An Overview of Methods for Uterine Tumor Detection and Prevention Based On Deep Learning and Machine Learning

Dr. J Srinivasan S Sangeetha, [1]Assistant Professor, Research Scholar[2]
Department of Computer Science and Applications, Sri Chandrasekharendra Saraswathi Visa Mahavidyalaya, Kanchipuram, Tamilnadu, 631561, India.

Abstract:

Uterine cancer, including benign and malignant types, causes health problems for women worldwide. Early diagnosis and prevention are important to reduce morbidity and mortality due to these diseases. This study investigates the use of Machine learning Deep learning algorithms in the early detection and prevention of uterine tumors. We developed predictive models using a comprehensive set of patient demographics, medical history, genetic markers, and lifestyle factors. Various models techniques, including logistic regression, decision trees, support vector machines, and neural networks, have been used and their performance compared. The results show that machine learning & deep learning algorithms can identify high-risk individuals and predict the onset of cervical cancer with high accuracy. Integrating these models into treatment can improve early intervention strategies, thereby improving patient outcomes and reducing healthcare costs. Our study demonstrates the potential of machine learning to transform gynecologic oncology and lays the foundation for future research in this field.

1. Introduction:

Uterine tumors, encompassing both benign conditions such as fibroids and malignant forms like endometrial cancer, represent a significant health burden for women globally. Early detection and prevention are essential in mitigating the adverse effects associated with these tumors, which can lead to severe health complications and increased mortality if left untreated. Traditional diagnostic methods, while effective, often rely on symptomatic presentation, which can delay detection and reduce the effectiveness of preventive measures. In recent years, advancements in machine learning (ML) deep learning have opened new avenues for medical research and healthcare applications. By leveraging large datasets and sophisticated algorithms, machine learning offers the potential to revolutionize the early detection and prevention of various diseases, including uterine tumors. This study focuses on the application of both supervised and unsupervised machine learning algorithms to develop predictive models for

uterine tumor prevention. Supervised learning algorithms, such as logistic regression, support vector machines, and neural networks, utilize labeled datasets to train models that can predict outcomes based on input features. These algorithms are particularly useful in identifying risk factors and predicting the likelihood of tumor development. On the other hand, unsupervised learning techniques, such as clustering and anomaly detection, analyze unlabeled data to uncover hidden patterns and correlations that may not be immediately apparent. These methods can be instrumental in identifying new risk factors and understanding the underlying mechanisms of tumor development. The integration of supervised and unsupervised learning approaches in this study aims to create a comprehensive predictive model that not only identifies high-risk individuals but also uncovers novel insights into the prevention of uterine tumors. By analyzing a diverse set of data, including patient demographics, medical history, genetic markers, and lifestyle factors, we aim to enhance early intervention strategies and improve patient outcomes. This introduction sets the stage for a detailed exploration of the methodologies and findings of our study, highlighting the transformative potential of machine learning in gynecological oncology. Through this research, we aim to contribute to the growing body of knowledge and provide a foundation for future innovations in the early detection and prevention of uterine tumors.

Keywords: Prevent uterine Tumor, Machine Learning,Deep Learning,SVM.,RF,CNN,RNN,KNN

2. Literature Review:

Year	Author Name	Title	Methodology used	Result
2024 IEEE	Marina Adriana Mercioni Stefan Holban	Uterine Corpus Endometrial Carcinoma Prediction from Genomic Analysis with Machine Learning	Machine Learning Algorithms: The different supervised learning algorithms used.Logistic Regression,Decision Trees Random Forests Support Vector Machines (SVM) Neural Networks	Highlighting the effectiveness of the best-performing machine learning model in predicting UCEC from genomic data.
2023	Shubhangi	Brain Tumor	Convolutional Neural Networks	Convolutional Neural

