Sunan Kalijaga of Journal Physics
Vol. 5, No. 2, 2023, pp. 81 - 94
ISSN: 2715-0402, DOI:

Artificial Intellegent algorithms for Tumor Disease Detection: systematic Literature Review

Muhammad Hafid Alkarim [1], Iswanto Suwarno [2,*], Muhammad Ahmad Baballe [3], Mukhtar Ibrahim Bello [4]
[1] ITS PKU Muhammadiyah Surakarta, Surakarta, Indonesia
[2] Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
[3] Department of Mechatronics Engineering, Nigeria Defence Academy (N.D.A), Nigeria
[4] Department of computer science, School of Technology, Kano state polytechnic, Nigeria.
* Corresponding Author

ARTICLE INFO

Article history:

Received July 28, 2023
Revised August 28, 2023
Accepted September 28, 2023

Keywords:

Algorithms
Artificial Intelligence
Tumor Detection.

ABSTRACT

A Tumor is a swelling in the body caused by cells that multiply abnormally. Tumors or neoplasms consisting of benign tumors and malignant tumors. Benign tumors can grow larger but do not spread to other body tissues. Malignant tumors are cancers that attack the entire body and are uncontrollable. Comparison between the cell nucleus with the cytoplasm of malignant tumors, while benign tumors are the same as normal cells. Cancer cells can develop rapidly. These cells attack and damage body tissues through the bloodstream and lymph vessels so that they can grow in new places. One way to detect tumor disease is by utilizing Artificial intelligence algorithms for tumor Disease Detection. The purpose of this paper is for the development of Artificial Intellegent algorithms for the detection of tumor Diseases and optimization of Artificial Intellegent algorithms for the detection of tumor Diseases. This research uses systematic literature review by using preferred Reporting Items for Systematic Review (PRISMA). The results of screening and selection of articles obtained 64 potential articles that have met the inclusion criteria. The results showed that with earlier detection, a person can check tumor disease earlier using the help of Artificial intelligence algorithms. The results of research on the development of Artificial intelligence algorithms for detection of tumor Diseases have found Artificial intelligence algorithms that can be used to reduce the risk of tumor disease. Optimization of Artificial Intelegency algorithms for tumor classification, performing new data processing methods such as artificial intelligence can be selected to provide the accuracy of classification and diagnosis, exploration of detection limits is a very important aspect in tumor diagnosis based on SERS, finding improved and suitable nanoparticle substrates so as to significantly improve the original Raman signal.

Cite Article:

Muhammad Hafid Alkarim, Iswanto Suwarno, Muhammad Ahmad Baballe, and Mukhtar Ibrahim Bello, "Artificial Intellegent algorithms for Tumor Disease Detection: systematic Literature Review," *Sunan Kalijaga of Journal Physics*, vol. 5, no. 2, pp. 81 - 94, 2023, doi: .

1. INTRODUCTION

Based on Riskesdas data, the prevalence of tumors in Indonesia showed an increase from 1.4 per 1000 population in 2013 to 1.79 per 1000 population in 2018. The highest prevalence of cancer is in the province of Yogyakarta 4.86 per 1000 population, followed by West Sumatra 2.47 79 per 1000 population and Gorontalo 2.44 per 1000 population. Squamous cell malignant Tumor of the head and neck is a malignancy of the epithelium of the upper aerodigestive tract, including the paranasal sinuses, nasal cavity, oral cavity, pharynx and larynx [1]; [2]. The etiology of malignant tumors of the head of the neck is multifactorial, including genetics, carcinogenic substances such as cigarettes, betel nut, alcohol and viral infections such as Epstein-Barr virus and lately associated with Human Papilloma virus (especially HPV type 16 and HPV type 18).2.3 malignant tumors of the head and neck is the sixth most malignant tumor worldwide or 6% of all malignant tumors[3]; [4]; [5].

It is estimated that there are 650,000 new malignant tumors of the head of the neck each year and there are 350,000 deaths per year.The average age at which a malignant tumor of the head of the neck is diagnosed is the sixth decade. With more dominance in males. The incidence of malignant tumors of the head and neck varies in different countries [6]; [7]; [8]. In North America and Europe the incidence is estimated at 3-4% while in Southeast Asia and Africa the incidence of malignant tumors of the head and neck is estimated at 8-10% of all malignant tumors. The presence of artificial intelligence can help ease the human workload for example in making decisions, finding information more accurately or making computers easier to use with a more understandable display [9]. The way artificial intelligence works is to receive input, to then be processed and then issue an output in the form of a decision. According to [10], an expert system is the process of knowing and modeling human thought processes and designing machines to mimic human behavior. This intelligence or intelligence can be based on knowledge and experience, for that in order for the software developed to have intelligence, the software must be given a knowledge and ability to reason [11]; [12]. From the knowledge gained in finding solutions or conclusions like an expert in a specific field, artificial intelligence also offers media and intelligence theory tests [13]; [14]; [15]. Implementations of artificial intelligence today can be found in the field of Health, the above, AI finds application in the field of forecasting and quite a lot of research has been done on how to detect diseases [16]; [17]. One of the diseases that can be detected using intelligence from AI is tumor Disease [2];[18]; [19]; [20]; [21]. For the detection of tumor diseases can use Artificial Intelegency algorithms (for example, for tumor detection and histological assessment) have been developed for various tumor diseases[22]; [23]; [24]; [25].

Some of these AI-based tools have received first-time permission from the US Food and Drug Association and CE Marking as in-vitro diagnostics from the European Medicines Agency [26]; [27]; [28]; [29]; [30]. Although few studies have been conducted regarding the use of; AI algorithms for assessing endoscopic images, for radiological detection, and for classification of esophageal tumors, as well as for pathological detection and characterization of Barrett's lesions, to the best of our knowledge, only one small study has been conducted using AI-based algorithms to detect tumors in esophageal biopsies [31]; [32]; [33]; [34]. A previous study [35], Artificial intelligence for tumour tissue detection and histological regression grading in oesophageal adenocarcinomas: a retrospective algorithm development and validation study, explained that it is important to improve current AI and ML technologies and develop new programs that benefit patients. This article discusses the use of AI and ML algorithms in cancer prediction, including their current application, limitations, and future prospects. Another study [36], Clinical applications of artificial intelligence and machine learning in cancer diagnosis: looking into the future explains that by using an AI-based systems approach, researchers can collaborate in real-time and digitally share knowledge that has the potential to cure millions of people. In addition to previous studies, there is still a significant lack of understanding between experimental data and real-time collected data for tumor Diseases.

Based on previous research, there does not appear to be a systematic literature review that specifically reviews Artificial intelligence algorithms for Tumor Disease Detection: A systematic Literature Review. The purpose of this study is to examine the development and optimization of Artificial Intellegent algorithms for the detection of Tumor Diseases.

2. METHODS

This study uses a systematic literature review method using preferred Reporting Items for Systematic Review (PRISMA). Research is carried out systematically through the appropriate stages of research. The Data provided are comprehensive, balanced and aimed at synthesizing relevant research results. Stages of systematic literature review research, among others, writing background, research objectives, formulating research questions, literature search, screening and selection of relevant articles, screening and selection of appropriate research articles, further analysis, synthesis of qualitative findings, and making Research reports.

3. RESULTS AND DISCUSSION

Systematic literature review is one of the research methods that aims to identify, analyze, evaluate all the results of previous studies. The results have been obtained in accordance with the stages of research that has been done.

Formulate research questions

The results of the formulation of research questions related to Artificial Intellegent algorithms for the detection of Tumor Diseases: systematic literature review which can be seen in Table 1.

Chart 1. Research questions

Code	Research Questions	Motivation
RQ1	How is the development of Artificial intelligence algorithms for Tumor detection ?	Identification of articles related to the development of Artificial Intellegent algorithms for the detection of Tumor Diseases
RQ2	How to optimize Artificial intelligence algorithm for Tumor detection ?	Identification of articles related to optimization of Artificial Intellegent algorithms for detection of Tumor Diseases

Literature Search

Literature search is done on relevant articles by using keywords, i.e. algorithm, Artificial Intellegent, Tumor detection. Articles are collected from various databases, such as Scopus, Web of Science, and Researchgate (Publish or perish). The strategies used to search for articles are predefined inclusion and exclusion criteria. This aims to make a determination in finding the article you are looking for.

