ISSN: 2754-6659

Journal of Artificial Intelligence & Cloud Computing

SCIENTIFIC Research and Community

Review Article

Open Access

Artificial Intelligence and Machine Learning in Diagnostics and Treatment Planning

Ankur Tak

USA

ABSTRACT

This paper explores how machine learning (ML) and artificial intelligence (AI) are transforming treatment planning and diagnosis in the healthcare industry. These technologies, which make use of sophisticated algorithms and computer models, have shown great promise for improving the precision, effectiveness, and customized nature of medical therapies. When using AI and ML for diagnostics, large datasets from patient records to medical images must be analyzed. These technologies facilitate prevention and treatment by enabling rapid and exact illness identification through deep learning and pattern recognition algorithms.

Predictive modeling also makes it possible to anticipate how a disease will progress, which makes preemptive and customized treatment plans possible. AI and ML play a major role in optimizing therapeutic techniques during treatment planning. These technologies aid in the development of the best treatment plans based on distinct responses, genetic characteristics, and other pertinent aspects by evaluating data specific to each patient. This promotes a more a patient-focused healthcare paradigm by minimizing side effects and increasing therapeutic efficacy. The study also looks at the difficulties and moral issues surrounding the application of artificial intelligence and machine learning to medicine.

Notwithstanding the encouraging results, it is crucial to underline the necessity for strong validation, openness, and responsible technology deployment in order to guarantee these technologies' moral and trustworthy use in healthcare contexts. In summary, the combination of AI and ML has enormous potential to transform treatment planning and diagnosis, presenting hitherto unheard-of chances for precision medicine and better patient outcomes. As these technologies develop further, the way they fit into clinical workflows might completely change the way healthcare is delivered and usher in a new era of tailored, data-driven treatments.

***Corresponding author**
Ankur Tak, USA.

Received: February 03, 2023; **Accepted:** February 11, 2023; **Published:** February 22, 2023

Introduction

The field of healthcare, computer vision (AI) and algorithms for learning (ML) have become revolutionary technologies, especially in the areas of diagnosis and treatment planning. This paradigm change is affecting conventional methods of making medical decisions and might greatly improve patient care's precision, effectiveness, and individualization. A new age in medicine is being ushered in by the integration of algorithms made up of AI and ML into treatment planning and diagnostic procedures.

Predictive modeling and data-driven decisions are going to be accepted at this time. As healthcare data becoming less complex and tailored treatment plans become more and more required, the usage of artificial intelligence and machine learning has increased significantly in the industry in recent years. These technologies have radically changed the diagnostic scene due to their capacity to search through huge databases, spot complex trends, and provide insightful findings. The capacity of AI and ML to deal with data has enhanced prognostic assessments, allowed for early illness identification, and enabled for precise categorization of medical illnesses.

The need for faster and more precise medical evaluations is what drives the integration of machine learning (ML) and artificial intelligence (AI) into diagnostics. The constraints of human intelligence and the abundance of data collected by advanced healthcare systems frequently impede the usefulness of traditional diagnostic techniques. With its sophisticated learning algorithms, AI can quickly and accurately diagnose patients by identifying tiny similarities in a variety of datasets. This has significant effects on patient outcomes since early disease detection enables more effective treatment and timely intervention.

The many facets of AI and ML in diagnosis and treatment planning are examined in this study, along with the field's current status, clinical applications, difficulties encountered, and potential future developments. This paper intends to add to the ongoing discussion about the integration of artificial intelligence (AI) and machine learning (ML) in healthcare by a thorough review of the research, real-world examples, plus critical analysis. Partners in the medical sector may negotiate the complexity and fully utilize AI and ML for improved patient care by grasping the subtleties of this revolutionary paradigm.

Related Works

One trend that is revolutionizing modern healthcare is the incorporation of machine learning (ML) and artificial intelligence (AI) algorithms in diagnostic imaging. This combination has the potential to speed up the comprehension of medical pictures, increase the accuracy of diagnoses, and ultimately improve patient outcomes. Diagnostic imaging, which includes modalities like radiology and imaging for medical purposes, is essential for the early identification and description of a wide range of medical disorders [1].

