Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 357-363 | ISSN:2251-6727

Prediction of Blood Disorder and Cancer using Artificial Neural Networks: A Review

[1]Pulla Sujarani, [2]Dr. K. Kalaiselvi, [3]Dr. M. Yogeshwari

[1]Research Scholar, Department of Computer Science, Vels Institute of Science, Technology and Advanced Studies(VISTAS), Chennai-117.

[2]Professor, Department of Computer Applications, Vels Institute of Science, Technology and Advanced Studies(VISTAS), Chennai-117.

[3]Assistant professor, Department of Information Technology, Vels Institute of Science, Technology and Advanced Studies(VISTAS), Chennai-117.

(Received: 07 January 2024 Revised: 12 February 2024 Accepted: 06 March 2024)

KEYWORDS

Artificial Neural Network, Blood Disorder, Cancer, Correlation Feature Selection, Multilayer Perceptron (MLP), Radial Basis Function Networks,

ABSTRACT:

Blood disorder and cancer is the one of the major health problem in all types of age group. The main aim of this paper is to predict the blood disorder and cancer. This paved a way to propose comparative study with previous studies based on artificial neural networks. The proposed work contains two levels such as feature selection and classification with 15 attributes. Blood disorder and cancer dataset collected from the Kaggle. First the Correlation Feature Selection (CFS) is formulate to identify the selected attributes for blood disorder and cancer prediction. Next all the data examine through the Radial Basis Function Neural Network (RBFNN) and find the centroid of each cluster using kernel k-means clustering algorithm. RBF has fast training process so it achieves high accuracy to predict the blood disorder and Cancer. According to this study, RBF is the best neural network approach than compared to other artificial neural network models.

I. Introduction

Blood disorder causes the concentration of red blood cells in the body less than the normal range. If the body has low hemoglobin level, then decreasing the strength of the blood to carry oxygen. Anaemia is the world wide health disease affects in children and pregnant women. The deficiency of nutrition, iron deficiency and vitamin B12 are the main causes of anaemia. WHO announced that pregnant women and five year age children are suffering from anaemia[1]. Cancer can affect any part of the body and it causes when normal cells in the body changes into tumour cells. If the cancer disease can detected earlier, mortality can be reduced. Screening is one type of method to identify the specific cancer but not suitable for all type of cancers. Cancer has different types such as leukaemia, lymphoma and myeloma. If the cancer treatment will be late, the cancer cells spread into whole body parts. To predict the cancer in early stage, to prolong the patients life [2]. Radial basis neural network has different architecture compare to other neural network architecture. It contains three layers such as input layer, hidden layer and output layer. Each neuron in the hidden layer consists of radial basis activation function which it is different than other neural networks [21].

II. Literature Review

According to the previous studies, a comparative analysis was prepared for Blood disorder and cancer prediction. Various artificial neural network techniques and algorithms were used by the researchers.

Y. j. Tan [3] formulated the convolutional neural network approach to detect the breast cancer by using mammogram imaging system. The ouput shows that the proposed model yielded higher accuracy than existing method. Kuo Men [4] applied the one of the fast training and testing method is deep dilated convolutional neural networks method. Collected 278 patients of data used for rectal cancer evaluation. From this, randomly choosed 218 patients of data for training and remaining data used for validation. Shekoofeh Azizi [5] suggested to the better detection of the prostate cancer using recurrent neural networks and introduce long short term memory network for which gives highest accuracy for detection. Steven Walczak [6] proposed that pancreatic cancer is the dangerous cancer and mainly causing death in united states. Even after surgery people suffering with morbidity and mortality due to pancreatic cancer. To