Screening and selection of articles

Screening and selection of articles using inclusion criteria to direct the search and selection of English-language research articles, full articles published in international journals from 2010-2023, which are indexed in the database, and have the theme of Artificial intelligence algorithms for the detection of Tumor Diseases . The results of screening and selection of articles using PRISMA chart obtained 145 articles from three databases, Pubmed, Web of Science, and Scopus (Figure 1). All articles (n= 145) are logged to Mendeley Desktop version 1.19.8, and articles that are duplicate, unqualified by automation tools, and deleted. In order, 21 articles were issued for several reasons mentioned in Figure 1. In the end, 64 articles were proposed for review in the article script. The resource persons in charge of conducting the assessment are two reviewers who work independently.

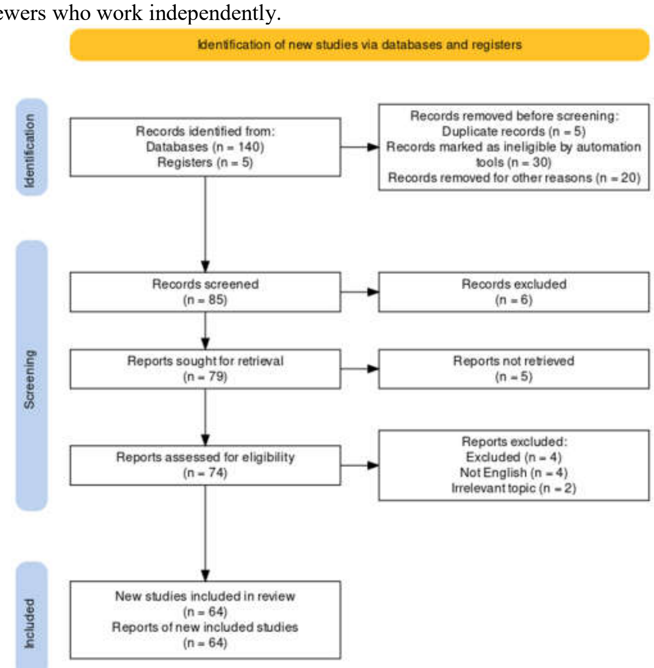


Figure 1. Prism chart

Data extraction, primary study quality test, and synthesis

Data extraction aims to collect data in order to answer the research questions that have been set. The research quality test plays a role in determining the interpretation of the findings synthesis and drawing up the conclusions described. Data synthesis aims to collect evidence from selected studies to answer research questions.

Discussion

Article search on three databases has been successfully done and obtained 145 articles. The results of screening and selection of articles obtained 64 potential articles that have met the inclusion criteria. Theme Artificial Intellegent algorithm for Tumor Disease Detection. Used as the theme of the new statement of the meta-analysis on 64 articles. In this theme, the author discusses the development of Artificial intelligence algorithms for the detection of Tumor Diseases and optimization of Artificial intelligence algorithms for the detection of Tumor Diseases.

Development of Artificial intelligence algorithms for Tumor Disease Detection

Article search on three databases has been successfully conducted and obtained 145 articles. The results of screening and selection of articles obtained 64 potential articles that have met the inclusion criteria. The theme of Artificial Intellegent algorithms for Tumor Disease Detection: systematic Literature Review was used as a new statement theme of the meta-analysis on 110 articles. In this theme, the author discusses the development of Artificial intelligence algorithms for the detection of Tumor Diseases and optimization of Artificial intelligence algorithms for the detection of Tumor Diseases. Begin by examining the tumor disease. The term tumor is more or less a synonym of the term neoplasm. The Tumor is a benign lump, microscopically and macroscopically the lump does not invade the surrounding tissue. The growth of benign tumors can be stopped through local surgical procedures so that patients can survive. Soft tissue tumors are tumors that are classified based on tissue derived from fat, neurovascular, and much more [37]. Some soft tissue tumors have an unknown derivation[38]; [39]; [40]; [41].

All tumor terms are simply defined as a swelling or clot, and sometimes the term " true tumor" is used to distinguish neoplasms from other clots. Neoplasms can be distinguished by their properties, some are benign and some are malignant [42]; [43].

Chart 1. Types of tumors based on tumor growth

Type	Explanation
Malignant tumor [44]; [45]	Malignant tumors are also called cancer. Cancer can attack and even damage tissue and metastasize (movement or spread of cancer cells from organ to organ).
Benign tumor[46]	Benign tumors do not invade tissues and do not metastasize, but can grow large. Cancer is definitely a tumor but the tumor is not definitely cancer

The cause of the occurrence of tumors according to [47] due to abnormal cell division. The difference in the nature of tumor cells depends on the magnitude of deviations in their shape and autonomous function in growth, their ability to infiltrate and cause metastasis. The causes of tumors or neoplasms are multifactor. There are several factors that are considered to be the cause of tumors, including [48]; [49]; [50] :

a. Carcinogens
b. Parasite
c. Genetic factors
d. Lifestyle factors
e. Hormone factor
f. Virus
g. Air pollution
h. Radiation coming from chemicals
i. Hypersensitivity to drugs

A Tumor is a disease process that begins when abnormal cells are altered by genetic mutations of cellular DNA [51]. DNA damage that causes increased activity, oncogenes, changes in genes that regulate apoptosis, and inactivation of tumor suppressor genes so that cells are encouraged to continue to proliferate, loss of control over cell proliferation, loss of the ability to stop the cell cycle, and the ability to apoptosis [52]; [53]; [54]. Cells that were normal then do not function and continue to grow and divide (replicate) to form millions of new cells, giving rise to lumps that form new tissue (tumors/neoplasms). Neoplasm cells receive energy mainly from anaerobes because the cell's ability to oxidize is reduced, despite having complete enzymes for oxidation. The abnormal cells then become parasites in the body, which occurs is phagocyte nutrition by these abnormal cells. This causes normal cells to lack nutrients.

The intake of nutrients to the organs decreases and causes the metabolic processes in the body to increase and the intake of nutrients to decrease [55]; [56]; [57]; [58]. What happens is weakness, lethargy and fatigue. The mass of fibrosis tissue surrounds and defines the enveloping structure but does not invade it and cause swelling that compresses the pain nerves in the tissue and causes pain. The growing Tumor causes pressure on the organs around the abdomen [59]. Physiological functions may be impaired due to obstruction or suppression. An increasingly enlarged Tumor can stop intestinal motility, resulting in intestinal obstruction. These tumors can then press on the urethra and cause urethral obstruction leading to urinary retention. Other symptoms that can be found include : hematuria, dysuria, polakisuria, oliguria and anuria. When the tumor grows on the surface of the body, it can erode through the surface, breaking down the natural defenses of intact skin and mucous membranes and providing passage for microorganisms to enter [60]. Neoplastic cells divert nutrients for their own use, causing changes that reduce the patient's appetite[61]; [62]; [63]; [64]. In the early stages of the disease, changes in glucose metabolism lead to an increase in serum glucose levels, which produces negative feedback and results in anorexia (loss of appetite). In addition, the tumor secretes substances that decrease appetite by changing taste and smell, giving rise to an earlier feeling of fullness [65]; [66]. In many cases, rapid and unexplained weight loss is the first manifestation.

When the fibrotic tissue mass invades other tissues, abnormal cells also infiltrate the surrounding tissue and gain access to lymph and blood vessels, through these blood vessels the cells can be carried to other areas of the body to form metastases (tumor spread)to other parts of the body. Metastases transmitted through blood or lymph allow new tumors to form in distant organs. The ability of tumors to metastasize by intravasation of malignant cells through the wall in the blood or lymph and into the blood circulation. One of them is to metastasize to the bone marrow, which causes hematopoiesis disorders [67]; [68]; [69]. Thus, the danger of tumor disease should be done immediately for the Prevention of tumor disease detection as early as possible.