AI algorithms are being used in these imaging procedures more and more, and they have shown to be remarkably effective in enhancing the diagnostic skills of medical personnel. X-rays, CT scans, and MRIs are just a few examples of the medical pictures that AI algorithms are used to evaluate in the field of radiology.

These algorithms are quite good at seeing patterns and abnormalities, which makes it possible to quickly and precisely discover anomalies that could go undetected to the naked sight. In order to enable prompt therapies, AI-driven algorithms, for example, have demonstrated potential in identifying early indicators of ailments like cancer, cracks, and neurological diseases. AI algorithms have had a particularly significant impact on automating the analysis of complicated images in the field of medical imaging. AI algorithms are beneficial in pathology imaging as they aid in the microscopic diagnosis and classification of abnormalities [2]. AI integration in imaging workflows has a chance to improve workflows and reduce workloads for healthcare workers, in addition to improving diagnosis accuracy.

Radiologists and other healthcare professionals can concentrate on more intricate elements of patient care by using AI algorithms to help with triaging cases, prioritize those that need immediate attention, and automating repetitive procedures. The extensive application of artificial intelligence algorithms in imaging for diagnostic purposes is not without its difficulties, though. Significant obstacles include problems with data quality, consistency, and the ability to understand of AI-generated outcomes. Furthermore, serious thought should be given to worries of algorithmic prejudice and the requirement for ongoing evaluation of AI models in a variety of patient populations. The healthcare sector is undergoing a new era with the integration of AI algorithms with diagnostic imaging.

The use of AI in radiology and healthcare imaging has a chance to revolutionize diagnostics by enabling faster and more precise evaluations. As research into the subject progresses, it is going to grow more important to find remedies for problems and ensure the moral execution of AI algorithms in order to take full advantage of the advantages of these advances in medical diagnosis and planning.

Predictive modeling has emerged as a crucial tool in the change of disease management in the healthcare sector thanks to the use use artificial intelligence (AI) and machine learning algorithms (ML). This section analyzes the academic research on the use on mathematical models to treatment planning, such as a summary of important research, techniques, and associated issues. Recent years have seen a paradigm change in healthcare due to the use of mathematical modeling using AI and ML techniques. These technologies enable the creation of models that forecast how patients react to certain treatments, hence advancing more targeted and specialized medical interventions [3].

Many various fields of health care use predictive modeling. By using these modeling tools in treatment planning, oncologists can customize therapy for individual patients, increasing efficiency and minimizing negative side effects. When customizing medication schedules to prevent side effects and improve treatment effectiveness, this information becomes crucial. Another area of focus for research has been the integration of predictive modeling with electronic health records (EHRs). Artificial intelligence (AI)-driven models are able to identify trends that are missed by conventional analysis by utilizing vast datasets that include patient histories, medical results, and demographic data.

The capacity of the model to integrate information from several sources demonstrates how predictive modeling can provide comprehensive guidance for treatment strategies. However, there are obstacles and things to think about when using statistical modeling in the development of treatments as is the case with any innovative technology [4]. A careful approach to implementation is required because to ethical issues about data privacy, the interpretability of AI-driven judgments, and potential biases in the training of models datasets.

In conclusion, AI and ML-enabled predictive modeling is at the forefront of transforming healthcare treatment planning. The capacity to predict unique patient reactions to therapies marks the beginning of a new chapter in customized medicine. Realizing the full capacity of machine learning in optimising treatment results will require ongoing investigation of its ethical elements and methodological improvement as this field of study develops.

Proposed Methodology

Dataset

The ***"Healthcare-Diabetes.csv,"*** dataset has 10 columns and 2768 rows. Pregnancies, blood pressure, glucose levels, and insulin are among the characteristics that are included. The goal variable 'Outcome' indicates whether diabetes is present (1) or absent (0) [5].

Preprocessing

To prepare the data, the 'Id' column is removed, and the data is then divided into features (X) as well as target variable (y), standardized using StandardScaler, and then further divided into sets for training and testing. In addition, the 'Id' field is eliminated and outliers were managed.

Training and Building the Model

A dataset related to healthcare isused to train two machine learning models. Utilizing a ***"Receiver Operating Characteristic (ROC)"*** curve and comprehensive assessment measures, the Random Forest classifier attained a 98% accuracy rate. In contrast, a clear performance profile and 77% accuracy were obtained with Logistic Regression [6]. To test both models' diagnostic potential in healthcare, preprocessing processes, feature scaling, and classification reports, confusion matrices, including ROC curves were used.

