International Journal of Engineering & Technology, 7 (2.27) (2018) 104-108

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper



Automatic detection of ovarian cancer based on improved DWT transformation

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Abstract

Ovarian cancer sub-kinds are distinct pathologic individual with dissimilar prognostic and therapeutic suggestions. Histo-typing by pathologists has good reproducibility; therefore, occasional cases are challenging and require immuno-histo chemistry and sub-specialty discussion. Motivated by the need for more accurate and reproducible diagnosis and to facilitate pathologist's work-flow, implement an au-tomated system for ovarian cancer classification and identification. The main problem discussed for detecting procedure fields: (i) the cancer detection on ultra sound image is not easy to classify on the basis of clustering or segmentation. It can involve the False Acceptance Rate and False Rejection Rate higher at the interval of time recognition from the knowledge base. (ii)The working accuracy rate is 90 to 95 of Normal SVM existing systems. Our technique is implemented by detection of the cancer stage accordingly workflow. We implement im-ages of cancer at two enlargement and extract features like a, color, text and shape data using digital image processing techniques. We ana-lyze the machine-learning algorithm and spatial domain algorithm used to extract the features in four phases: LL, HL, LH and HH. Extract the features used to dimension reduction and a SVM classification to divide the 5 ovarian cancer stages. The research paper repre-sents, the details of our implementation and its validate on (Govt. hospital) clinically derived database of high-resolution diagnosis images. The new system attained a linear classification accuracy 98% when classifying un-seen tissues. The method has been implemented using simulation tool using MATLAB 2016a. The Ovarian Stages were then tested for the accuracy using transformation software. Testing consequences defined an accuracy of 94%, Specificity 0.99 and Sensitivity value is 0.9978 for MRI Medical Images respectively.

Keywords: *Cancer Detection; Wavelet Transformation and Machine Learning; Support Vector Machine.*

1. Introduction

In medicinal sciences pictures of human body help in understanding the idea of human natural framework. Restorative imaging assumes a vital part in location, finding and treatment of disease. Therapeutic imaging is initial phase in keeping the spread of malignancy through early location. Computer Tomography, Positron Emission Tomography, Single photon outflow PC tomography is a strategy to identify cancer [1].

Cancer is a medical symptom where abnormal cells began to grow in uncontrolled manner and also influence nearby tissues in human body. A tumor is primary name for initial stage of cancer [2]. Cancer is a hereditary disease caused by genes transformation. Genetic changes, which cause cancer, can be acquired by our parents. This can also happens because of disorders occurred while cell division or because of some natural exposures to chemicals like tobacco smoke or radiations like sun's UV rays [3]. More than 100 kinds of cancers are known. Usually, the type of cancer is named for the organ or tissue, where cancer develops. E.g., Lung cancer begins in lung cells, brain tumor initiates in cerebrum cells, breast cancer cells develop in bosoms, leukemia cancer starts in blood tissues, ovarian cancer initiated in or on ovaries and so on [4].

Ovarian cancer structures in or on the ovary. Peculiar cell, which can assault or spread to diverse body parts. Initially there might be no or only vague symptoms occurs that are unrecognizable. Indications will become more noticeable as the cancer advances. If diagnosed in early phase, the survival chances rise up to 90 percent for at least 5 years [5].

Generally, ovarian cancer starts in epithelium or extra coating of an ovary. Indications might match with other disorders like PMS, IBS temporary bladder, etc. Few early indications of ovarian cancer may comprise of pain in pelvis or lower abdomen, back pain, indigestion, heartburn, frequent urination, etc. Several indications that is noticeable as cancer develop are nausea, weight loss, breathlessness, tiredness, appetite loss. In case, an individual suffers from swelling, weight, or agony in stomach, she must contact the relevant doctor to avoid complications [6-7].

Support vector machine calculation has right now characterized their capacity in plan forecast and grouping. The primary objective is to compute the exactness of vector machine on medicinal picture forecast and arrangement assignments SVM models represent the cases as point in space mapped in way that disengaged classes tests is partitioned by a hole performing direct order. Besides, SVMs can also achieve non-linear classification using Kernel trick [8].The wavelet change has increased broad acknowledgment in flag preparing and picture pressure. Wavelets are acquired from a solitary model wavelet called mother wavelet by expansions and moving. The DWT has been presented as an exceptionally proficient and adaptable strategy for sub band deterioration of signs [9,10]. OTSU strategy is a streamlined, dependable and effective technique, utilized world-broadly. It's an overall constraining system with dim estimation of picture. Otsu system was proposed by Scholar Otsu in 1979. Otsu procedure is utilized worldwide to restrict the assurance

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system, which is broadly utilized choice technique [11]. The Otsu strategy requires enlisting a dull level histogram before running. In any case, in perspective of the one-dimensional which simply think about diminish level information; it doesn't give better division result.