Chart 3. The main methods for detecting tumors

The main methods of tumor detection	Explanation
Tumor markers	Tumor marker detection is used for early monitoring of tumors from the perspective of Molecular Biology, which are prone to individual differences and certain benign diseases [70]; [71], only some types of cancer have specific markers, such as alpha-fetoprotein, tumor markers, liver cancer.
Imaging	Imaging methods of diagnosis are usually used only as auxiliary tools in clinical practice [72]. Since the imaging diagnosis method can only identify the shape and size of the tumor at an early stage, it cannot accurately identify benign and malignant tumors qualitatively, with a high ratio of false positives

Histopathology	Histopathology is the" gold standard " for the clinical application of tumor diagnosis [73]; [74], which can be traced to 100 years ago. In this method, cell types and subtypes of cancer, both benign and malignant, as well as tumor stage can be known through tissue biopsy and cell scale for further tumor treatment

The development of tumor disease detection has begun to be done with the use of Artificial Intellegent algorithms:

A.Artificial intelligence with Raman spectroscopy

Tumor Diagnosis Raman spectroscopy can be easily collected from the commercial instrument" Confocal Raman Microscope", which has been widely applied in tumor diagnosis. Data processing is essential for tumor diagnosis based on Raman spectroscopy[75]; [76]; [77]; [78]; [79]; [80]; [81]. The conventional method of spectrochemical analysis is to process the original Raman data through several simple algorithms and then output the results, manually identify the difference between the output data of normal samples and cancer samples, and assess the ownership of unknown samples, such as the main component. quadratic discriminant analysis (PCA), linear discrimination analysis (LDA), quadratic discriminant analysis (QDA), partial least squares (PLS),. This method has a great advantage in the processing of small sample data.

As technology develops, the amount of data obtained increases significantly, making it difficult to calculate and extract subtle variations in complex hidden features from big data with conventional methods. Machine learning is a system that can independently obtain and integrate knowledge, find hidden features to significantly strengthen the difference between normal samples and cancer samples, and independently assess the affiliation of unknown samples, such as supporting vector machine (SVM), random forest (RF). [82]; [83]; [84], etc. Machine learning has been widely used in the field of biomedical photonics. In addition, AI is a kind of computational model that abstracts the neural network of the human brain from the perspective of information processing. It has the characteristics of nonlinear, indefinite, strong adaptability and fault tolerance. In contrast, non-AI methods primarily start from the data itself, extract features through Matrix transformations and other methods, and lastly perform classification and regression through modeling. In this chapter, we first introduce conventional procedures in tumor diagnosis based on Raman spectroscopy, and then focus on the application of AI in tumor diagnosis.

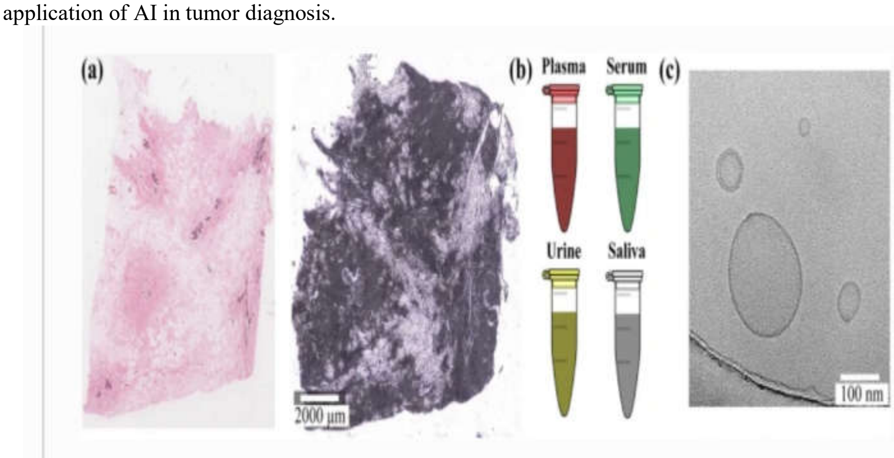
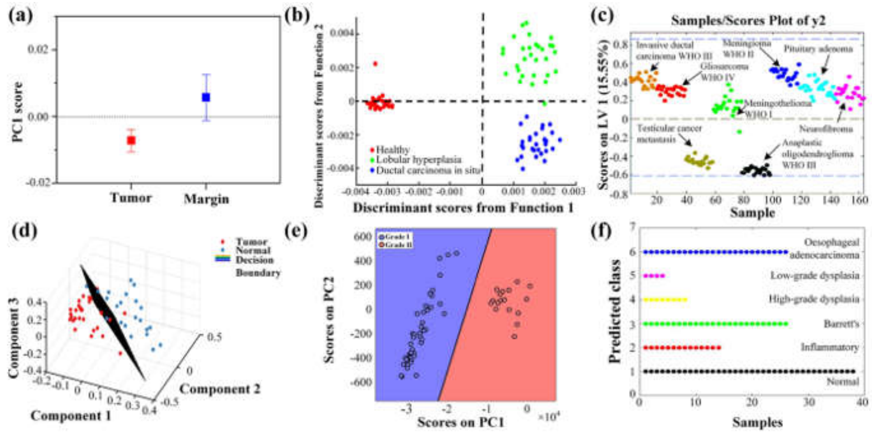


Figure 2. Sample preparation for tumor diagnosis by Raman spectroscopy (a) white light micrograph of stained and uncolored sections of frozen healthy breast tissue ; (b) Raman spectra of human body fluids (plasma, serum, urine, saliva) to identify cancer; (c) cryo transmission electron microscope images of EV).



Gambar 3. Multivariate statistical analysis for tumor diagnosis by Raman spectroscopy (a) PCA analysis result of tumoral tissue and healthy margin; b) PCA-LDA analysis result of breast cancer; c) PLS-DA analysis result of different cancers; d) PLS-LDA analysis result of oral cancer; e) PCA-QDA analysis result of meningiomas; f) GA-QDA analysis result of esophageal cancer.)

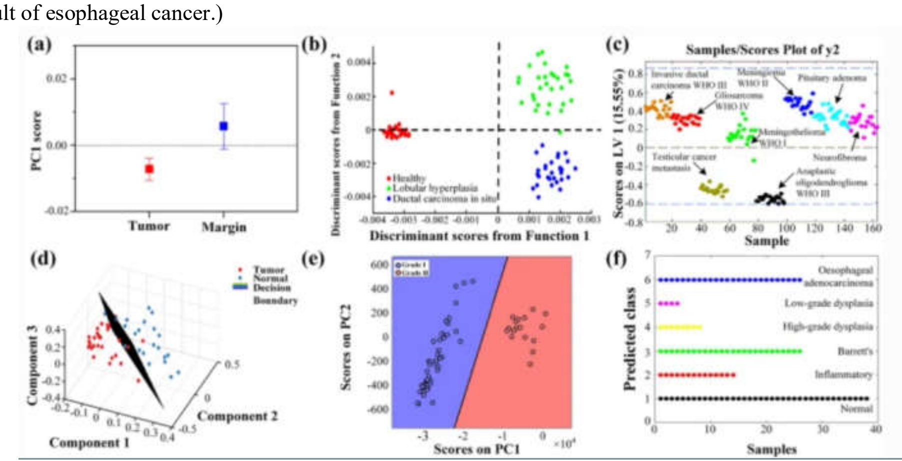


Figure 4. Multivariate statistical analysis for tumor diagnosis by Raman spectroscopy, PCA analysis results of tumor tissue and healthy margins ; b PCA-LDA analysis results of breast cancer ; c PLS-DA analysis results of various types of cancer ; d PLS-LDA analysis results of oral cancer ; e
PCA-QDA meningioma analysis results; f GA-QDA esophageal cancer analysis results.