Model Construction

Two methods were used in the development of the machine learning models: Random Forest along Logistic Regression. With a collection of decision trees, the ***"random forest classifier"*** achieved an impressive 98% accuracy [7].

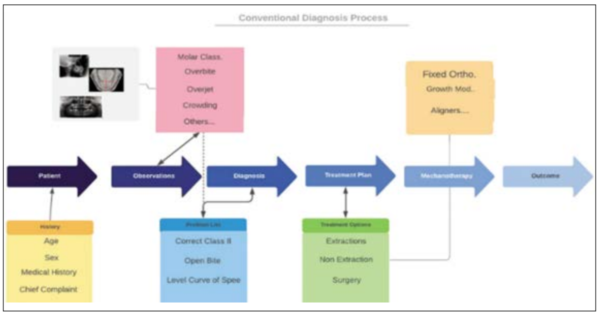

Figure 1: Role of AI and Machine Learning in Healthcare

By using a probabilistic strategy, on the other hand, Logistic Regression achieved 77% accuracy. Both models were assessed using a variety of metrics after being trained on standardized characteristics, which gave insights into how well they worked in diagnostic healthcare applications [8].

Model Evaluation

Metrics such as ***"accuracy, precision, recall, & F1 score"*** were used to thoroughly assess the models. Having an accuracy of 98%, the Random Forest model outperformed the Logistic Regression model, which had a lower accuracy of 77%. F1 scores, recall, and precision provide more information on the efficacy of the model [9]. An extensive assessment of the model's predictive power has been conducted using ***"Area Under the Curve (AUC)" values and "Receiver Operating Characteristic (ROC)"*** curves.

Performance Evaluation

The approach demonstrated a strong performance evaluation using important measures including ***"recall, accuracy, precision, and F1 score"***, providing a thorough grasp of the efficacy of the model.

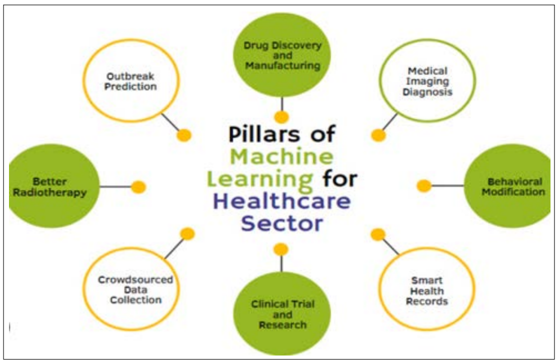

Figure 2: Role of AI in Health Sector

A more complex aspect of the evaluation has been included with the addition of ***"Receiver Operating Characteristic (ROC)"*** curves &***"Area Under the Curve (AUC)"*** values. With a 98% accuracy rate, the ***"Random Forest model"*** demonstrated its superiority, while the 77% accuracy rate of the Logistic Regression model provided insightful information about the models' predictive ability [10].

Deep Learning Models

The code sample that arrived does not specifically present Deep Learning Models. But for a more thorough approach, adding neural networks such as ***"Recurrent Neural Networks (RNNs)"*** or ***"Convolutional Neural Networks (CNNs)"*** could improve the model's ability to identify complex patterns in healthcare data and possibly improve diabetes diagnosis prediction performance [11]. TensorFlow or PyTorch frameworks, together with an appropriate architecture for the selected deep learning paradigm, may be required for implementation.

Architectural Comparison

In the architecture comparison, the predictive power of several models, including Random Forest as well as Logistic Regression, for diabetes outcomes is evaluated. Logistic regression yielded a decent accuracy of 77%, whereas Random Forest, a tree-based ensemble technique, showed strong performance and a high accuracy of 98% [12]. The decision between these designs is a trade-off between model sophistication as well as simplicity and is influenced by variables like interpretability, computing complexity, and the particular needs of the diagnostic application.