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 357-363 | ISSN:2251-6727

predict this, proposed artificial neural network model which improving prognosis and reducing decision regret. Ashok kumar [7] proposed a microarray gene expression data technique for cancer classification and compared to other ouputs, ANN obtained 98% of accuracy. Krazysztof J. Geras [9] proposed that mainly women suffering due to breast cancer. applied a deep convolutional neural network to handle the high resolution images. Zhixiongzhang [11] applied a data preprocessing and feature selection techniques to extract the 16 features for 1358 single cells and proposed artificial neural network model for cancer cell migration Dr. T. Vijayakumar [12] formulated to investigate and predict the cancer at early stage. So applied convolutional neural network model which provided highest accuracy than compared with other two network models to investigate the tumour. Yiwen Xu [13] handled deep learning model to improve and useful for medical based predicton. It provided best outcome for prediction of lung cancer imaging scans. Mohammed Abdul Hay Abu Bakr]16] used artificial neural network method with the success of 99.57% was obtained. This approach was implemented in Just neural network(JNN) tool. Erdemyauvz [17] handled the principal component analysis technique to extract features and filtering. Generalized regression neural network approach was used to diagnosis the breast cancer with the success mean rate of 0.9773. Ola Mohammed Abu Kweik [18] formulated the artificial neural network approach with 309 samples with 15 features. The proposed model achieved 99.01% of highest accuracy for lung cancer detection. Subrato Bharati [19] reviewed dfferent artificial neural network models to related breast cancer disease. K. Deepa [20] handled artificial neural network method for cervical cancer prediction. Proposed approach outperforms to compared with other five algorithms. V. Kumararaja [22] applied artificial neural network approach for pap smear image classification to urinary cancer prediction. Proposed approach provided 90% of accuracy which was compared to other five neural network techniques. Dr. Asadi Srinivasulu [23] used extended convolutional neural networks for prediction of Lung cancer detection. The formulated approach yielded 96.88% of highest accuracy than existing system. M. Ramkumar [24] applied convolutional Neural Networks for classification of cervical cancer in women. Data samples collected from the different health centers across india as part of the real time data collection process. Proposed model obtained best outcomes to compared with other neural networks. Dr. M. Sujatha [25] handled textural analysis and hybrid hopfield neural networks for standard oral cancer classification. Applied histopathology PAIP 2020 dataset for this experimentation. The extracted feature images are classify by using hybrid hopfield neural networks with ant colony optimization (ACO) algorithm with the highest accuracy of 98.98%. Matteo santoni [26] proposed artificial neural network technique to predict the kidney cancer in future. Used RCC-related risk factors for this incidence and MATLAB software for implementation. Dataset collected from the population numbers. Yan-Wei Lee [27] formulated a deep learning model to predict the breast cancer status. Used one of the best technique is CAP system was provided the best outcome.

III. Proposed model

The blood disorder and cancer dataset collected from the Kaggle and select the suitable attributes from the patients. Next performs the pre-processing step and applied the filtration method which is correlation feature selection (CFS). It is extract and apply the model of RBF Neural Networks using the selected data and to find the each cluster centroid using kernel k-means clustering algorithm. The following fig.1 shows the proposed architecture of blood disorder and cancer prediction.

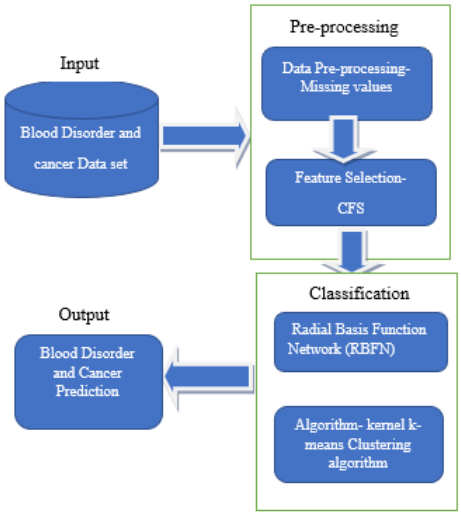

Fig.1: proposed Architecture of Blood disorder and Cancer Prediction

Data set

The dataset contains 15 Attributes which are suitable for the patients of blood disorder and cancer. The Attributes are Age, Medical History (MH), Red Blood Count (RBC), Complete Blood Count (CBC), Platelet Count (PC), Blood Chemistry Test (BCT), Coagulation Test (COT), Bone marrow Aspiration and Biopsy (BMA), Lumbar Puncture (LP), Cytochemistry (CC), Polymerase Chain Reaction (PCR), Peripheral Blood

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 357-363 | ISSN:2251-6727

Smear (PBS), Fluorescent in Situ Hybridization (FISH), Cytogenetics (CG), Chromosome Test (CT). The following Table.1 shows Attributes for prediction of Blood Disorder and Cancer.

Attribute No	Attribute Name
1	Age
2	Medical History
3	Red Blood Count
4	Complete Blood Count
5	Platelet Count
6	Blood Chemistry Test
7	Coagulation Test
8	Bone marrow Aspiration and Biopsy
9	Lumbar Puncture
10	Cytochemistry
11	Polymerase Chain Reaction
12	Peripheral Blood Smear
13	Fluorescent In Situ Hybridization
14	Cytogenetics
15	Chromosome Test

Table. 1: Attributes for prediction of Blood Disorder and cancer

The following Table.2 shows the dataset of blood disorder which was collected from the Kaggle.