2. Literature review

Irfan Ullah et al., 2016 [12] discussed that the proficiency of Raman spectroscopy is a kind of scanner as a showing method for ovarian cancer. Raman spectroscopy from the blood-serum of solid control and ovarian growth subjects were estimated. Extremely important Raman movements and power varieties were seen in the Tumour amass when contrasted with the solid gathering. These spectral contrasts were mistreated by help vector machine classifier towards PC helped characterization. Simple Vector Algorithm not easily detect and reduce the accuracy rates. Sharmistha Bhattacharjee et al., 2017 [13] described ovarian cancer is the 5th important reason for cancer regarded death amid women and is the deadliest of gynecological cancers. The death rate of cancer grade is higher. Early diagnosis and treatment are significant for enhancing the patient's treatment rate and extending their survival. They study mass spectroscopy area data to implement a CAS (Computer-aided system) for the purpose. Machine learning algorithms using data is classified into dissimilar categories to verify the malignant and benign cancer cells and study of the comparison has been completed to verify the most appropriate method under dissimilar operational situations and databases. They comparative analysis show that the MLP is the best options for likes detection measuring it performance parameters such as accuracy, errors and true positive rates. Beant Kaur et al., 2018 [14] described that ovarian cancer detection and found the stages of cancer in the malignant cancer image. In this proposed method is used to found the unique properties in the image and text form. An object there are various characteristics interesting key points on the object that could be extracted to feature and a description of the object. In optimization algorithm used to refractor the features w.r.t. to the fit value. In fitness function calculated by three parameters fs, ft and e fetch the value is called fit value. After that classify the features and detect cancer and evaluate the performance parameters like increases the error rate. Yen-Chiao Lu et al., 2017 [15] analyzed the machine learning techniques and connected with the collection learning methods worldwide measured as the most successful technique to create aim to an inferential issue of recurrent ovarian cancer. In this analysis studied that the support vector machine and multi-variant adaptive regression splines were considered to discover significant risk factors and to predict the re-current proneness for OC (Ovarian Cancer). They use collection learning to enhance the defect of classification accurate rate used normal machine study and selecting risk factors by learning method. Yasodha P et al., 2018 [16] studied the main aim of this research is to use effective data mining method on a large amount of ovarian cancer database to verify the disease in an effective way. in this study of the proposed work a new method for identifying ovarian cancer using connected self-organizing maps immune clonally selection and GENN. It is used for better characteristics selection which is used for extracting valuable interesting data from the huge amount of medical data and the neural network is utilized for the classification process. Miao Wu et al., 2018 [17] studied a DNN based on alexnet to repeatedly classify the dissimilar kinds of ovarian cancer form images. The algorithm consists of five convolution layers, 3 max polling layers, and 2 full re-connect layers. They trained the model by two classes input data divided, one was real image data and the other one was increased image data adding image enhancement and rotation. In testing, consequences are attained by the technique of 10 folder cross validation defining that the accuracy of classification technique has been enhanced from 72 ~78% by using increased images as training data.

Table 1: Comparison of Previous Research

Year	Techniques	Gap	Parameters
IrfanUllah, (2016)	Raman Spectroscopy, SVM	Unable to provide an objective explanation for negative lipids.	Sensitivity, Specificity, predictive value.
ArinzeAkutewe, 2014	Random Forest, LASSO, SVM	-	Sensitivity, Specificity, Type 1 error, Accuracy.
HasemBabahosseini, 2012	-	-	Elasticity, Mean, Peak Value.
SheemaSameen, 2011	Micro RNA	-	-
Andrew Janowczyk, 2012	HNCuts algorithm, k-means clustering	-	Sensitivity, efficiency, predictive rates, mean shift, throughput
H. S. Khazendar, 2014	LBP, SVM	-	Accuracy, Confidence level.