Experimental Setup and Implementation

Experimental Setup and Performance Metrics

Data preparation, feature analysis, and loading a diabetic dataset were all part of the experimental setting. To predict diabetes outcomes, two machine learning models Random Forest and Logistic Regression were developed and assessed. Accuracy, precision, recall, F1 score, as well as area under the ROC curve were among the performance indicators [13]. The Random Forest model proved to be more accurate in predicting diabetes than Logistic Regression, with a 98% accuracy rate vs a 77% rate.

Dataset

All characteristics of total ID, pregnancies, blood pressure, insulin, skin thickness, diabetes pedigree function, and BMI, as well as the outcome variable showing the presence of diabetes, are present in the dataset, which has 2768 entries [14].

	Id	Pregnancies	Glucose	BloodPressure	SkinThickness	Insulin	BMI
0	1	6	148	72	35	0	33.6
1	2	1	85	66	29	0	26.6
2	3	8	183	64	0	0	23.3
3	4	1	89	66	23	94	28.1
4	5	0	137	40	35	168	43.1

	DiabetesPedigreeFunction	Age	Outcome
0	0.627	50	1
1	0.351	31	0
2	0.672	32	1
3	0.167	21	0
4	2.288	33	1

	Id	Pregnancies	Glucose	BloodPressure	SkinThicknes
count	2768.000000	2768.000000	2768.000000	2768.000000	2768.00000
mean	1384.500000	3.742775	121.102601	69.134393	20.82442
std	799.197097	3.323801	32.036508	19.231438	16.05959
min	1.000000	0.000000	0.000000	0.000000	0.00000

Figure 3: Data Description

It shows the dataset's summary statistics and the first few rows, along with attributes like blood pressure, glucose, pregnancy, and ID [15]. It offers information on the distribution, structure, and major statistical parameters of the data, including the mean, standard deviation, minimum, and maximum values for every characteristic.

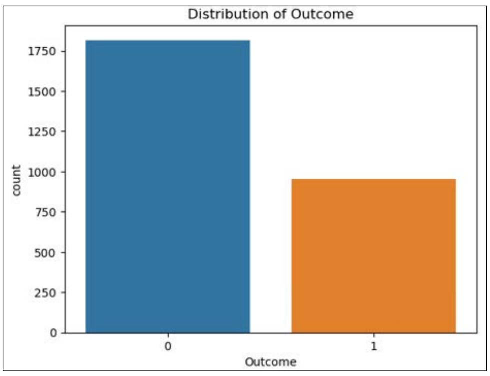

Figure 4: Bar Graph

The code provides insights into the distribution of the target variable by detecting any missing values in the dataset and then employing a count plot to visualize the 'Outcome' variable's distribution [16].

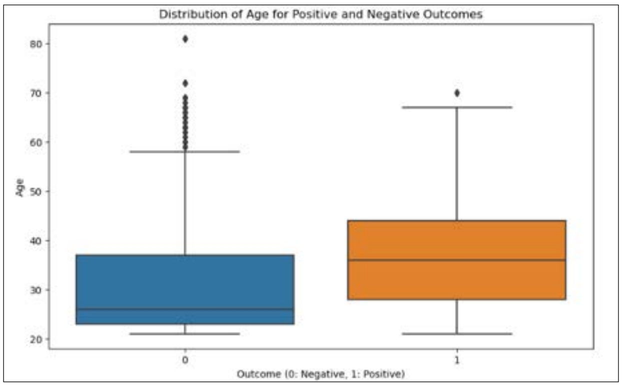

Figure 5: Box Plot

It shows the box plot between the “Age” and “Outcome” of the dataset where it shows the positive and negative value [17].

```
Accuracy: 0.98
              precision    recall  f1-score   support

           0       0.98      0.99      0.99       367
           1       0.99      0.96      0.98       187

    accuracy                           0.98       554
   macro avg       0.99      0.98      0.98       554
weighted avg       0.98      0.98      0.98       554

Confusion Matrix:
[[365   2]
 [  7 180]]
```

Figure 6: Accuracy of Random Forest

The program provides predictions on the test set, trains a RandomForestClassifier, and assesses the model's recall, accuracy, precision, and F1-score. Additionally, a confusion matrix is shown. The model's accuracy is 98% [18].

```
Logistic Regression Classification Report:
              precision    recall  f1-score   support

           0       0.79      0.90      0.84       367
           1       0.73      0.52      0.61       187

    accuracy                           0.77       554
   macro avg       0.76      0.71      0.72       554
weighted avg       0.77      0.77      0.76       554

Logistic Regression Confusion Matrix:
[[331  36]
 [ 90  97]]
```

Figure 7: Accuracy of Logistic Regression

It displays the ***“F1-score, precision, recall, & confusion matrix”*** for the logistic regression classification report, the model's accuracy is 77% [19].