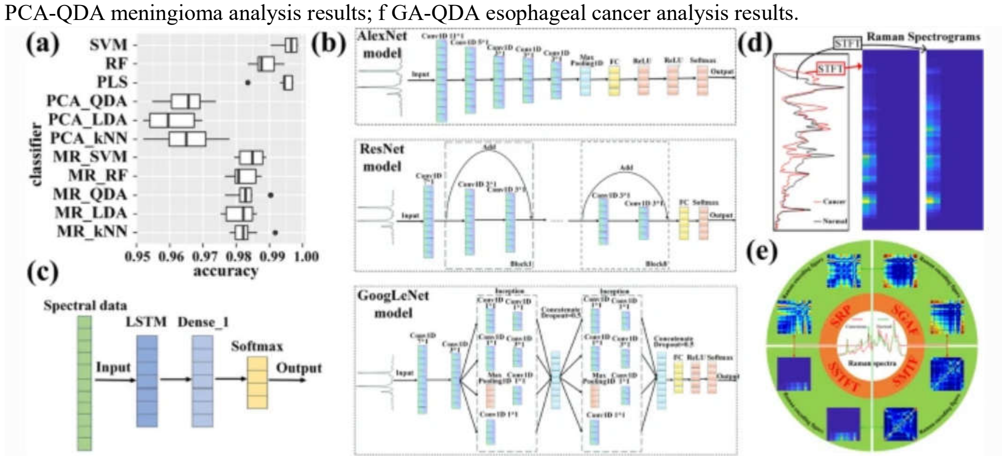


Figure 5. AI methods for tumor diagnosis with Raman spectroscopy a) accuracy of classification of bladder cancer cells of different levels from 11 classifiers; b) three classical CNN model structures (AlexNet, ResNet and GoogLeNet) for the diagnosis of gliomas; c) RNN model structures for the diagnosis of lung cancer and gliomas; d) conversion of Raman spectral signals into 2D Raman spectrograms ; e) Raman coding numbers.

B. Artificial intelligence with SERS

SERS can significantly improve the sample detection signal, tumor diagnosis methods based on SERS are widely used to detect small molecules such as cells and biomarkers, so the processing of collected Raman signals is often used for calibration of detection limits. Of course, some Raman signals are used for classification diagnosis, where researchers usually use multivariate statistical methods for classification. Nevertheless, artificial intelligence methods also provide unique methods for classification diagnosis in order to increase accuracy, such as breast cancer [85], tumors [86]. For ML methods in general, SVM is the most widely used classification method [87].

[88], using urinary SERS combined with SVM methods to identify liver cirrhosis (88.9% sensitivity, 83.3% specificity, and 85.9% accuracy) and hepatocellular carcinoma (85.5% sensitivity, 84.0% specificity, and 84.8% accuracy), while [89]; [90], also applied SERS technique combined with SVM to identify and dissect non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC) cells from normal cells including blood cells and immortalized lung cells, thus achieving 98.8% classification accuracy between NSCLC cells and normal cells and achieving 100% accuracy in the classification of SCLC cells and normal cells, as well as SCLC cells and NSCLC cells [91]; [92], except SVM method. [93], applied the classification tree method to the analysis of EVs biomarker expression levels in pancreatic cancer, chronic pancreatitis, and normal control individuals, measuring sensitivity and specificity by 0.95 and 0.96, respectively. . In addition, [94], differentiating EVs isolated from different ovarian cancer cell lines by machine learning methods based on logistic regression with accuracy, sensitivity, and specificity.

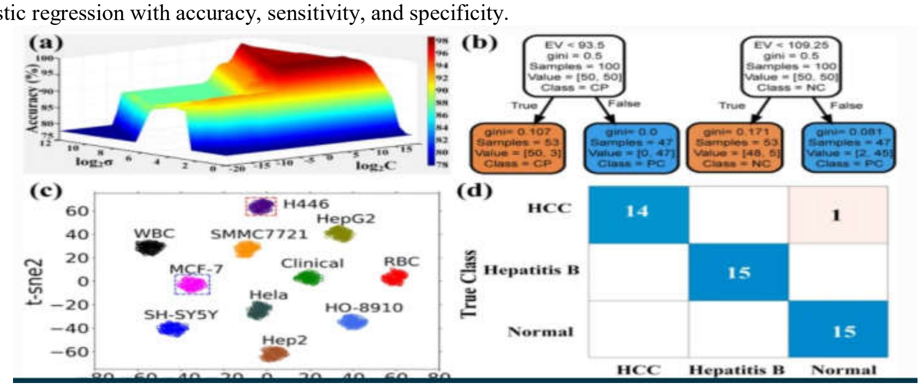


Figure 6. AI method for tumor diagnosis with SERS a)3D classification accuracy map for SVM model; b) EVs biomarker expression level classification tree analysis; c) residual tissue classification results of various tumor cells and blood cells; d) CNN classifier results from an independent test data set to recognize serum SERS Spectra. The development of artificial intelligence algorithms for tumor detection described above is increasingly progressing. With the help of Artificial intelligence algorithms for Tumor detection.

Optimization of artificial Intellegent algorithm for Tumor Disease Detection

With the advancement of artificial intelligence, machine learning (ML) has been applied in detectors based on Raman spectroscopy with higher accuracy. Here, conventional ML, SVM, RF methods, have been producing high accuracy for many years. Recently, deep learning, one of the branches of machine learning, has achieved better accuracy for tumor detection. For the optimization of Artificial Intellegent algorithms for the detection of Tumor Diseases, performing new data processing methods such as artificial intelligence can be selected to provide the accuracy of classification and diagnosis, exploration of detection limits is a very important aspect in the diagnosis of tumors based on SERS [9]. Finding an improved and suitable nanoparticle substrate can therefore significantly improve the original Raman signal. Appropriate data processing methods should be selected for further examination of tumor samples in order to achieve an accurate diagnosis of tumor subtypes [95]; [96]; [97]. the key to tumor diagnosis based on SERS is to find an improved and suitable nanoparticle substrate so as to significantly improve the original Raman signal. Because the original Raman signal is weak, the difference between the normal sample and the cancer sample will become larger after the increase. Therefore, the exploration of detection limits is a very important aspect in the diagnosis of tumors based on SERS [98].

On the contrary, due to the improvement of the signals carried by SERS technology, the processing of classification data and diagnosis of tumors based on SERS has become easier, and multivariate statistical methods are often used to distinguish them. However, although multivariate statistical methods have achieved high classification accuracy, but from the data processing of SERS-based tumor diagnosis methods, classification accuracy can still be improved, especially if artificial intelligence methods are used for data processing and classification, which has been proven by some literature. In fact, there is still relatively little literature on this diagnostic method using artificial intelligence [99]; [100]; [101]; [102]. In the future, the diagnosis of tumors based on SERS should begin from two aspects: signal enhancement and classification diagnosis[103]; [104]; [105]. On the one hand, more suitable SERS substrates with a greater increase in signal intensity should be sought from the perspective of biocompatibility and spatial distribution. On the other hand, for tumor classification, new data processing methods such as artificial intelligence can be selected to provide classification and diagnosis accuracy [106]; [107]; [108].

It is very important to know the limitations of the model in accurately classifying certain images. One of the main challenges we encountered was the misclassification of images due to their low resolution and unclear characteristics. These factors have a significant impact on the model's ability to extract meaningful features and patterns for accurate classification. The lack of clarity and fine detail in low-resolution images creates difficulties for models in capturing important discriminatory information [109]; [110]. As a result, the model may have difficulty classifying the image, leading to misidentification. While efforts have been made to optimize model performance, including fine-tuning the architecture and adjusting parameters, our current approach cannot fully address the inherent limitations posed by low resolution and unclear image quality. To overcome the inherent limitations brought about by low resolution and unclear image quality. Overcoming these limitations requires further research and potential improvements in pre-processing techniques or considering alternative approaches specifically designed to handle low-resolution or indistinct images.

4. CONCLUSION

A Tumor is a lump or group of abnormal cells with a dense consistency that can form in any part of the body. This lump occurs because of changes in the growth of cells in the body that takes place very quickly. Tumors or neoplasms are often associated with cancer. Early detection and diagnosis of tumors is essential to take adequate preventive measures, as is the case with most cancers. On the other hand, artificial intelligence (AI) has grown exponentially, and AI optimization for tumor detection must continue to be improved even in complex environments such as medicine in order to reduce mortality from tumor Diseases.