In diagnosed with ovarian malignancy, the ensuing stage is to perceive its stage and level. The phase of growth alludes to tumor's spread [18]. There are distinctive methods for organizing malignancy. The American Cancer Society utilizes a four-arrange framework. [19]

Table 2:. Ovarian Cancer Stages

Stage	Description
Stage 1	Cancer cells influence just the ovary or ovaries and have not spread to another region.
Stage 2	The cancer has influenced one or two ovaries and furthermore different organs inside the pelvis, for example, the uterus, fallopian tubes, bladder, or rectum.
Stage 3	The malignancy influences one or the two ovaries and either the covering of the mid-region or lymph hubs in the back of the mid-region.
Stage 4	The growth has spread to different parts of body, outside the peritoneal cavity. This hole incorporates the stomach area and pelvis. Zones that may now be influenced incorporate liver, spleen, and liquid around lungs.

Distinguishing the stage and grade will help the specialist to choose the best treatment. In any case, the stage and grade of ovarian malignancy alone can't anticipate how it will create. [20] [21].

3. Methodology work

Ovarian cancer is commonly found on the surface of ovaries cells. The current approach depends on ultrasound pictures to distinguish tumor from transferring tests. The ultrasound pictures are utilized to filter the inner structure of body parts which are secured with the skin. Several issues in detection process comprises of:

- The location on ultrasound picture is difficult to characterize based on grouping or division. It can influence FAR and FRR rate higher at acknowledgment time from the information base.
- The working exactness level is 90 to 95 of existing frameworks. It can be upgraded, so the framework can group all the more precisely and effectively.
- The past frameworks are not ready to group the phase of tumor. The stage distinguishing proof treats the patient all the more productively. So this upgrade can likewise streamline the execution of existing frameworks.

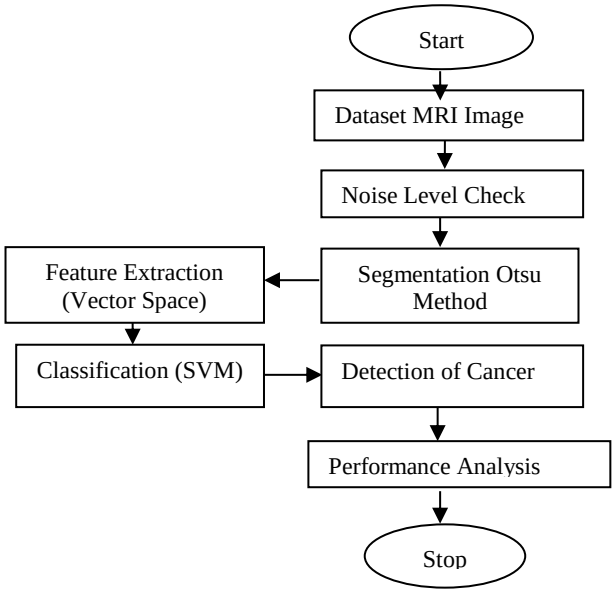


Fig. 1: Proposed Flow Chart.

In initial stage, several images gathered from different databases, used for training and testing of machine learning techniques with SVM. The pictures must be in .jpeg format. In pre-preparing stage, we transfer the picture and change over the RGB dim scale frame to diminish the pixel size of the ovarian tumor picture, to recognize the impedance level in the first picture that is MRI ovarian disease pictures. At that point distinguish the areas of the tumor picture utilizing Otsu Method. After that concentrate the highlights in the restorative picture utilizing DWT approach. It distinguishes two shape coefficients i.e. lower and higher bound. The arrangement is utilized SVM to prepare the malignancy pictures in the each stage dataset and test the growth identification and upgrade the nature of the tumor picture (MRI pictures).

4. Result discussions

In this section, we implemented the ovarian cancer using Discrete Wavelet Transformation and enhancement in support vector machine in medical image processing. The ovarian cancer stage found and cancer detect using DWT and Improved SVM method. The performance parameter like sensitivity, specificity, FAR, FRR and accuracy cancer detect are displayed.
In the training section using support vector machine. In the training state we define the cancer and non cancer image in medical image processing. Initialize the first image which is cancer image to train the system and design the knowledge dataset. To detect the regions and segment the data. Then we implement the feature extraction algorithm to identified the unique properties of the cancer image. Classify the ovarian cancer stage and performance parameters evaluated.