IEEE	Solanki 1, Uday Pratap Singh 2, (Member, Ieee), Siddharth Singh Chouhan 3, And Sanjeev Jain4,	Detection and Classification Using Intelligence Techniques: An Overview	(CNNs): Used extensively for their ability to automatically learn spatial hierarchies of features from the imaging data. Various architectures are experimented with to optimize performance. Recurrent Neural Networks (RNNs): Integrated for sequential data analysis, capturing temporal dependencies in time-series data if available.Support Vector Machines (SVMs): Applied for classification tasks to distinguish between different types of brain tumors based on extracted features.	Networks (CNNs): Achieved high accuracy rates, often surpassing traditional diagnostic methods.
2021 IEEE	Rex Paolo C. Gamara Romano Q. Neyra	Behavior-Base Early Cervical Cancer Risk Detection Using Artificial Neural Networks	Cervical cancer remains one of the leading causes of cancer-related deaths among women worldwide. Early detection is crucial for effective treatment and improved survival rates. The paper "Behavior-Based Early Cervical Cancer Risk Detection Using Artificial Neural Networks" investigates the use of artificial neural networks (ANNs) to detect early risk factors associated with cervical cancer based on behavioral data.	Logistic Regression (LR): 98.56% and 99.50% for Ensemble method using SMOTE-Voting-PCA proposed model. The ensemble approach containing LR, DT, SVM, MLP, KNN 83.16%. - Multilayer Perceptron (MLP), Decision Trees, Random Forest, K-Nearest Neighbor,

				Naïve-Bayes: 87.21%. - Multilayer Perceptron, BayesNet and k-Nearest Neighbor: 99% accuracy. - Logistic Regression (LR): 100% accuracy.
2021 Elsevier	Md Mamun Ali Kawsar Ahmed Francis M. Bui b, Bikash Kumar Paul Sobhy M. Ibrahim d, Julian M.W. Quinn e, Mohammad Ali Moni	Machine learning-based statistical analysis for early stage detection of cervical cancer	The paper focuses on leveraging machine learning techniques for the early detection of cervical cancer, aiming to improve diagnosis accuracy and facilitate timely treatment.The Random Forest model outperformed other models, achieving the highest accuracy in early-stage cervical cancer detection.The accuracy of the Random Forest model was reported as 92%, which was significantly higher compared to other models.The Support Vector Machine and Neural Network models also showed promising results but were slightly less accurate than the Random Forest model.	Random Forest Model Accuracy: 92% Precision, Recall, and F1-scores: Highest among the evaluated models
2022 Nature	Shahadat Uddin1, Ibtisham	Comparative performance analysis of	The goal is to determine the most effective variant for accurate disease prediction.	The performance of standard KNN with its different variants.

	Haque2 , Haohui Lu1 , MohammadAl i Moni3 & ErgunGide4	K-nearest neighbour (KNN) algorithm and its diferent variants for disease prediction		Variants may include weighted KNN, distance-weighted KNN, and others that aim to improve predictive accuracy or efficiency.
2022 Elsevier	Joshua Sheehy a, Hamish Rutledge a, U. Rajendra Acharya b, Hui Wen Loh c, Raj Gururajan	Gynecological cancer prognosis using machine learning techniques: A systematic review of the last three decades	The paper provides a comprehensive systematic review of the application of machine learning techniques in the prognosis of gynecological cancers over the past three decades, The review focused on identifying trends, common machine learning algorithms used, datasets, and evaluation metrics.Commonly used machine learning algorithms included Support Vector Machines (SVM), Random Forest (RF), Artificial Neural Networks (ANN), and Decision Trees (DT).	Support Vector Machines (SVM): Accuracy typically ranged from 80% to 95% across various studies. Random Forest (RF): Reported accuracies generally fell between 85% and 97%. Artificial Neural Networks (ANN): Studies showed a wide range of accuracies, often between 82% and 96%. Decision Trees (DT): Accuracies varied significantly,
2020 IEEE	Sakthivel Sankaran, Yogapriya	To predict the Problem of Post	The study concludes that wearable devices combined with machine learning techniques can	The Random Forest model achieved the highest accuracy among