DECLARATION

Supplementary Materials

The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Figure S1: title; Table S1: title; Video S1: title.

Author Contribution

All authors contributed equally to the main contributor to this paper. All authors have read and agreed to the published version of the manuscript.

Funding

Please add: “This research received no external funding” or “This research was funded by NAME OF FUNDER, grant number XXX” and “The APC was funded by XXX”.

Acknowledgments

In this section, you can acknowledge any support given which is not covered by the author con-tribution or funding sections. This may include administrative and technical support, or donations in kind (e.g., materials used for experiments).

Conflict of Interest

Declare conflicts of interest or state “The authors declare no conflict of interest.”

REFERENCES

[1] F. Kabagenyi, J. Otiti, J. Namwagala, A. Kamulegeya, and S. Kalungi, “A descriptive study of human papilloma virus in upper aero-digestive squamous cell carcinoma at Uganda cancer institute assessed by P16 immunohistochemistry,” Cancers Head Neck, vol. 5, no. 1, p. 10, Dec. 2020, doi: 10.1186/s41199-020-00057-3.
[2] J. M. Shin, P. Kamarajan, J. C. Fenno, A. H. Rickard, and Y. L. Kapila, “Metabolomics of Head and Neck Cancer: A Mini-Review,” Front. Physiol., vol. 7, Nov. 2016, doi: 10.3389/fphys.2016.00526.
[3] D. E. Johnson, B. Burtness, C. R. Leemans, V. W. Y. Lui, J. E. Bauman, and J. R. Grandis, “Head and neck squamous cell carcinoma,” Nat Rev Dis Primers, vol. 6, no. 1, p. 92, Nov. 2020, doi: 10.1038/s41572-020-00224-3.
[4] H. Sung et al., “Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries,” CA A Cancer J Clinicians, vol. 71, no. 3, pp. 209–249, May 2021, doi: 10.3322/caac.21660.
[5] E. P. Lin et al., “Head and Neck Paragangliomas: An Update on the Molecular Classification, State-of-the-Art Imaging, and Management Recommendations,” Radiology: Imaging Cancer, vol. 4, no. 3, p. e210088, May 2022, doi: 10.1148/rycan.210088.
[6] J. S. Bell et al., “Global incidence of brain and spinal tumors by geographic region and income level based on cancer registry data,” Journal of Clinical Neuroscience, vol. 66, pp. 121–127, Aug. 2019, doi: 10.1016/j.jocn.2019.05.003.
[7] J. M. Gilyoma, P. F. Rambau, N. Masalu, N. M. Kayange, and P. L. Chalya, “Head and neck cancers: a clinico-pathological profile and management challenges in a resource-limited setting,” BMC Res Notes, vol. 8, no. 1, p. 772, Dec. 2015, doi: 10.1186/s13104-015-1773-9.
[8] A. Barsouk, J. S. Aluru, P. Rawla, K. Saginala, and A. Barsouk, “Epidemiology, Risk Factors, and Prevention of Head and Neck Squamous Cell Carcinoma,” Medical Sciences, vol. 11, no. 2, p. 42, Jun. 2023, doi: 10.3390/medsci11020042.
[9] Z. Chen, “Collaboration among recruiters and artificial intelligence: removing human prejudices in employment,” Cogn Tech Work, vol. 25, no. 1, pp. 135–149, Feb. 2023, doi: 10.1007/s10111-022-00716-0.
[10] Y. Jiang, X. Li, H. Luo, S. Yin, and O. Kaynak, “Quo vadis artificial intelligence?,” Discov Artif Intell, vol. 2, no. 1, p. 4, Mar. 2022, doi: 10.1007/s44163-022-00022-8.
[11] S. F. Ahmad et al., “Impact of artificial intelligence on human loss in decision making, laziness and safety in education,” Humanit Soc Sci Commun, vol. 10, no. 1, p. 311, Jun. 2023, doi: 10.1057/s41599-023-01787-8.
[12] R. Pishghadam, M. Faribi, M. Kolahi Ahari, F. Shadloo, M. J. Gholami, and S. Shayesteh, “Intelligence, emotional intelligence, and emo-sensory intelligence: Which one is a better predictor of university students’ academic success?,” Front. Psychol., vol. 13, p. 995988, Aug. 2022, doi: 10.3389/fpsyg.2022.995988.