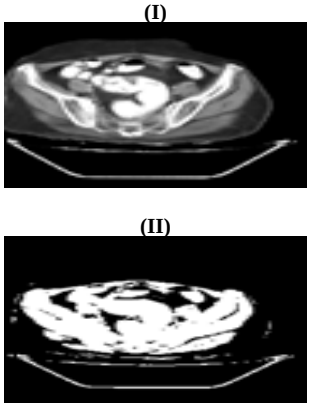


Fig. 2: (I) Input Image and (II) Output Image.

The mentioned above figure shows that the select the image through the dataset. First we upload the image and detect the regions using Sobel methods. In this method calculate the regions based on the features. To introduce the salt and pepper noise means artificial noise in this system. In median filter to remove the noise ratio in the original image. To segmented image using fuzzy c means clustering algorithms. In this algorithm, we extract the data into the three segments. Fuzzy cluster algorithms works by transmission membership to each data-point corresponding to each segment center on the behalf's of distance between the segment center and the data-point.

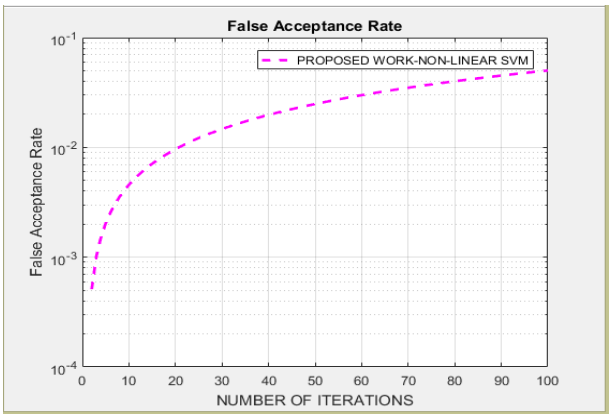


Fig. 3: False Acceptance Rate.

The above performance parameters is False Acceptance Rate is the proportion in which the system erroneously receives a fraud as the genuine user.

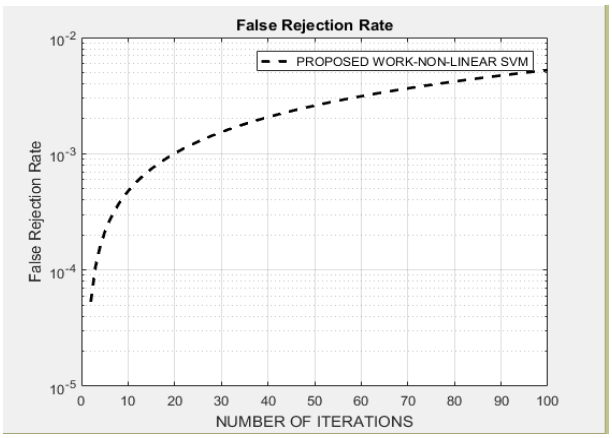


Fig. 4: False Rejection Rate.

In this performance parameter is False Rejection Rate shows the fraction in which the approved user is wrongly rejected by the system.

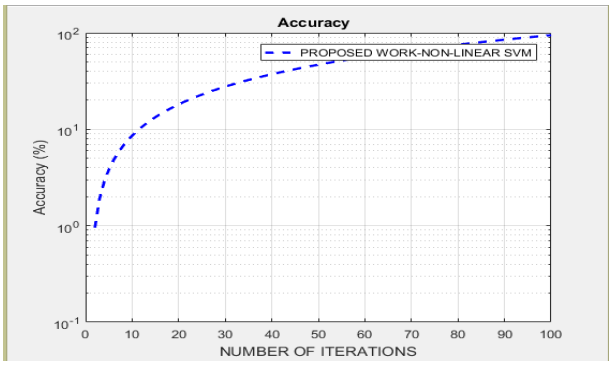


Fig. 5: Accuracy.

Above-mentioned figure 5 shows that the considerable accuracy is verified as the dissimilar between the considered of a factor and the

accepted value for that factor from a corrected external source or the %ge which the binary value dissimilar.