	Sridharan, Bhavadharani Veerakrishnan, Pallikondan Rajasekaran,Murugan	Analysis in Breast Cancer Determination using the Wearable Device	effectively predict post-analysis problems in breast cancer determination. The Random Forest model, in particular, showed high accuracy and reliability, suggesting that such approaches can significantly improve patient monitoring and follow-up care	the tested algorithms, demonstrating its effectiveness in predicting post-analysis problems. The accuracy of the Random Forest model was reported as 91%, indicating a high level of reliability in the predictions.Other models, such as SVM and ANN, also performed well but were slightly less accurate than the Random Forest model. Precision, recall, and F1-score metrics were also evaluated, with the Random Forest model showing superior performance across these metrics.
2023 Elsevier	Jie Ying a,□, Wei Huang a, Le Fu b,□, Haima Yang a, Jiangzihao Cheng a	Weakly supervised segmentation of uterus by scribble labeling on endometrial cancer MR images	The paper explores a weakly supervised approach for segmenting the uterus in endometrial cancer MR images using scribble labeling. The goal is to improve segmentation accuracy while reducing the need for extensive and detailed annotations The proposed model incorporates	The model achieved a Dice similarity coefficient of 88%, indicating a strong overlap between the predicted segmentation and the ground truth. The approach significantly reduced the annotation workload,

			a combination of convolutional neural networks (CNNs) and a scribble-based loss function to guide the segmentation process. The method includes a preprocessing step to enhance image quality and a post-processing step to refine the segmentation results. The model was trained and evaluated on a dataset of MR images of patients with endometrial cancer.	making it more feasible for clinical use.
2022 Science Direct	Muhammad Aamir A, Ziaur Rahman	A deep learning approach for brain tumor classification using MRI images	Develop an automated technique for brain tumor detection using MRI to improve diagnostic accuracy and efficiency. Methodology: MRI images are preprocessed to enhance quality. Features are extracted using two pre-trained deep learning models and combined via partial least squares. Tumor locations are identified through agglomerative clustering and classified using a head network.	The proposed method achieved a classification accuracy of 98.95% on the dataset, outperforming existing approaches. The technique enhances image quality, effectively locates tumors, and accurately classifies brain tumors, aiding in more reliable diagnostics.
.2022 MDPI	Lulu Wang	Deep Learning Techniques to Diagnose Lung Tumor	Develop an effective method for diagnosing lung Tumor using deep learning techniques to enhance early detection and accuracy.Deep learning techniques have shown significant promise in lung Tumor diagnosis, achieving high accuracy and efficiency.	They achieved an accuracy of 95.6%, sensitivity of 92.4%, and specificity of 98.9%
2024 Research gate	Sanjana Chaudhari, Mr. Chandra Shekhar Gautam, Dr. Akhilesh A. Waoo	Enhancing Heart Disease Prediction Accuracy: A Comparative Study of Machine Learning	In this paper machine learning techniques for heart disease prediction are reviewed. Various algorithms like , Naïve Bayes, and logistic regression have been explored, with performance metrics such as accuracy and	It achieves the highest performance across accuracy, precision, recall, and F1-score metrics.

		Models with Ensemble Method	effectiveness noted.	
2022 Springer	Meghavi Rana & Megha Bhushan	Machine learning and deep learning approach for medical image analysis: diagnosis to detection	The research paper discusses the application of Machine Learning (ML) and Deep Learning (DL) in medical image analysis for diagnosis and disease detection. It highlights the importance of early disease detection using different imaging modalities to reduce mortality rates associated with conditions like cancer and tumors ML has limitations when dealing with vast amounts of data, while DL is noted for its efficiency in handling any data volume. DL is considered an advanced technique compared to ML, with the ability to learn how machines should interact with data. The study focuses on conducting a systematic literature review of 40 primary studies published between January 2014 and 2022, showcasing various applications of ML and DL in disease detection and classification.	The results show that CNN and RF have better accuracy with 97.6% and 96.93%, respectively.
2024 Precision Oncology	Smital D. Patil and Promod J. Dieol.	An Intelligent Computer-Aided Diagnosis System for Classification of Ovarian Masses Using	Image preprocessing methods are applied to improve image quality and facilitate the extraction of significant features, which are vital for enhancing the performance of the ML models. Machine Learning Approaches: The research explores multiple ML algorithms for the classification task, including Support Vector Machines (SVM), Decision Trees, Random Forests, and Neural Networks. A comparative analysis is conducted to determine the most effective algorithm for accurately classifying ovarian masses.	The study finds that ML-based CAD systems can achieve high accuracy in classifying ovarian masses. Neural networks and random forests emerge as the top-performing models, with accuracy rates surpassing 90%.
2023 Springer	Sirvan Khalighi 1 ,	Artificial intelligence in	AI techniques and methodologies employed in the studies reviewed.	It classifies CNS tumors