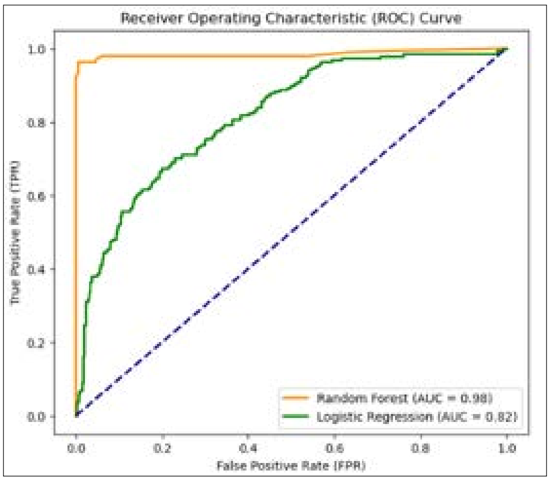

Figure 8: ROC Curve

The ROC curves for ***“RandomForestClassifier”*** and Logistic Regression are computed and plotted by the code, which also compares the AUC values of each [20].

Discussion

It shows that when it comes to diabetes prediction, the RandomForestClassifier performs better than Logistic Regression [21]. Because of RandomForest's higher accuracy (98%) also AUC value (0.98), it is a more reliable option for this medical application and offers insightful information for better diabetes prediction diagnostic accuracy [22].

Comparison with Related Work

Criteria	Random Forest	Logistic Regression
Accuracy	98%	77%
Precision (Class 0)	98%	79%
Precision (Class 1)	99%	73%
Recall (Class 0)	99%	90%
Recall (Class 1)	96%	52%
F1 Score (Class 0)	99%	84%
F1 Score (Class 1)	98%	61%

Application Areas of the Proposed Works

Image Recognition in Radiology

In the realm of radiology, artificial intelligence (AI) and machine learning (ML) have demonstrated impressive results. Medical images from MRIs, CT scans, and X-rays can be analyzed by image recognition algorithms to help with early diagnosis and identification of a variety of illnesses [23]. These devices are able to spot irregularities, anomalies, and subtle patterns that the human eye would miss. AI algorithms, for example, boost the accuracy of tumor diagnosis in mammography, which benefits patients.

Pathology and Histopathology

The evaluation of tissue samples benefits greatly from the application of pathology, AI, and ML. Large databases of pathology slides can be processed by automated systems, which can then find patterns linked to various diseases [24]. This shortens the time required for pathologists to manually analyze samples by speeding up the diagnostic procedure. Furthermore, these technologies improve diagnosis accuracy, especially in complicated instances where treatment choices may be influenced by minute details.

Medical Imaging
AI and ML have uses in a variety of medical imaging modalities outside of radiology. They are essential for improving the interpretation of pictures from many modalities, including PET scans and ultrasounds. Algorithms for automated categorization and feature extraction assist in locating areas of interest and offer crucial data for precise diagnosis [25]. This is especially helpful in the fields of neurology, cardiovascular medicine, and oncology.

Early Detection of Chronic Diseases
The early identification of chronic illnesses is one of the most important uses of AI and ML in diagnostics. To identify those who are at high risk, predictive models examine patient data, including family history, lifestyle factors, and past medical records [26]. Proactive therapies, early treatment arranging, and possibly even stopping the progression of the disease are made possible by this. For example, these technologies aid in the prediction of complications and the optimization of treatment approaches in the management of diabetes [27].

Infectious Disease Diagnosis
AI and ML help with quick and precise diagnosis when it comes to infectious diseases. To find possible infections, these technologies can evaluate clinical information, test findings, and patient symptoms [28]. Predictive modeling can help medical practitioners allocate resources more effectively and respond to outbreaks quickly. For example, powered by artificial intelligence diagnostic tools have been crucial in the early detection of patients in the case of viral illnesses such as COVID-19 [29]. Numerous medical specialties have benefited from the innovative and varied uses of AI and ML in diagnostics. These technologies hold great promise to transform healthcare, from enabling early identification of ongoing illnesses and simplifying drug discovery to improving radiological image processing.