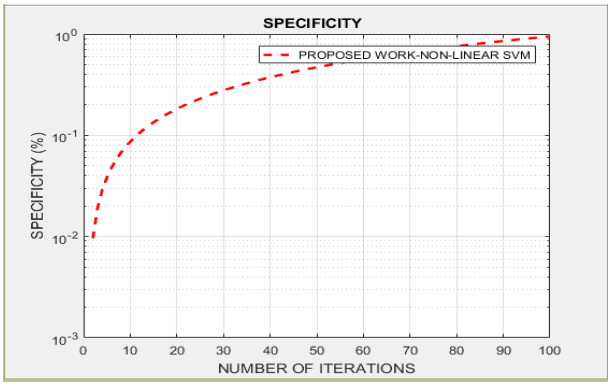


Fig. 6: Specificity.

Above mentioned figure 6 shows that the specificity parameter performance. Here, negatives fractions measured, which are identified appropriately (Example, the percentage of well people who are appropriately recognized as not have the situation)

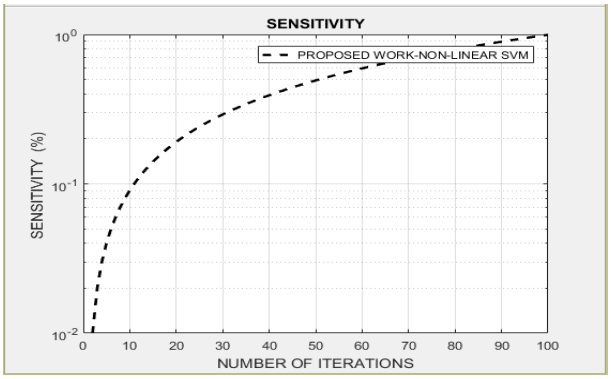


Fig. 7: Sensitivity.

Above mentioned figure 7 defines that the sensitivity evaluated performance parameters. It computes the proportion of positives that are appropriately recognized as such (Example, the percentage of unwell people who are appropriately identified as having the situation).

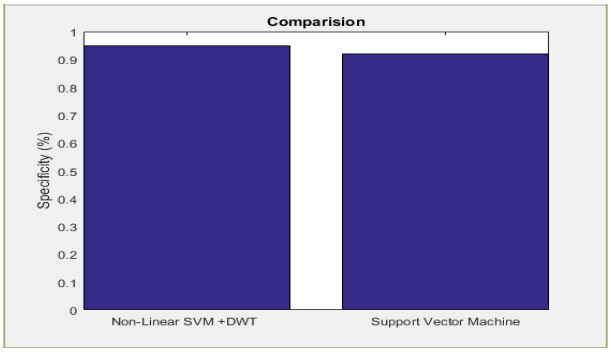


Fig. 8: Specificity Performance Parameters Comparison.

Above mentioned figure 8 defines the comparison between proposed (Non-linear SVM +DWT) and existing work (SVM) algorithm. We improve the performance parameters in specificity in percentage form.

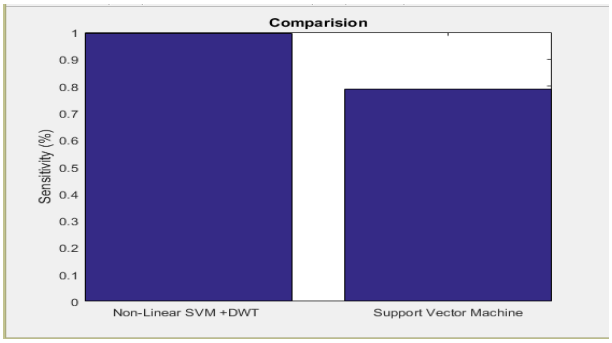


Fig. 9: Sensitivity Parameter Comparison.

Above-mentioned figure 9 defines the comparison between proposed (Non-linear SVM andDWT) and existing work (SVM) algorithm. We improve the performance parameters in sensitivity in percentage form.

Table 3: Performance Parameters

Parameters	Proposed Work
False Acceptance Rate	0.0502
False Rejection Rate	0.00524
Specificity	0.994
Sensitivity	0.9498
Accuracy	94.455

In above mentioned table 3 defines that the performance parameters like Far, Frr, Accuracy, Specificity and Sensitivity and Accuracy.

Table 4: Comparison between Proposed and Existing Work in Specificity and Sensitivity

Parameters	Proposed Work	Existing Work
Specificity	0.994	0.9194
Sensitivity	0.9498	0.7889

In above mentioned table 4 defines that the comparison between proposed and existing performance parameters like specificity and sensitivity.