[13] A. Eric Msughter, A. Ogechi Perpetua, and A. Lillian Itiafa, "Artificial Intelligence and the Media: Revisiting Digital Dichotomy Theory," in Information Systems Management, R. Raja and H. Raja, Eds., IntechOpen, 2023. doi: 10.5772/intechopen.108042.
[14] Y. Zhai, J. Yan, H. Zhang, and W. Lu, "Tracing the evolution of AI: conceptualization of artificial intelligence in mass media discourse," IDD, vol. 48, no. 3, pp. 137–149, Apr. 2020, doi: 10.1108/IDD-01-2020-0007.
[15] M.-F. de-Lima-Santos and W. Ceron, "Artificial Intelligence in News Media: Current Perceptions and Future Outlook," Journalism and Media, vol. 3, no. 1, pp. 13–26, Dec. 2021, doi: 10.3390/journalmedia3010002.
[16] O. Ali, W. Abdelbaki, A. Shrestha, E. Elbasi, M. A. A. Alryalat, and Y. K. Dwivedi, "A systematic literature review of artificial intelligence in the healthcare sector: Benefits, challenges, methodologies, and functionalities," Journal of Innovation & Knowledge, vol. 8, no. 1, p. 100333, Jan. 2023, doi: 10.1016/j.jik.2023.100333.
[17] Z. Chang et al., "Application of artificial intelligence in COVID-19 medical area: a systematic review," J Thorac Dis, vol. 13, no. 12, pp. 7034–7053, Dec. 2021, doi: 10.21037/jtd-21-747.
[18] M. Sufyan, Z. Shokat, and U. A. Ashfaq, "Artificial intelligence in cancer diagnosis and therapy: Current status and future perspective," Computers in Biology and Medicine, vol. 165, p. 107356, Oct. 2023, doi: 10.1016/j.compbiomed.2023.107356.
[19] E. Karger and M. Kureljusic, "Artificial Intelligence for Cancer Detection—A Bibliometric Analysis and Avenues for Future Research," Current Oncology, vol. 30, no. 2, pp. 1626–1647, Jan. 2023, doi: 10.3390/curroncol30020125.
[20] M. Ullah, A. Akbar, and G. Yannarelli, "Applications of artificial intelligence in, early detection of cancer, clinical diagnosis and personalized medicine," AIC, vol. 1, no. 2, pp. 39–44, Aug. 2020, doi: 10.35713/aic.v1.i2.39.
[21] M. Liu et al., "The value of artificial intelligence in the diagnosis of lung cancer: A systematic review and meta-analysis," PLoS ONE, vol. 18, no. 3, p. e0273445, Mar. 2023, doi: 10.1371/journal.pone.0273445.
[22] M. Sugimoto, S. Hikichi, M. Takada, and M. Toi, "Machine learning techniques for breast cancer diagnosis and treatment: a narrative review," Ann Breast Surg, vol. 7, pp. 7–7, Mar. 2023, doi: 10.21037/abs-21-63.
[23] J.-R. Lin et al., "High-plex immunofluorescence imaging and traditional histology of the same tissue section for discovering image-based biomarkers," Nat Cancer, vol. 4, no. 7, pp. 1036–1052, Jun. 2023, doi: 10.1038/s43018-023-00576-1.
[24] N. Ghaffar Nia, E. Kaplanoglu, and A. Nasab, "Evaluation of artificial intelligence techniques in disease diagnosis and prediction," Discov Artif Intell, vol. 3, no. 1, p. 5, Jan. 2023, doi: 10.1007/s44163-023-00049-5.
[25] J.-Y. Wang et al., "Stratified assessment of an FDA-cleared deep learning algorithm for automated detection and contouring of metastatic brain tumors in stereotactic radiosurgery," Radiat Oncol, vol. 18, no. 1, p. 61, Apr. 2023, doi: 10.1186/s13014-023-02246-z.
[26] G. A. Van Norman, "Drugs and Devices," JACC: Basic to Translational Science, vol. 1, no. 5, pp. 399–412, Aug. 2016, doi: 10.1016/j.jacbts.2016.06.003.
[27] C. Wollenhaupt, T. Sudhop, and W. Knoess, "A Systematic Database Approach to Identify Companion Diagnostic Testing in Clinical Trials under the New In Vitro Diagnostic Medical Devices Regulation," Diagnostics, vol. 13, no. 12, p. 2037, Jun. 2023, doi: 10.3390/diagnostics13122037.
[28] L. K. Vora, A. D. Gholap, K. Jetha, R. R. S. Thakur, H. K. Solanki, and V. P. Chavda, "Artificial Intelligence in Pharmaceutical Technology and Drug Delivery Design," Pharmaceutics, vol. 15, no. 7, p. 1916, Jul. 2023, doi: 10.3390/pharmaceutics15071916.
[29] V. Valla, S. Alzabin, A. Koukoura, A. Lewis, A. A. Nielsen, and E. Vassiliadis, "Companion Diagnostics: State of the Art and New Regulations," Biomark�Insights, vol. 16, p. 117727192110477, Jan. 2021, doi: 10.1177/11772719211047763.
[30] G. H. Javitt and E. R. Vollebregt, "Regulation of Molecular Diagnostics," Annu. Rev. Genom. Hum. Genet., vol. 23, no. 1, pp. 653–673, Aug. 2022, doi: 10.1146/annurev-genom-121521-010416.
[31] M. Mejza and E. Małecka-Wojciesko, "Diagnosis and Management of Barrett's Esophagus," JCM, vol. 12, no. 6, p. 2141, Mar. 2023, doi: 10.3390/jcm12062141.
[32] B. Merchán Gómez, L. Milla Collado, and M. Rodríguez, "Artificial intelligence in esophageal cancer diagnosis and treatment: where are we now?—a narrative review," Ann Transl Med, vol. 11, no. 10, pp. 353–353, Aug. 2023, doi: 10.21037/atm-22-3977.
[33] Y. Tokai, T. Yoshio, and J. Fujisaki, "Development of artificial intelligence for the detection and staging of esophageal cancer," Ann Esophagus, vol. 6, pp. 3–3, Mar. 2023, doi: 10.21037/aoe-2020-33.
[34] R. Pannala et al., "Artificial intelligence in gastrointestinal endoscopy," VideoGIE, vol. 5, no. 12, pp. 598–613, Dec. 2020, doi: 10.1016/j.vgie.2020.08.013.
[35] B. Zhang, H. Shi, and H. Wang, "Machine Learning and AI in Cancer Prognosis, Prediction, and Treatment Selection: A Critical Approach," JMDH, vol. Volume 16, pp. 1779–1791, Jun. 2023, doi: 10.2147/JMDH.S410301.
[36] M. J. Iqbal et al., "Clinical applications of artificial intelligence and machine learning in cancer diagnosis: looking into the future," Cancer Cell Int, vol. 21, no. 1, p. 270, May 2021, doi: 10.1186/s12935-021-01981-1.
[37] M. Alieva, J. Van Rheenen, and M. L. D. Broekman, "Potential impact of invasive surgical procedures on primary tumor growth and metastasis," Clin Exp Metastasis, vol. 35, no. 4, pp. 319–331, Apr. 2018, doi: 10.1007/s10585-018-9896-8.
[38] M. Van Vliet, M. Kliffen, G. P. Krestin, and C. F. Van Dijke, "Soft tissue sarcomas at a glance: clinical, histological, and MR imaging features of malignant extremity soft tissue tumors," Eur Radiol, vol. 19, no. 6, pp. 1499–1511, Jun. 2009, doi: 10.1007/s00330-008-1292-3.

[39] N. Sajko, S. Murphy, and A. Tran, “Undifferentiated epithelioid sarcoma presenting as a fever of unknown origin: a case report,” J Med Case Reports, vol. 13, no. 1, p. 24, Dec. 2019, doi: 10.1186/s13256-018-1951-1.
[40] E. Rassy et al., “Sarcoma of unknown primary: myth or reality?,” J Egypt Natl Canc Inst, vol. 34, no. 1, p. 27, Dec. 2022, doi: 10.1186/s43046-022-00128-1.
[41] X. Liu et al., “Predicting Cancer Tissue-of-Origin by a Machine Learning Method Using DNA Somatic Mutation Data,” Front. Genet., vol. 11, p. 674, Jul. 2020, doi: 10.3389/fgene.2020.00674.
[42] K. Rahbar et al., “Differentiation of Malignant and Benign Cardiac Tumors Using 18 F-FDG PET/CT,” J Nucl Med, vol. 53, no. 6, pp. 856–863, Jun. 2012, doi: 10.2967/jnumed.111.095364.
[43] F. Yan, Z. Song, M. Du, and A. L. Klibanov, “Ultrasound molecular imaging for differentiation of benign and malignant tumors in patients,” Quant. Imaging Med. Surg, vol. 8, no. 11, pp. 1083–1083, Dec. 2018, doi: 10.21037/qims.2018.12.08.
[44] A. Patel, “Benign vs Malignant Tumors,” JAMA Oncol, vol. 6, no. 9, p. 1488, Sep. 2020, doi: 10.1001/jamaoncol.2020.2592.
[45] T. T. Tang, J. A. Zawaski, K. N. Francis, A. A. Qutub, and M. W. Gaber, “Image-based Classification of Tumor Type and Growth Rate using Machine Learning: a preclinical study,” Sci Rep, vol. 9, no. 1, p. 12529, Aug. 2019, doi: 10.1038/s41598-019-48738-5.
[46] M. Valet and P. Narbonne, “Formation of benign tumors by stem cell deregulation,” PLoS Genet, vol. 18, no. 10, p. e1010434, Oct. 2022, doi: 10.1371/journal.pgen.1010434.
[47] R. Baghban et al., “Tumor microenvironment complexity and therapeutic implications at a glance,” Cell Commun Signal, vol. 18, no. 1, p. 59, Dec. 2020, doi: 10.1186/s12964-020-0530-4.
[48] K. D. Miller et al., “Brain and other central nervous system tumor statistics, 2021,” CA A Cancer J Clinicians, vol. 71, no. 5, pp. 381–406, Sep. 2021, doi: 10.3322/caac.21693.
[49] M.-A. Majérus, “The cause of cancer: The unifying theory,” Advances in Cancer Biology - Metastasis, vol. 4, p. 100034, Jul. 2022, doi: 10.1016/j.adcanc.2022.100034.
[50] A. I. Riggio, K. E. Varley, and A. L. Welm, “The lingering mysteries of metastatic recurrence in breast cancer,” Br J Cancer, vol. 124, no. 1, pp. 13–26, Jan. 2021, doi: 10.1038/s41416-020-01161-4.
[51] A. Nishiyama and M. Nakanishi, “Navigating the DNA methylation landscape of cancer,” Trends in Genetics, vol. 37, no. 11, pp. 1012–1027, Nov. 2021, doi: 10.1016/j.tig.2021.05.002.
[52] M. I. Carr and S. N. Jones, “Regulation of the Mdm2-p53 signaling axis in the DNA damage response and tumorigenesis,” Transl. Cancer Res., vol. 5, no. 6, pp. 707–724, Dec. 2016, doi: 10.21037/tcr.2016.11.75.
[53] D. Hanahan and R. A. Weinberg, “The Hallmarks of Cancer,” Cell, vol. 100, no. 1, pp. 57–70, Jan. 2000, doi: 10.1016/S0092-8674(00)81683-9.
[54] H. E. Marei et al., “p53 signaling in cancer progression and therapy,” Cancer Cell Int, vol. 21, no. 1, p. 703, Dec. 2021, doi: 10.1186/s12935-021-02396-8.
[55] S. Amarya, K. Singh, and M. Sabharwal, “Changes during aging and their association with malnutrition,” Journal of Clinical Gerontology and Geriatrics, vol. 6, no. 3, pp. 78–84, Sep. 2015, doi: 10.1016/j.jcgg.2015.05.003.
[56] S. R. El-Zayat, H. Sibaii, and K. A. El-Shamy, “Physiological process of fat loss,” Bull Natl Res Cent, vol. 43, no. 1, p. 208, Dec. 2019, doi: 10.1186/s42269-019-0238-z.
[57] A. M. Valdes, J. Walter, E. Segal, and T. D. Spector, “Role of the gut microbiota in nutrition and health,” BMJ, p. k2179, Jun. 2018, doi: 10.1136/bmj.k2179.
[58] N. Casanova, K. Beaulieu, G. Finlayson, and M. Hopkins, “Metabolic adaptations during negative energy balance and their potential impact on appetite and food intake,” Proc. Nutr. Soc., vol. 78, no. 3, pp. 279–289, Aug. 2019, doi: 10.1017/S0029665118002811.
[59] A. Gupta, R. Sedhom, and M. S. Beg, “Ascites, or Fluid in the Belly, in Patients With Cancer,” JAMA Oncol, vol. 6, no. 2, p. 308, Feb. 2020, doi: 10.1001/jamaoncol.2019.5409.
[60] J. Briffa, E. Sinagra, and R. Blundell, “Heavy metal pollution in the environment and their toxicological effects on humans,” Heliyon, vol. 6, no. 9, p. e04691, Sep. 2020, doi: 10.1016/j.heliyon.2020.e04691.
[61] A. Csibi and J. Blenis, “Appetite for destruction: the inhibition of glycolysis as a therapy for tuberous sclerosis complex-related tumors,” BMC Biol, vol. 9, no. 1, p. 69, Dec. 2011, doi: 10.1186/1741-7007-9-69.
[62] N. Kedia-Mehta and D. K. Finlay, “Competition for nutrients and its role in controlling immune responses,” Nat Commun, vol. 10, no. 1, p. 2123, May 2019, doi: 10.1038/s41467-019-10015-4.
[63] C. L. Rock et al., “American Cancer Society nutrition and physical activity guideline for cancer survivors,” CA A Cancer J Clinicians, vol. 72, no. 3, pp. 230–262, May 2022, doi: 10.3322/caac.21719.
[64] T. Fiolet et al., “Consumption of ultra-processed foods and cancer risk: results from NutriNet-Santé prospective cohort,” BMJ, p. k322, Feb. 2018, doi: 10.1136/bmj.k322.
[65] R. Hao and H. Guo, “Anorexia, undernutrition, weight loss, sarcopenia, and cachexia of aging,” Eur Rev Aging Phys Act, vol. 9, no. 2, pp. 119–127, Oct. 2012, doi: 10.1007/s11556-012-0103-7.
[66] M. E. J. Lean and D. Malkova, “Altered gut and adipose tissue hormones in overweight and obese individuals: cause or consequence?,” Int J Obes, vol. 40, no. 4, pp. 622–632, Apr. 2016, doi: 10.1038/ijo.2015.220.
[67] N. Del Piccolo et al., “Tumor-on-chip modeling of organ-specific cancer and metastasis,” Advanced Drug Delivery Reviews, vol. 175, p. 113798, Aug. 2021, doi: 10.1016/j.addr.2021.05.008.
[68] T. T. Lah, M. Novak, and B. Breznik, “Brain malignancies: Glioblastoma and brain metastases,” Seminars in Cancer Biology, vol. 60, pp. 262–273, Feb. 2020, doi: 10.1016/j.semcancer.2019.10.010.