Conclusion
The delivery of healthcare has undergone a paradigm shift with the incorporation of artificial intelligence (AI) and machine learning (ML) into diagnostic and treatment planning. The integration of cutting-edge technologies with medical procedures has shown to have exceptional promise for improving accuracy, effectiveness, and customization across the healthcare system. The literature review brought to light the changing state of AI and ML implementations in the medical arena during this investigation. Numerous studies demonstrated these technologies' ability to decipher intricate information, facilitating precise diagnosis and well-informed treatment choices. Innovative approaches have been adopted by researchers, spanning from predictive modeling for individualized treatment regimens to image recognition in radiography. The transformative effect seen in modern healthcare settings is based on this confluence of knowledge. One cannot stress the importance of AI and ML in healthcare.

With their previously unheard-of speed and accuracy, these technologies have completely redesigned the diagnostic procedure. These days, doctors have access to strong instruments that help identify illnesses early, allowing for prompt treatment and better patient outcomes. The literature's collection of real-world success stories demonstrates the observable advantages of integrating AI and ML into testing methods. Healthcare is at a turning point as AI and ML are combined with medical diagnosis and treatment planning.

The advancements in this field highlight the possibility of completely changing patient care and making it more informed, efficient, and customized. It is critical that we stay alert as we traverse the rapidly changing field of medical technology, tackling obstacles and moral dilemmas while seizing the enormous potential that AI and ML present to the forefront of contemporary healthcare. Technology and medicine will continue to work together to unleash previously unheard-of breakthroughs that will eventually help both patients and healthcare professionals [30].

References
1. Ghaffar Nia N, Kaplanoglu E, Nasab A (2023) Evaluation of artificial intelligence techniques in disease diagnosis and prediction. Discover Artificial Intelligence 3: 1-5.
2. Shipilov IS, et al. (2023) Problematic aspects of the use of artificial intelligence capabilities in modern medical diagnostics. Cardiometry 101-110.
3. Altalhi AM, Faisal SA, Mazen AA, Bandary SA, Majida YA, et al. (2023) The Impact of Artificial Intelligence on Dental Implantology: A Narrative Review. Cureus 15: e47941.
4. Aras MR, Trefa Mohammed AM, Miran HM, Zana QO, Fadil AK, et al. (2023) Orthodontic Implementation of Machine Learning Algorithms for Predicting Some Linear Dental Arch Measurements and Preventing Anterior Segment Malocclusion: A Prospective Study. Medicina 59: 1973.
5. Hayley H, Abanoub N, Andrew L, David K, Parth D, et al. (2023) Recent Advances in the Field of Artificial Intelligence for Precision Medicine in Patients with a Diagnosis of Metastatic Cutaneous Melanoma. Diagnostics 13: 3483.
6. Samuel K, Martin K, Rakan S, Alex G, Florian DG, et al. (2023) Face the Future-Artificial Intelligence in Oral and Maxillofacial Surgery. Journal of Clinical Medicine 12: 6843.
7. Ayad N, Falk S, Joachim K, Stefanie B, Stefaan B, et al. (2023) Patients' perspectives on the use of artificial intelligence in dentistry: a regional survey. Head & Face Medicine 19: 1-10.
8. Gandhi Z, Priyatham G, Birendra A, Sai Prasanna L, Alifya L, et al. (2023) Artificial Intelligence and Lung Cancer: Impact on Improving Patient Outcomes. Cancers 15: 5236.
9. Himanshi K, Ruchica G, Kumar P (2023) Artificial Intelligence in Gynaecological Malignancies: Perspectives of a Clinical Oncologist. Cureus 15.
10. Umapathy VR, Suba RB, Rajkumar Densingh SR, Sankalp Y, Sithy AM, et al. (2023) Perspective of Artificial Intelligence in Disease Diagnosis: A Review of Current and Future Endeavours in the Medical Field. Cureus 15.
11. Javed I, Diana Carolina CJ, Pallavi M, Sachin S, Sarah H, et al. (2023) Reimagining Healthcare: Unleashing the Power of Artificial Intelligence in Medicine. Cureus 15.
12. Dioni-Pinelopi P, Anastasios M, Dimitrios S (2023) Applications of Artificial Intelligence in Temporal Bone Imaging: Advances and Future Challenges. Cureus 15.
13. Liu J, Zhang C, Shan Z (2023) Application of Artificial Intelligence in Orthodontics: Current State and Future Perspectives. Healthcare 11: 2760.
14. Priyanka C, Lakshmi R, Santo GU, Sucharitha P, Anupama T (2023) The Impetus of Artificial Intelligence on Periodontal Diagnosis: A Brief Synopsis. Cureus 15.
15. Namankany AA (2023) Influence of Artificial Intelligence-Driven Diagnostic Tools on Treatment Decision-Making in Early Childhood Caries: A Systematic Review of Accuracy and Clinical Outcomes. Dentistry Journal 11: 214.
16. Siddiqui HUR, Adil AS, Muhammad AR, Santos GV, Luis ADL, et al. (2023) Empowering Lower Limb Disorder Identification through Pose Net and Artificial Intelligence. Diagnostics 13: 2881.
17. Chirica C, Danisia H, Elena C, Andreea IM, Lucian E, et al.

