

RESEARCH ON THE POSSIBILITIES OF APPROACHING ARTIFICIAL INTELLIGENCE IN ORTHODONTICS

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In the area of computer science, artificial intelligence (AI) refers to the capacity for intelligence demonstrated by devices, in contrast to the natural intelligence present in human beings and some animal species.

The field of AI in computer science refers to the study of "intelligent agents," including devices that can perceive their environment and take actions to maximize the chances of successfully achieving their goals.

About AI (artificial intelligence), it is said to have the ability to accurately interpret external data, learn from that data, and use the acquired knowledge to achieve its specific goals and tasks through flexible adaptation, according to Kaplan and Haenlein. The term "artificial intelligence" is commonly used to describe machines that simulate the "cognitive" functions associated with the human mind, such as "learning" and "problem solving". The field of AI grounds upon computer science, information engineering, mathematics, psychology, linguistics, philosophy, and other disciplines.

AI technology was created on the premise that human intelligence can be described so accurately that it is possible to create a machine to simulate it. This statement brings into discussion a lot of philosophical issues related to the nature of mind and ethical dilemmas related to the creation of artificial entities equipped with human-like intelligence. They have been discussed since Antiquity and continue to be the subject of intense debate in the modern technological age.

Since the 21st century, artificial intelligence technologies have experienced a significant renaissance due to simultaneous advances in computing power, large data accumulations, and theoretical development. Accordingly, artificial intelligence methods have become fundamental in the technology industry, making significant contributions to solving complex problems in computer science, software engineering, and operations research.

In the medical field, artificial intelligence has multiple implications, including the administration of health systems, patient scheduling through various applications, simulation of diagnosis, and even therapy, such as the use of robotics in surgery. According to a CNN report, a study made by a team of the surgeons at the "Children's National Medical Center in Washington" successfully highlighted the use of an autonomous robot in a surgical intervention. Surgeons watched the robot as it performed soft tissue surgery, repairing the ruptured intestine of a pig in an open operation. The team has declared that the results obtained by the robot were better than those of a human surgeon one.

Another area where artificial intelligence is used is in Dentistry, in the computerized analysis of

profile radiographs and teleradiographs in Orthodontics, as well as the evaluation of facial aesthetics through digital photographs. Initially, in dental medicine, digital technology left its mark starting from the simple computers needed for the patient database, to intraoral video cameras, 2D/3D radiology systems, intraoral 3D scanning cameras. Through the intraoral scanner, the information of the dental arches is obtained digitally (instead of the classic traditional impression), and is transformed by the computer processor into a 3D model. Future dental work, orthodontic braces, and obtained by computerized milling by a lathe using CAD-CAM technology or obtained by means of 3D prints are projected in 3D on these models.

Later, these obtained medical information are analyzed by complex algorithms specific to Artificial Intelligence, obtaining new results or useful information for dental doctors.

The general part of the thesis includes the description of the evolution of the concept of artificial intelligence and the types of algorithms used. In the second and third chapters, the various types of software used in general dentistry and Orthodontics are described, which guide in making a quick and precise diagnosis, as well as an individualized treatment plan, correlated with the information obtained through artificial intelligence.

The motivation of the research is demonstrated in the second part, entitled "**Personal contributions**", and is related to the need to evaluate digital software with clinical potential. This evaluation is essential to ensure the effectiveness and safety of these tools in the medical field, contributing to improving the quality of patient care and advancing medical practice.

The first study called "Comparative study on the results of orthodontic diagnosis using algorithms that define Artificial Intelligence and simple algorithms", is a research carried out on a proprietary software (ORTHO AI) that uses deep learning algorithms to detect dental contours and establish the axis of symmetry. Through this study, the detection of the position and shape of the teeth in various orthodontic anomalies was analyzed in order to diagnose orthodontics in relation to the facial axes.

The second study called "Comparative study on the guidance of orthodontic treatments by software based on artificial intelligence and classic software", is a research carried out on a proprietary software with two versions, one using simple algorithms and another using AI algorithms, which evaluated ease of use, performance and adaptability of the software in both software versions.

The third study called "The role of virtual reality and artificial intelligence in reducing children's anxiety in fixed orthodontic therapy", evaluated the importance of using virtual reality (VR) eye-glasses with artificial intelligence (AI) for reducing the anxiety of patients with fixed orthodontic appliances during orthodontic treatments.

The results obtained from the quantification of the statistical variables were compared with other studies from the specialized literature, and the conclusions were formulated for each of the three studies.

General Discussions and General Conclusions have been written in a separate chapter.