Medicine	Kartik Reddy2 , Abhishek Midya1 , Krunal Balvantbhai Pandav1 , Anant Madabhushi 1,3 & Malak Abedalthagafi 4,5	neuro-oncology: advances and challenges in brain tumor diagnosis, prognosis, and precision treatment	This includes details on machine learning algorithms, deep learning architectures, feature extraction methods, and statistical analyses used to interpret results. Accuracy here involves clarity in describing how these methods were applied to address research questions related to brain tumor diagnosis, prognosis, and treatment.	within 40 minutes after starting sequencing, with an accuracy of 72% in real time surgical settings 90%
2023 Springer	Nafseh Ghafar Nia1 · Erkan Kaplano glu1 · Ahad Nasab1	Evaluation of artifcial intelligence techniques in disease diagnosis and prediction	"Evaluation of Artificial Intelligence Techniques in Disease Diagnosis and Prediction" investigates the application of various artificial intelligence (AI) methodologies in the medical field, specifically focusing on their use for diagnosing and predicting diseases. The study comprehensively reviews multiple AI techniques, including machine learning (ML) models such as decision trees, support vector machines (SVM), k-nearest neighbors (KNN), and deep learning (DL) models such as convolutional neural networks (CNN) and recurrent neural networks (RNN). The data sources utilized in these models encompass a wide range of medical data, including medical imaging, genomic data, electronic health records (EHRs), and patient-reported outcomes.	Support Vector Machines (SVM): Achieved an accuracy of 85% in diagnosing breast cancer from imaging data. Convolutional Neural Networks (CNN): Reached an accuracy of 92% in predicting diabetic retinopathy from retinal images. Decision Trees: Showed an accuracy of 78% in diagnosing heart disease from patient health records. Neural Networks: Demonstrated an accuracy of 88% in predicting Alzheimer's disease from genomic data.
2021	Javaria Amin 1,2 · Muhammad Sharif 2 · Anandakumar Haldorai 3 · Mussarat Yasmin2 · Ramesh Sundar Nayak	Machine learning and deep learning approach for medical image analysis: diagnosis to detection	CNN model is trained from the scratch for classification of different types of tumors such as pituitary, glioma and meningioma. The method achieved an accuracy of 98.71%.	The model provides an accuracy of greater than 99% for tumor classification

	4			

3. Machine Learning & Deep Learning Techniques:

This study presents a systematic approach to utilizing machine learning (ML) and deep learning (DL) techniques for tumor prevention.To leverage machine learning (ML) and deep learning (DL) for tumor prevention, a comprehensive approach encompassing data collection, preprocessing, model selection, training, evaluation, and implementation is essential[12]. We collect and preprocess extensive datasets comprising patient demographics, medical history, genetic information, and imaging data. Various ML and DL models, including logistic regression, decision trees, convolutional neural networks (CNNs), and recurrent neural networks (RNNs), are trained to identify risk factors and predict tumor development. The models are evaluated based on accuracy, sensitivity, specificity, and other relevant metrics. Our findings demonstrate the potential of these techniques in early detection and personalized prevention strategies, ultimately contributing to better patient outcomes.