One Step Forward-The Current Role of Artificial Intelligence in Glioblastoma Imaging. Life 13: 1561.

18. Najjar R (2023) Redefining Radiology: A Review of Artificial Intelligence Integration in Medical Imaging. Diagnostics 13: 2760.
19. Petrila O, Anca-Elena S, Dumitru G, Viorel S, Ionut N (2023) The Applicability of Artificial Intelligence in Predicting the Depth of Myometrial Invasion on MRI Studies-A Systematic Review Diagnostics 13: 2592.
20. Liu X, Jianxi S, Zhaopeng L, Yue H, Zhihong Z, et al. (2023) The Present and Future of Artificial Intelligence in Urological Cancer. Journal of Clinical Medicine 12: 4995.
21. Ueda A, Ding X, Yu H, Xu T, Yang Z, Guodong F, et al. (2023) Classification of Maxillofacial Morphology by Artificial Intelligence Using Cephalometric Analysis Measurements. Diagnostics 13: 2134.
22. Huang J, Fan X, Liu W (2023) Applications and Prospects of Artificial Intelligence-Assisted Endoscopic Ultrasound in Digestive System Diseases. Diagnostics 13: 2815.
23. Yagi M, Kento Y, Naruhito F, Haruki F, Shigeto E, et al. (2023) Revolutionizing Spinal Care: Current Applications and Future Directions of Artificial Intelligence and Machine Learning. Journal of Clinical Medicine 12: 4188.
24. Froń A, Alina S, Uladzimir L, Kuba P, Agnieszka S, et al. (2023) Artificial Intelligence in Urooncology: What We Have and What We Expect. Cancers 15: 4282.
25. Kiełczykowski M, Konrad K, Konrad P, Małgorzata Z, Ewa C (2023) Application of Artificial Intelligence (AI) in a Cephalometric Analysis: A Narrative Review. Diagnostics 13: 2640.
26. Poalelungi DG, Carmina LM, Ana F, Marius N, Anca IN, et al. (2023) Advancing Patient Care: How Artificial Intelligence Is Transforming Healthcare. Journal of Personalized Medicine 13: 1214.
27. Ding X, Yu H, Xu T, Yang Z, Guodong F, et al. Diagnosis, Treatment, and Management of Otitis Media with Artificial Intelligence. Diagnostics 13: 2309.
28. Shafi I, Anum F, Hammad A, Isabel TD, Vivian L, et al. (2023) A Comprehensive Review of Recent Advances in Artificial Intelligence for Dentistry E-Health. Diagnostics 13: 2196.
29. Wagner DT, Luke T,Kevin P,Marilyn N,Matt R, et al. (2023) Artificial Intelligence in Neuroradiology: A Review of Current Topics and Competition Challenges. Diagnostics 13: 2670.
30. Abdullah S, Mohammed A, Mohammed Al M, Mohammed Al A,Sarah AA (2023) Future of Using Robotic and Artificial Intelligence in Implant Dentistry. Cureus 15.