the other hand. If that is the case, speakers possess clear linguistic textual knowledge to establish and understand, a knowledge that they develop little by little during the course of individual and collective linguistic acquisition.

(Note: It is a faculty added to the two known faculties: linguistic (linguistic) by: (Chomsky) and rhetorical by him. Dale. Hymes.), it can be called the textual faculty (compétence textuelle), which is founded in terms of justifications for its existence, as Lita Lundquist (1999) sees (MICHEL ADEM, 1999, p. 56) on various data, including syntactic grammar and Linguistic, including cognitive psychological, as Lindquist wonders in this context, saying: If some famous linguistic scholars such as Benvenist (1962), Jacobson (1968), and Charol (1997) believe that the formation of expressions depends on the rules on which it is based? The construction of sentences, and the distribution of the units that make up the text..., which are the known rules at the level of sentence structure, that sentence-associative system that does not exceed the level applicable in the sentence, while they agreed on the order to which sentences must be subjected to in order to be text (MICHEL ADEM, 1999, p. 57), and all of these skills must be collected in the computer's memory bank in order to be processed, transferred, and transformed into a computer language.

Its founder, Philip Soller, Ph. This requires a lot of effort and a long time. For this reason, a person needs a computer to compensate for the effort of reviewing, correcting, and modifying, relying on programs and systems that enable us to do so, in order to gain time and effort, in addition to keeping up with the requirements of the age of speed and advanced technology in various fields, especially language, since it is our means of communication.

2- 5- Teaching languages: Learning languages is considered an important matter in the life of modern people, but learning a language is not innocent, but rather it transfers the culture of the acquired language to the learner. From this standpoint, it seems that language and culture cannot be separated from each other. As for computational linguistics, it has worked to spread languages and cultures of various races and types, based on Computer capabilities, as it is one of the most important means that provide smooth communication between societies, and this process aims to overcome traditional educational methods that are based on "indoctrination, memorization, and recitation; a basic and main method of transferring knowledge" (Sayid Mahmoud Ahmed, 1998, p. 137), and for that, he worked hard. Each of

Linguists and linguists in order to prepare educational computer programs that keep pace with technological progress in the field of education, and also contribute to turning the world into a small village. One of the most important people who spread the Arabic language in Internet science is the Algerian Bashir Hilmi, whose brilliance began in Japan in 1978 after his scientific mission to Tokyo. With regard to culture, it has an abundance of computer programs and extensions that develop the linguistic, cultural, and cognitive balance, including historical and religious programs, such as the venerable Qur'an Encyclopedia program, the latter of which enables the user to preview the Qur'anic text, accompanied by audio listening, in addition to learning the rulings. The encyclopedia and the famous Wikipedia encyclopedia, which is rich in all definitions, all of these programs contribute to spreading culture in the world. The Arabic language is considered one of the global languages that has been able to keep pace with civilizational progress throughout history, as it has been connected to different civilizations, and thanks to the efforts of its people, it was able to absorb and communicate with all of these civilizations.

The use of the Arabic language in computers was an incentive for many linguistic researchers to cooperate with computer researchers, to seek radical solutions that address the various problems of Arabic computational linguistics.

Thus, it became necessary to reformulate our linguistic heritage from linguistic studies in a new form, in light of the achievements that have been achieved in the light of linguistics. The computer in other languages so that it becomes possible to deal properly with the Arabic language with its distinct characteristics, and in this regard we discuss the control mechanisms in this complex field.

3- Mechanisms for controlling language in computer programs

3- 1- Machine translation: The computer is programmed to translate in several ways, including the most famous two methods. Either the computer translates the vocabulary and presents its equivalent in the target languages so that the individual can use it in editing texts. This method is concerned with translating the meanings of the vocabulary that it acquires in the context. The most commonly used language, while the second one is more accurate at all its linguistic levels, lexical, morphological, and grammatical. To achieve this, vocabulary and terms must be limited to a scope specific to each sector or field, such as terminological dictionaries, thus saving time, because the translation achieved here is specific or specific to a specific field after collecting the terms.

3- 2- Electronic research programs: It works to exploit linguistics in the service of electronic research, and the Arabic language is necessarily included in the languages of the world, due to the multiplicity of sections of programs for research, which we classify into five branches, which are:

3-3- Letters: Linguists are making great efforts to achieve computer processing of the Arabic letters by preparing a program suitable for writing Arabic letters. The Arabic language letters have been standardized on the keyboard of computers across the world, and this depends primarily on two aspects, as the first aspect depends on the rules of a formal algorithm for drawing the Arabic letter. It takes into account the size and orientation desired by the user. The second aspect works to unify the keyboard among various Arab countries and even in the entire world. In order to facilitate the dissemination and transfer of data...it also attempts to preserve documents in the Arabic language. To ensure its circulation among Arab users of computers.

One of the most important works is the keyboard with "specifications and standards, as the character codes for standardizing the Arabic computer keyboard and placing them in the device at the user's disposal" (Muhammad Bakka, 2005, p. 12), and one of the conditions for the keyboard is that it respond to all the fonts and requirements that the Arabic calligraphy needs in terms of formation. And others.