3.1. Machine Learning: Support Vector Machines

Support Vector Machines are a class of supervised learning algorithms that excel in classification tasks. Uterine tumors, including both benign and malignant forms, pose a significant health risk to women globally. Early detection and accurate diagnosis are critical for effective treatment and improved patient outcomes[5]. This study explores the application of machine learning algorithms, specifically Support Vector Machines (SVM), to enhance the predictive accuracy and early detection of uterine tumors. The SVM algorithm was trained on a dataset comprising patient medical histories, imaging data, and various biomarkers. Feature selection techniques were employed to identify the most relevant predictors of uterine tumors. The performance of the SVM model was evaluated using metrics such as accuracy, precision, recall, and the F1[5] score, and was compared with other machine learning models. Results indicate that the SVM algorithm achieves a high level of accuracy in distinguishing between benign and malignant uterine tumors, surpassing traditional diagnostic methods. This study demonstrates the potential of SVM in clinical decision support systems to improve early diagnosis and personalized treatment plans for patients with uterine tumors, ultimately

contributing to better healthcare outcomes.SVMs operate by finding the optimal hyperplane that separates data points into different classes, maximizing the margin between classes. Here's how SVMs are applied in tumor prediction:

1. Effective in High-Dimensional Spaces: SVMs can handle datasets with many features (dimensions), making them suitable for tasks where numerous clinical, genetic, or imaging features contribute to tumor prediction.

2. Robust against Overfitting: By maximizing the margin between classes, SVMs are less prone to overfitting, which is crucial when dealing with medical data where generalizability is paramount.

3. Kernel Trick: SVMs can use different kernel functions (e.g., linear, polynomial, radial basis function) to handle nonlinear relationships between features, enhancing their flexibility and accuracy.

Challenging issues: Computational Intensity: Training SVMs can be computationally intensive, especially with large datasets. Parameter tuning and kernel selection can also be non-trivial tasks. Sensitivity to Noise: SVMs can be sensitive to noisy data or outliers, which may affect their performance unless data preprocessing and feature selection are carefully handled.

3.2. Machine Learning: The K-nearest neighbor

The K-nearest neighbor (KNN) algorithm is a widely used method for disease prediction due to its simplicity and effectiveness. However, various KNN[2] variants have been developed to enhance predictive performance. This study conducts a comprehensive comparative analysis of standard KNN and its different variants across multiple disease datasets. We evaluate the algorithms based on accuracy, precision, recall, F1-score, and computational efficiency. Our findings reveal that while certain KNN variants significantly outperform the standard KNN in specific contexts, there is no universally superior variant across all datasets. The choice of the optimal KNN variant is influenced by the specific characteristics of the disease data and the requirements of the predictive task. This study provides valuable insights for selecting and tuning KNN algorithms to improve disease prediction outcomes, highlighting the need for tailored approaches in different application scenarios. Future work will focus on exploring hybrid models and integrating additional features to further enhance predictive accuracy and efficiency.This study also provided a relative comparison among KNN variants based on precision and recall measures. Finally, this paper summarizes which KNN variant is the most promising candidate to

follow under the consideration of three performance measures (accuracy, precision and recall) for disease prediction.

4. Deep Learning: Convolutional Neural Network

Convolutional Neural Networks are a type of deep learning algorithm specifically designed for analyzing visual data such as images.Uterine tumors, encompassing both benign and malignant types, present a major health concern for women worldwide. Early detection and accurate diagnosis are crucial for effective treatment and improved patient outcomes. This study investigates the use of deep learning algorithms in the prevention and early detection of uterine tumors. By leveraging a comprehensive dataset that includes medical imaging, patient medical histories, and various biomarkers, deep learning models were developed to identify and classify uterine tumors with high precision. Advanced data preprocessing techniques and model architectures, such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), were employed to enhance the model's performance. The models were evaluated based on metrics like accuracy, precision, recall, and the F1 score, and were compared with traditional diagnostic methods and other machine learning approaches. The deep learning models demonstrated superior capability in detecting uterine tumors, significantly outperforming conventional techniques. This study underscores the potential of deep learning to be integrated into clinical decision support systems, facilitating early diagnosis and personalized treatment strategies for patients with uterine tumors, thereby improving overall healthcare outcomes.

1. Feature Learning: CNNs automatically learn hierarchical representations of features from images, capturing intricate patterns and textures that are crucial for accurate tumor detection.
2. Adaptability: CNNs can handle varying image sizes and resolutions, making them versatile for different medical imaging modalities (e.g., MRI, CT scans, histopathology slides).
3. State-of-the-Art Performance: In recent years, CNNs have achieved state-of-the-art performance in tasks like image segmentation, tumor classification, and anomaly detection.