Table 5: Comparison between Classifier Method in Accuracy (percentage)

Classifier	Performance Parameters (%)
J84	77.2%
MLP	73.2%
LMT	77.2%
SVM+DWT	94.455

5. Conclusion and future scope

In this research conclusion, Using this work, we have implemented a system for the medical deployment. In this thesis, presented a new approach for development of an evaluating system for detection the ovarian cancer system for stage detecting cancer category or stage like Normal, II, III stage and I. The correction of the system is completed by samples of dissimilar STAGE of the OVARIAN CANCER. This method could be simply adapted for detection of the stage and CANCER verification in medical areas. The study illustrates the capacity of Raman spectroscopy for the measurement of ovarian cancer. Particularly, changes in peak position and intensity of Raman spectrum for cancer blood serum samples as compare to well samples were productively quantified. In this proposed work, the association of the various existing algorithm (Linear SVM, Decision Tree. MLP methods) with some novel add on aspects and stages. The process starts with the segmentation and then the feature extraction is evaluating the feature extracted using DWT identified the LL, LH, HL and HH bands in transformation method. The classify the selected features using Non – Linear in SVM classification method. The method has been implemented using simulation tool using MATLAB 2016a. The Ovarian Stages were then tested for the accuracy using transformation software. Testing consequences defined an accuracy of 94%, Specificity 0.99 and Sensitivity value is 0.9978 for MRI Medical Images respectively. Results obtained

have proven that a better normal agreement is realized with the result from the human machine interaction but by means of some errors like false rejection, false acceptance and accuracy.
Future scope, includes be appropriate the confidence level based classification of dissimilar types of benign and dissimilar types of malignant cancers, evaluating and further enhancing its effectiveness because different sub-classes of tumor require dissimilar treatments. It will also study the helpfulness of the proposed scheme of classification for patients of dissimilar age-groups

References

[1] Li, Yan-E., Juan Zhang, Bin Han, and Lihua Li. "Identifying Ovarian Cancer Chemotherapy Response Relevant Gene Cliques." In *Bioinformatics and Biomedicine (BIBM), 2011 IEEE International Conference on*, pp. 294-298. IEEE, 2011.

[2] Koshiyama, Masafumi, Noriomi Matsumura, and Ikuo Konishi. "Clinical efficacy of ovarian cancer screening." *Journal of Cancer* 7, no. 10 (2016): 1311. https://doi.org/10.7150/jca.14615.

[3] Khazendar, S., H. Al-Assam, H. Du, S. Jassim, A. Sayasneh, T. Bourne, J. Kaijser, and D. Timmerman. "Automated classification of static ultrasound images of ovarian tumours based on decision level fusion." In *Computer Science and Electronic Engineering Conference (CEEC), 2014 6th*, pp. 148-153. IEEE, 2014.

[4] Renz, Christian, Jagath C. Rajapakse, Khalil Razvi, and Stephen Koh Chee Liang. "Ovarian cancer classification with missing data." In *Neural Information Processing, 2002. ICONIP'02. Proceedings of the ninth International Conference on*, vol. 2, pp. 809-813. IEEE, 2002. https://doi.org/10.1109/ICONIP.2002.1198171.

[5] Cherkassky, Vladimir, and Yunqian Ma. "Practical selection of SVM parameters and noise estimation for SVM regression." *Neural networks* 17, no. 1 (2004): 113-126. https://doi.org/10.1016/S0893-6080(03)00169-2.

[6] Gupta, Dipalee, and Siddhartha Choubey. "Discrete wavelet transform for image processing." *International Journal of Emerging Technology and Advanced Engineering* 4, no. 3 (2015): 598-602.

[7] WENQING, LIU JIANZHUANG LI. "The Automatic thresholding of gray-level pictures via two-dimensional otsu method [J]." *Acta Automatica Sinica* 1 (1993): 015.

[8] Liu, Jianfei, Shijun Wang, Marius George Linguraru, Jianhua Yao, and Ronald M. Summers. "Augmenting tumor sensitive matching flow to improve detection and segmentation of ovarian cancer metastases within a PDE framework." In *Biomedical Imaging (ISBI), 2013 IEEE 10th International Symposium on*, pp. 652-655. IEEE, 2013.

[9] Kaur, Ada Rajneet. "Feature extraction and principal component analysis for lung cancer detection in CT scan images." *International Journal of Advanced Research in Computer Science and Software Engineering* 3, no. 3 (2013).