3- 4- Adjusting sounds: This aspect seeks to accurately simulate the skill of reading text phonetically, and the most we can achieve in this regard is to convert spoken speech into written text automatically. The Arabic language makes things easier for the computer and simplifies the conversion mechanisms because it relies on consonants rather than vowels, which has made it the most responsive language to linguistic computing. However, it is required to complete the linguistic equipment that has the ability to collect the characteristics of the process, and this technology can be used in automatic dictation in the Arabic language. It also makes it

easier for beginners in the Arabic language to correctly pronounce its sounds with appropriate movements. It also helps the disabled to pronounce the Arabic language. One of the most important things is Voice applications achieve oral machine translation.

What we seek through the above is to make the computer possess “the skill of adjusting the phonetic text of the entered texts without making spelling errors between similar and close sounds in the outputs” (Muhammad Bakka, 2005, p. 17). The computer does not understand, but rather embodies the data that we enter into its memory, as we have to move from abstraction to embodiment, for example: “If you want to describe (the present tense verb), for example, to the computer with formal evidence, it will not be enough for it to tell it - as is the case with human beings - that the present tense verb is the verb that begins with one of the letters (Anette).” Because he will be chosen based on this criterion (Akram, Takbir, Nasser, Yabis)” (Abdul Jalil, 2002, p. 20), and for this reason several audio laboratories and voice centers were established in universities in addition to phonetics institutes.

3-5 - E-learning programs: They are many, but they can be classified into three categories:

A- Education using containerized educational programs saved on disks:

- It is characterized by being local, placed on the computer or on CD-ROMs, and envisages interaction between the learners and the computer, with the latter playing the role of the teacher.

- It facilitates the process of self-education, and is intended to “enable the learner to rely on himself on an ongoing basis in acquiring the knowledge, skills and abilities necessary to form his personality and continue his self-education in a way that enables him to adapt positively and appropriately to the requirements of life in a rapidly changing society” (Sayid Mahmoud Ahmed, 1998, p. 140) where the student becomes an active member in the educational process after being a recipient who records the information said by the professor or something similar to a recording device.

B- Education on the E-Learning platform: This type “is concerned with distance education using the Internet, and the interaction between the learners and the professor is necessary in the process, and it depends on the use of the Internet, and then receiving an immediate response in a dialogue between the machine and the human in an almost natural way in the form of questions and answers, based on what is stored in his memory.” , or by pre-stored educational programs. According to the above, “In light of the flood of information, the successive change, and the growth of knowledge at rapid rates, which resulted from the information revolution that we are experiencing now, the world is experiencing a major scientific and technological revolution, and education has become required to search for new educational methods and models to confront many challenges at the global level.

The E-Learning model appears to help the learner learn in the appropriate place and time through interactive content that contains multimedia (texts, sound, images, movement, and is presented through cartoon media, computers and the Internet. Thus, e-learning is considered a new type of education imposed by... The scientific and technological changes that the world is witnessing to this day, and traditional methods and methods are no longer able to keep pace with them, and therefore there has become an urgent need to adopt another type of education, which is e-learning" (Muhammad Abdel Karim, 2010, p. 112) From this we conclude that traditional education methods and methods have become sufficient to deliver the necessary information to learners, so it has become necessary for us to address modern means.

Examples of this include: "The (Moodle) platform, which is the method used in Algerian universities since the spread of COVID19, in order to achieve social distancing, equal opportunities among learners, and invest in modern technology to develop higher education" (University of Constantine, 2021)

C- The third is the endless Mooc platform education: This type "is concerned with distance education using the Internet as well, but in this type of platform the number of people enrolled in the educational process is unlimited, which means that its capacity to accommodate students is unlimited, and it is called Mooc, which means the endless education platform, such as the Edex platform" (University of Constantine, 2021)

3- 6 - Spelling and grammar checker: It works to correct errors, whether spelling or grammatical, as getting to know "the Arabic word through the rules set by the linguist, not through the dictionary of stored words" (Muhammad Al-Hanash, 2019, p. 19).

It is a very important program as it corrects errors, whether for beginners who are learning The language contributes to their acquisition of the language or those who practice it when they make a mistake inadvertently, alerting them to their lapse in order to correct the situation. Through an automated grammar and spelling checker, the computer corrects the written Arabic text at the spelling, grammatical, and even morphological levels, based on the Arabic rules that the computer has stored in its memory. This can only be achieved by uniting the efforts of linguists and computer computing engineers side by side.

Conclusion

Through the computerization of language, or what is known as computational linguistics, man seeks to create stereotypes that imitate the human brain. Great efforts have been made in this regard, and the real breakthrough was in 1971. There is no doubt that man will benefit greatly from the computer, its digital applications, and the speed of its processing of information, in addition to the ease of communication. Among humans in the world, there are

many areas of exploitation, including documentation, electronic dictionary making, machine translation, writing and composing texts, in addition to teaching languages.

As for the mechanisms used to integrate language with computers, they are electronic search programs, optical character recognition, designing and setting letters, and adjusting sounds. And e-learning programs such as E-Learning, which are accredited in Algerian universities, represented by the Moodle platform and the endless Mooc platform, represented by the Edex platform. As for machine translation, it is the most important mechanism of all because of the great benefits it achieves and links bridges of communication between nations, in addition to the spelling and grammar checker that polishes language skills. To come out in your best outfit, and this The cross-fertilization between linguistics and computer programming generates modernity and development that overcomes difficulties for humans to be able to achieve their desired goals.

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