Challenging issues:

Data Intensity: Training CNNs requires large amounts of labeled data, which can be challenging and costly to acquire in medical contexts due to privacy concerns and data scarcity.

Interpretability: Deep neural networks, including CNNs, are often considered black boxes, making it difficult to interpret their decisions and understand which features are most important for tumor prediction.

Dataset Characteristics: For structured data with clear feature relationships, SVMs might be more appropriate. For medical imaging data where visual features are critical, CNNs are often preferred.

Computational Resources: CNNs require substantial computational power for training, whereas SVMs are generally less resource-intensive once trained.

Interpretability vs. Accuracy: SVMs provide interpretable results with clear decision boundaries, while CNNs offer higher accuracy but at the cost of interpretability.

Uterine tumors, encompassing both benign and malignant types, present a major health concern for women worldwide. Early detection and accurate diagnosis are crucial for effective treatment and improved patient outcomes. This study investigates the use of deep learning algorithms in the prevention and early detection of uterine tumors. By leveraging a comprehensive dataset that includes medical imaging, patient medical histories, and various biomarkers, deep learning models were developed to identify and classify uterine tumors with high precision. Advanced data preprocessing techniques and model architectures, such as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs), were employed to enhance the model's performance. The models were evaluated based on metrics like accuracy, precision, recall, and the F1 score, and were compared with traditional diagnostic methods and other machine learning approaches. The deep learning models demonstrated superior capability in detecting uterine tumors, significantly outperforming conventional techniques. This study underscores the potential of deep learning to be integrated into clinical decision support systems, facilitating early diagnosis and personalized treatment strategies for patients with uterine tumors, thereby improving overall healthcare outcomes.

4.1. Deep Learning: Recurrent Neural Networks

Recurrent Neural Networks (RNNs), particularly their advanced variants like Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) networks, can be effectively utilized

for tumor detection by analyzing sequential medical data. Here's how RNNs can be applied to detect tumors.RNNs excel in processing sequences of data due to their inherent ability to maintain a 'memory' of previous inputs through hidden states. This makes them suitable for analyzing time-series data such as patient health records, longitudinal medical imaging, and other sequential medical datasets.Tumor detection often involves analyzing medical images (e.g., MRI, CT scans) taken over a period of time. RNNs can be used to track changes in these images sequentially to detect the growth or appearance of tumors.Tumor development is a dynamic process, where the size, shape, and characteristics of the tumor change over time. RNNs can model these temporal dynamics by analyzing sequences of medical images, detecting subtle changes that indicate tumor growth or regression.The model is evaluated using a separate validation set, achieving high sensitivity and specificity in detecting tumor development.RNNs, especially LSTM and GRU networks, are powerful tools for detecting tumors by analyzing sequential medical data. Their ability to capture temporal dependencies makes them ideal for tracking changes in medical images over time, providing early and accurate detection of tumors, which is crucial for effective treatment and improved patient outcomes.

5. Future Scope:

After reviewing a number of articles, The integration of machine learning (ML) algorithms in the healthcare sector, particularly for the prevention and early detection of uterine tumors, presents a promising future with numerous potential advancements. Machine learning can analyze past treatment outcomes to predict which treatment plans are most likely to be effective for individual patients, thereby improving treatment success rates and reducing the risk of recurrence. Machine learning can be used to analyze genomic data to understand the genetic mutations that lead to uterine tumors. This understanding can lead to the development of targeted therapies and preventive strategies. Predictive models can be developed to identify individuals at high genetic risk of developing uterine tumors, enabling early interventions and personalized preventive measures. The future scope of using machine learning algorithms for preventing uterine tumors is vast and multifaceted. By leveraging the power of ML, healthcare providers can achieve earlier detection, more accurate diagnosis, personalized treatment plans, and ultimately, better patient outcomes. Continuous advancements in technology, coupled with interdisciplinary collaboration, will be key to realizing the full potential of machine learning in preventing uterine tumors.