[69] E. Farahani et al., “Cell adhesion molecules and their relation to (cancer) cell stemness,” Carcinogenesis, vol. 35, no. 4, pp. 747–759, Apr. 2014, doi: 10.1093/carcin/bgu045.
[70] Y. Luan et al., “A panel of seven protein tumour markers for effective and affordable multi-cancer early detection by artificial intelligence: a large-scale and multicentre case–control study,” eClinicalMedicine, vol. 61, p. 102041, Jul. 2023, doi: 10.1016/j.eclinm.2023.102041.
[71] S. N. Lone et al., “Liquid biopsy: a step closer to transform diagnosis, prognosis and future of cancer treatments,” Mol Cancer, vol. 21, no. 1, p. 79, Mar. 2022, doi: 10.1186/s12943-022-01543-7.
[72] O. Oren, B. J. Gersh, and D. L. Bhatt, “Artificial intelligence in medical imaging: switching from radiographic pathological data to clinically meaningful endpoints,” The Lancet Digital Health, vol. 2, no. 9, pp. e486–e488, Sep. 2020, doi: 10.1016/S2589-7500(20)30160-6.
[73] M. Jiang et al., “Detection and clinical significance of circulating tumor cells in colorectal cancer,” Biomark Res, vol. 9, no. 1, p. 85, Nov. 2021, doi: 10.1186/s40364-021-00326-4.
[74] S. Krishna, S. S. Suganthi, A. Bhavsar, J. Yesodharan, and S. Krishnamoorthy, “An interpretable decision-support model for breast cancer diagnosis using histopathology images,” Journal of Pathology Informatics, vol. 14, p. 100319, 2023, doi: 10.1016/j.jpi.2023.100319.
[75] Y. Qi, Y. Liu, and J. Luo, “Recent application of Raman spectroscopy in tumor diagnosis: from conventional methods to artificial intelligence fusion,” PhotoniX, vol. 4, no. 1, p. 22, Jul. 2023, doi: 10.1186/s43074-023-00098-0.
[76] K. Hanna, E. Krzoska, A. M. Shaaban, D. Muirhead, R. Abu-Eid, and V. Speirs, “Raman spectroscopy: current applications in breast cancer diagnosis, challenges and future prospects,” Br J Cancer, vol. 126, no. 8, pp. 1125–1139, May 2022, doi: 10.1038/s41416-021-01659-5.
[77] D. V. Garcia et al., “Analysis of Raman spectroscopy data with algorithms based on paraconsistent logic for characterization of skin cancer lesions,” Vibrational Spectroscopy, vol. 103, p. 102929, Jul. 2019, doi: 10.1016/j.vibspec.2019.102929.
[78] F. Yin et al., “A novel detection technology for early gastric cancer based on Raman spectroscopy,” Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, vol. 292, p. 122422, May 2023, doi: 10.1016/j.saa.2023.122422.
[79] G. W. Auner et al., “Applications of Raman spectroscopy in cancer diagnosis,” Cancer Metastasis Rev, vol. 37, no. 4, pp. 691–717, Dec. 2018, doi: 10.1007/s10555-018-9770-9.
[80] M. Sharma et al., “Identification of Healthy Tissue from Malignant Tissue in Surgical Margin Using Raman Spectroscopy in Oral Cancer Surgeries,” Biomedicines, vol. 11, no. 7, p. 1984, Jul. 2023, doi: 10.3390/biomedicines11071984.
[81] F. E. R. Woods, C. A. Jenkins, R. A. Jenkins, S. Chandler, D. A. Harris, and P. R. Dunstan, “Optimised Pre-Processing of Raman Spectra for Colorectal Cancer Detection Using High-Performance Computing,” Appl Spectrosc, vol. 76, no. 4, pp. 496–507, Apr. 2022, doi: 10.1177/00037028221088320.
[82] S. Rostamzadeh, A. Abouhossein, M. Saremi, F. Taheri, M. Ebrahimian, and S. Vosoughi, “A comparative investigation of machine learning algorithms for predicting safety signs comprehension based on socio-demographic factors and cognitive sign features,” Sci Rep, vol. 13, no. 1, p. 10843, Jul. 2023, doi: 10.1038/s41598-023-38065-1.
[83] F. Yu, C. Wei, P. Deng, T. Peng, and X. Hu, “Deep exploration of random forest model boosts the interpretability of machine learning studies of complicated immune responses and lung burden of nanoparticles,” Sci. Adv., vol. 7, no. 22, p. eabf4130, May 2021, doi: 10.1126/sciadv.abf4130.
[84] P. Thanh Noi and M. Kappas, “Comparison of Random Forest, k-Nearest Neighbor, and Support Vector Machine Classifiers for Land Cover Classification Using Sentinel-2 Imagery,” Sensors, vol. 18, no. 2, p. 18, Dec. 2017, doi: 10.3390/s18010018.
[85] A. Irshad Khan et al., “Prediction of breast cancer based on computer vision and artificial intelligence techniques,” Measurement, vol. 218, p. 113230, Aug. 2023, doi: 10.1016/j.measurement.2023.113230.
[86] L. K. Singh, M. Khanna, and R. Singh, “Artificial intelligence based medical decision support system for early and accurate breast cancer prediction,” Advances in Engineering Software, vol. 175, p. 103338, Jan. 2023, doi: 10.1016/j.advengsoft.2022.103338.
[87] Z. Quan and L. Pu, “An improved accurate classification method for online education resources based on support vector machine (SVM): Algorithm and experiment,” Educ Inf Technol, vol. 28, no. 7, pp. 8097–8111, Jul. 2023, doi: 10.1007/s10639-022-11514-6.
[88] W. Dawuti et al., “Urine surface-enhanced Raman spectroscopy combined with SVM algorithm for rapid diagnosis of liver cirrhosis and hepatocellular carcinoma,” Photodiagnosis and Photodynamic Therapy, vol. 38, p. 102811, Jun. 2022, doi: 10.1016/j.pdpdt.2022.102811.
[89] X. Fang, S. Li, Q. Fu, P. Wang, X. Wu, and Y. Zhang, “Label-free identification of lung cancer cells from blood cells based on surface-enhanced Raman scattering and support vector machine,” Optik, vol. 248, p. 168157, Dec. 2021, doi: 10.1016/j.ijleo.2021.168157.
[90] J. Lei et al., “Label-free surface-enhanced Raman spectroscopy for diagnosis and analysis of serum samples with different types lung cancer,” Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, vol. 261, p. 120021, Nov. 2021, doi: 10.1016/j.saa.2021.120021.
[91] M. Kriegsmann et al., “Deep Learning for the Classification of Small-Cell and Non-Small-Cell Lung Cancer,” Cancers, vol. 12, no. 6, p. 1604, Jun. 2020, doi: 10.3390/cancers12061604.
[92] M. Zheng, “Classification and Pathology of Lung Cancer,” Surgical Oncology Clinics of North America, vol. 25, no. 3, pp. 447–468, Jul. 2016, doi: 10.1016/j.soc.2016.02.003.