	S. No.	Age	MH	RBC	CT	COT	BMA	LP	CBC	BCT	PLT /mm3	CG	CC	PCR	PBS	FISH
2			Medical hi	Red Blood	Chromoso	Coagulatic	Bone Marr	Lumbar Pu	Complete	Blood Che	Platelet	Cytogenet	CytoChem	Polymerra	peripheral	Fluorescen
3	1	28	0	5.66	34	60.1	17	28.2	20	11.1	128.3	9.6	32	17	19	4.6
4	2	41	0	4.78	44.5	93.1	28.9	31	13	7.02	419	13.8	34.5	34.5	28.9	4.78
5	3	40	1	4.65	41.6	89.5	28.8	32.2	13	8.09	325	13.4	45.5	28.8	24.3	5.2
6	4	76	0	4.24	36.7	86.6	26.7	30.8	14.9	13.41	264	11.3	36	26.7	26.7	4.24
7	5	20	1	4.14	36.9	89.1	27.8	31.2	13.2	4.75	196	11.5	47	27.8	27.8	4.14
8	6	24	0	4.29	40.1	93.5	29.6	31.7	14.5	13.96	233	12.7	26	32	29.6	4.29
9	7	28	1	4.98	42.3	84.9	24.9	29.3	16.2	9.33	213	12.4	56	24.9	24.9	4.6
10	8	14	0	4.97	43.8	88.1	28	31.7	15.2	3.92	229	13.9	28	28	28	4.97
11	9	16	0	4.16	38.7	93	28.8	31	17.9	5.77	211	12	46.5	28.8	28.8	4.16
12	10	62	0	5.25	45.6	86.9	25.3	29.2	15.6	10.68	151	13.3	48.2	25.3	25.3	5.25
13	11	42	0	2.17	28.3	93.5	28.1	30	24.6	3.46	92	6.1	28.9	28.1	23,8	2.17
14	12	28	0	4.81	44.4	92.3	27.9	30.2	14.3	6.22	150	13.4	56.3	27.9	27.9	4.81
15	13	59	0	3.41	32.9	96.5	29.9	31	16.8	6.62	132	10.2	28.9	28	29.9	3.41
16	14	28	1	2.26	26.9	119	41.2	34.6	15.6	5.27	222	9.3	37.6	41.2	41.2	2.26
17	15	60	0	4.52	38.5	87.4	26.5	30.4	14.7	10.52	589	12	28.9	26.5	26.5	4.52
18	16	22	0	5.17	44.5	86.1	27.7	32.1	13.2	10.7	268	14.3	49.3	27.7	27.7	5.17
19	17	64	0	4.6	41.4	90	28.5	31.6	14.4	9.67	150	13.1	37.8	29	28.5	4.6
20	18	78	0	4.24	36.7	86.6	26.7	30.8	14.9	13.41	264	11.3	45.3	26.7	26.7	4.24

Table.2 Data set of Blood Disorder and Cancer

Data pre-processing:

Data preprocessing is the one of the important process to be suitable for the training. Without preprocessing, the neural networks training will be slow. Every dataset contains noisy and missing data values which it is affects on the output. So we have to preprocess the blood disorder and cancer data set which it was collected from the kaggle. In this stage, the elimination of the records whose attribute information are missed and other preprocessing done [8].

Feature Selection:

The preprocessed data set is transfer to feature selection. Feature selection is the process to eliminate the noisy and redundant of data. Feature selection is also called subset selection. one of the filtration method is proposed namely correlation based feature selection (CFS) which is powerful technique will be used in this

Journal of Chemical Health Risks
www.jchr.org
JCHR (2024) 14(2), 357-363 | ISSN:2251-6727

stage for reduction to select a subset of the inputs, discard the remainder[10].

Classification

Radial Basis Function Neural Network:

In this research work, we propose Radial Basis Function Neural Network with Kernal K-means clustering Algorithm. Radial Basis Function Neural Network is one type of Feed Forward Neural Network architecture [21]. It is usually used for prediction. In the first step, we examine all the data through RBF. The below fig.2 shows radial basis function architecture which the selected 15 attributes were connected with RBF neurons.