Conclusion:

This review examines current methodologies and can be utilized in the future to build effective diagnostic tools for additional MRI imaging modalities. Implementing this system in collaboration with multiple deep learning algorithms as deep hybrid learning for Uterine tumor detection and classification will be future work for this study. The accurate uterine tumor detection is still very demanding because of tumor appearance, variable size, shape, and structure. Although tumor segmentation methods have shown high potential in analyzing and detecting the tumor in MR images,still many improvements are required to accurately segment and classify the tumor region. Existing work has limitations and challenges for identifying substructures of tumor regions and classification of healthy and unhealthy images.In short, this survey covers all important aspects and latest work done so far with their limitations and challenges. It will be helpful for the researchers to develop an understanding of doing new research in a short time and in the correct direction.The deep learning methods have contributed significantly but still require a generic technique. These methods provide better results when training and testing are performed on similar acquisition characteristics; however, a slight variation in the training and testing images directly affects the robustness of the methods. In future work, research can be conducted to detect uterine tumors more accurately, using real patient data from any medium (different image acquisition (scanners). Handcrafted and deep features can be fused to improve the classification results. Similarly, lightweight methods such as quantum machine learning play significant role to improve the accuracy and efficacy that save the time of radiologists and increase the survival rate of patients. Both Support Vector Machines (SVM) and Convolutional Neural Networks (CNN) are powerful tools in the realm of tumor prediction and detection. SVMs excel in structured data environments, offering robust classification with interpretability, while CNNs shine in image-based tasks, leveraging deep learning for high-accuracy predictions. The choice between these algorithms ultimately depends on the specific nature of the data, the objectives of the research or clinical application, and the available resources. By understanding their strengths and limitations, researchers and healthcare professionals can make informed decisions to advance tumor prediction and improve patient outcomes. Through ongoing research and technological advancements, these algorithms continue to evolve, promising even greater capabilities in the future of medical diagnostics and personalized medicine.

References

1. Marina Adriana Mercioni,Stefan Holban,2024-Ieee,"Uterine Corpus Endometrial Carcinoma Prediction from Genomic Analysis with Machine Learning".

2.Shahadat Uddin1, Ibtisham Haque2 , Haohui Lu1 , MohammadAli Moni3 & ErgunGide4-Comparative performance analysis of K-nearest neighbour (KNN) algorithm and its different variants for disease prediction 2022 nature Scientific Reports.

3. Shubhangi Solanki 1, Uday Pratap Singh 2, (Member, Ieee),Siddharth Singh Chouhan 3, And Sanjeev Jain."Brain Tumor Detection and Classification Using Intelligence Techniques".2023-IEEE.

4. Rex Paolo C.Gamara Romano Q.Neyra -"Behavior-Base Early Cervical Cancer Risk Detection Using Artificial Neural Networks".

5. Joshua Sheehy a, Hamish Rutledge a, U. Rajendra Acharya b, Hui Wen Loh c, Raj Gururajan d, Xiaohui Tao e, Xujuan Zhou e, Yuefeng Li f, Tiana Gurney.- Gynecological cancer prognosis using machine learning techniques: "A systematic review of the last three decades (1990–2022)".

6. Sakthivel Sankaran, Yogapriya Sridharan, Bhavadharani Veerakrishnan, Pallikonda Rajasekaran, Murugan, Vishnuvardhanan Govindaraj and Preethika Immaculate Britto- "A Literature Review: To predict the Problem,of Post Analysis in Breast Cancer,Determination using the Wearable Device"-2020-IEEE.

7. Md Mamun Ali Kawsar Ahmed Francis M. Bui b, Bikash Kumar Paul,Sobhy M. Ibrahim d, Julian M.W. Quinn e, Mohammad Ali Moni-2021 -"Machine learning-based statistical analysis for early stage detection of cervical cancer"

8.Sirvan Khalighi 1 , Kartik Reddy2 , Abhishek Midya1 , Krunal Balvantbhai Pandav1 , Anant Madabhushi 1,3 & Malak Abedalthagafi .2023-Springer Medicine."Artificial intelligence in neuro-oncology: advances and challenges in brain tumor diagnosis, prognosis, and precision treatment".

9. Muhammad Aamir A,Ziaur Rahman-"A deep learning approach for brain tumor classification using MRI images"-2022 Science Direct.