[93] H. Zhou, L. Xu, Z. Ren, J. Zhu, and C. Lee, “Machine learning-augmented surface-enhanced spectroscopy toward next-generation molecular diagnostics,” Nanoscale Adv., vol. 5, no. 3, pp. 538–570, 2023, doi: 10.1039/D2NA00608A.
[94] L. A. McAlarnen, P. Gupta, R. Singh, S. Pradeep, and P. Chaluvally-Raghavan, “Extracellular vesicle contents as non-invasive biomarkers in ovarian malignancies,” Molecular Therapy - Oncolytics, vol. 26, pp. 347–359, Sep. 2022, doi: 10.1016/j.omto.2022.08.005.
[95] A.-L. Doebley et al., “A framework for clinical cancer subtyping from nucleosome profiling of cell-free DNA,” Nat Commun, vol. 13, no. 1, p. 7475, Dec. 2022, doi: 10.1038/s41467-022-35076-w.
[96] S. N. Lone et al., “Liquid biopsy: a step closer to transform diagnosis, prognosis and future of cancer treatments,” Mol Cancer, vol. 21, no. 1, p. 79, Mar. 2022, doi: 10.1186/s12943-022-01543-7.
[97] E. R. Malone, M. Oliva, P. J. B. Sabatini, T. L. Stockley, and L. L. Siu, “Molecular profiling for precision cancer therapies,” Genome Med, vol. 12, no. 1, p. 8, Dec. 2020, doi: 10.1186/s13073-019-0703-1.
[98] L. Shi, Y. Li, and Z. Li, “Early cancer detection by SERS spectroscopy and machine learning,” Light Sci Appl, vol. 12, no. 1, p. 234, Sep. 2023, doi: 10.1038/s41377-023-01271-7.
[99] I. Kononenko, “Machine learning for medical diagnosis: history, state of the art and perspective,” Artificial Intelligence in Medicine, vol. 23, no. 1, pp. 89–109, Aug. 2001, doi: 10.1016/S0933-3657(01)00077-X.
[100] D. Henckert et al., “Attitudes of Anesthesiologists toward Artificial Intelligence in Anesthesia: A Multicenter, Mixed Qualitative–Quantitative Study,” JCM, vol. 12, no. 6, p. 2096, Mar. 2023, doi: 10.3390/jcm12062096.
[101] B. Wahl, A. Cossy-Gantner, S. Germann, and N. R. Schwalbe, “Artificial intelligence (AI) and global health: how can AI contribute to health in resource-poor settings?,” BMJ Glob Health, vol. 3, no. 4, p. e000798, Aug. 2018, doi: 10.1136/bmjgh-2018-000798.
[102] Y. Tadavarthi et al., “The State of Radiology AI: Considerations for Purchase Decisions and Current Market Offerings,” Radiology: Artificial Intelligence, vol. 2, no. 6, p. e200004, Nov. 2020, doi: 10.1148/ryai.2020200004.
[103] C. Qiu et al., “Highly sensitive surface-enhanced Raman scattering (SERS) imaging for phenotypic diagnosis and therapeutic evaluation of breast cancer,” Chemical Engineering Journal, vol. 459, p. 141502, Mar. 2023, doi: 10.1016/j.cej.2023.141502.
[104] H. Qian et al., “Diagnosis of urogenital cancer combining deep learning algorithms and surface-enhanced Raman spectroscopy based on small extracellular vesicles,” Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, vol. 281, p. 121603, Nov. 2022, doi: 10.1016/j.saa.2022.121603.
[105] H. Shin et al., “Single test-based diagnosis of multiple cancer types using Exosome-SERS-AI for early stage cancers,” Nat Commun, vol. 14, no. 1, p. 1644, Mar. 2023, doi: 10.1038/s41467-023-37403-1.
[106] A. M. Al-Zoghby, E. M. K. Al-Awadly, A. Moawad, N. Yehia, and A. I. Ebada, “Dual Deep CNN for Tumor Brain Classification,” Diagnostics, vol. 13, no. 12, p. 2050, Jun. 2023, doi: 10.3390/diagnostics13122050.
[107] E. Nazari, M. Aghemiri, A. Avan, A. Mehrabian, and H. Tabesh, “Machine learning approaches for classification of colorectal cancer with and without feature selection method on microarray data,” Gene Reports, vol. 25, p. 101419, Dec. 2021, doi: 10.1016/j.genrep.2021.101419.
[108] A. U. Haq, J. P. Li, S. Khan, M. A. Alshara, R. M. Alotaibi, and C. Mawuli, “DACBT: deep learning approach for classification of brain tumors using MRI data in IoT healthcare environment,” Sci Rep, vol. 12, no. 1, p. 15331, Sep. 2022, doi: 10.1038/s41598-022-19465-1.
[109] T.-V. Dang, G.-H. Yu, and J.-Y. Kim, “Revisiting Low-Resolution Images Retrieval with Attention Mechanism and Contrastive Learning,” Applied Sciences, vol. 11, no. 15, p. 6783, Jul. 2021, doi: 10.3390/app11156783.
[110] H. Park et al., “Deep learning enables reference-free isotropic super-resolution for volumetric fluorescence microscopy,” Nat Commun, vol. 13, no. 1, p. 3297, Jun. 2022, doi: 10.1038/s41467-022-30949-6.