[10] Acharya, U. Rajendra, S. Vinitha Sree, Luca Saba, Filippo Molinari, Stefano Guerriero, and Jasjit S. Suri. "Ovarian tumor characterization and classification using ultrasound—a new online paradigm." *Journal of digital imaging* 26, no. 3 (2013): 544-553. https://doi.org/10.1007/s10278-012-9553-8.

[11] Rajendra Acharya, U., Luca Saba, Filippo Molinari, Stefano Guerriero, and Jasjit S. Suri. "Ovarian tumor characterization and classification using ultrasound: A new online paradigm." (2013): 413-423.

[12] Ullah, Irfan, Iftikhar Ahmad, Hasan Nisar, Saranjam Khan, Rahat Ullah, Rashad Rashid, and Hassan Mahmood. "Computer assisted optical screening of human ovarian cancer using Raman spectroscopy." *Photodiagnosis and photodynamic therapy* 15 (2016): 94-99. https://doi.org/10.1016/j.pdpdt.2016.05.011.

[13] Bhattacharjee, Sharmistha, Yumnam Jayanta Singh, and Dipankar Ray. "Comparative performance analysis of machine learning classifiers on ovarian cancer dataset." In *Research in Computational Intelligence and Communication Networks (ICRCICN), 2017 Third International Conference on*, pp. 213-218. IEEE, 2017.

[14] Kaur, Beant, Kulvinder Singh Mann, and Manpreet Kaur Grewal. "Ovarian cancer stage based detection on convolutional neural network." In *Communication and Electronics Systems (ICCES), 2017 2nd International Conference on*, pp. 855-859. IEEE, 2017.

[15] Lu, Yen-Chiao, Chi-Jie Lu, Chi-Chang Chang, and Yu-Wen Lin. "A hybrid of data mining and ensemble learning forecasting for recurrent ovarian cancer." In *Intelligent Informatics and Biomedical Sciences (ICIIBMS), 2017 International Conference on*, pp. 216-216. IEEE, 2017.

[16] Yasodha, P., and N. R. Ananthanarayanan. "Detecting the ovarian cancer using big data analysis with effective model." *Biomedical Research* 29 (2018).

[17] Wu, Miao, Chuanbo Yan, Huiqiang Liu, and Qian Liu. "Automatic classification of ovarian cancer types from cytological images using deep convolutional neural networks." *Bioscience reports* 38, no. 3 (2018): BSR20180289. https://doi.org/10.1042/BSR20180289.

[18] Tsai, Meng-Hsiun, Ching-Hao Lai, Shin-Jr Lu, and Shun-Feng Su. "Performance comparisons between unsupervised clustering techniques for microarray data analysis on ovarian cancer." In *Systems, Man and Cybernetics, 2006. SMC'06. IEEE International Conference on*, vol. 5, pp. 3685-3690. IEEE, 2006.

[19] Akutekwe, Arinze, and Huseyin Seker. "Two-stage computational bio-network discovery approach for metabolites: Ovarian cancer as a case study." In *Biomedical and Health Informatics (BHI), 2014 IEEE-EMBS International Conference on*, pp. 97-100. IEEE, 2014.

[20] Babahosseini, Hesam, Paul C. Roberts, Eva M. Schmelz, and Masoud Agah. "Roles of bioactive sphingolipid metabolites in ovarian cancer cell biomechanics." In *Engineering in Medicine and Biology Society (EMBC), 2012 Annual International Conference of the IEEE*, pp. 2436-2439. IEEE, 2012. https://doi.org/10.1109/EMBC.2012.6346456.

[21] Sameen, Sheema, Zoya Khalid, and Shaukat Iqbal Malik. "In Silico Mining of MicroRNA Signatures in Human Ovarian Cancer." In *Bioinformatics and Biomedical Engineering,(iCBBE) 2011 5th International Conference on*, pp. 1-4. IEEE, 2011. https://doi.org/10.1109/icbbe.2011.5780100.

[22] Janowczyk, Andrew, Sharat Chandran, Rajendra Singh, Dimitra Sasaroli, George Coukos, Michael D. Feldman, and Anant Madabhushi. "High-throughput biomarker segmentation on ovarian cancer tissue microarrays via hierarchical normalized cuts." *IEEE Transactions on Biomedical Engineering* 59, no. 5 (2012): 1240-1252. https://doi.org/10.1109/TBME.2011.2179546.