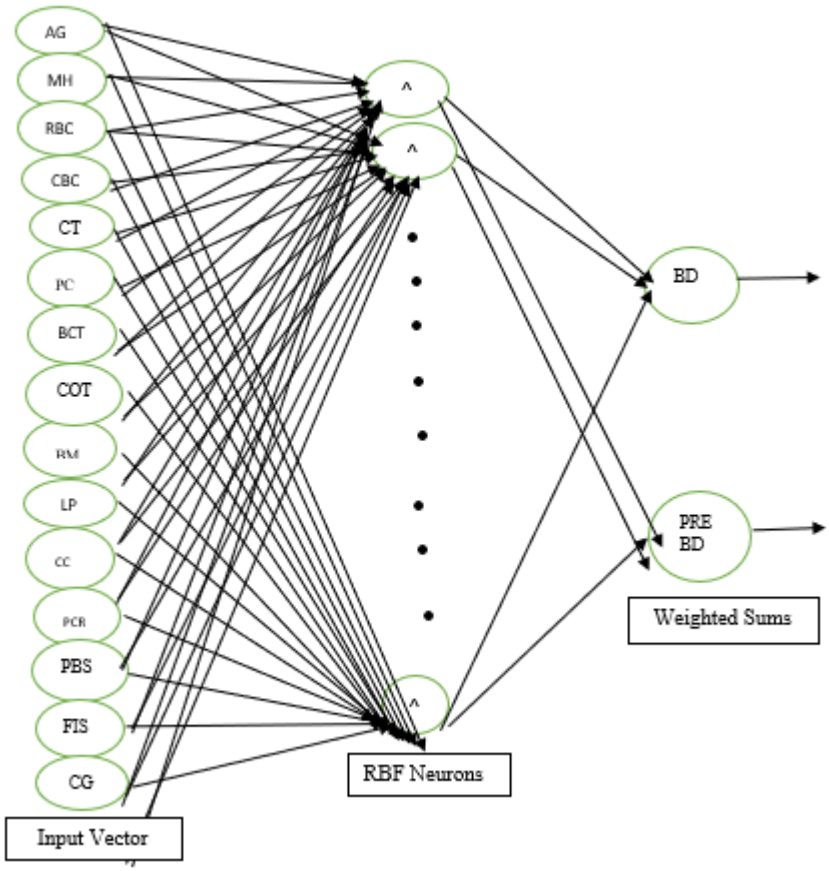

Fig:2. Block Diagram of Radial Basis Function Neural Network with selected attributes

It consists of input vector, RBF neurons, and output nodes. In the input layer, each neuron connects to each input variable. Next at the hidden layer, each neuron consists of radial basis activation function (Gaussian) which it is connects to all 15 input variables. Each hidden layer corresponds to one or more neurons. Each of them have radial basis activation function. Each input variable corresponds to each Gaussian activation function, it is centered point of all 15 input variables. In the hidden layer, every neuron weighted inputs to output layer. At the output layer, all the weighted sum of outputs from the hidden layer to provide the network output [14]. The equation of output layer is

$$f(x) = \sum_{j=1}^{m} w_j \, h_j \, (x)$$

here x is the input, w is the weight between hidden nodes and output nodes and h is the gaussian activation function[14].

The equation of gaussian activation function is

$$h(x) = \exp\left(-\frac{(x-c)^2}{r^2}\right)$$

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 357-363 | ISSN:2251-6727

To determine the RBF unit center c, we propose kernel k-means clustering algorithm and the cluster center become the center of the RBF unit.

Kernel k-means Clustering Algorithm:

kernal k-means clustering is the extension of k-means clustering. [15] It identifies the nonlinearly separable clusters and kernal method will be used that adds one cluster at each stage through a global search procedure. It has several executions of kernal k-means from suitable initializations[15].

Kernal k-means algorithm steps as follows:

Input:

X= $\{x_1, x_2, \ldots\ldots, x_n\}$, C,

ε(epsilon), T.

Output[15]:

V= $\{v_1, v_2, \ldots\ldots, v_c\}$,

U= $[r_{nc}]$ where n=1,2,….,N and c= 1,2,….,C.

1. Initialization: $V^0 = \{v_1, v_2, \ldots\ldots, v_c\}$,
2. Update membership of the data point x_i in j^{th} - cluster.
3. If c = $argmin_j$(K(x_n, x_n) ||– 2 K((x_n, μ_c) + K(μ_c, μ_c)),
   Then r_{nc} = 1. Otherwise, r_{nc} = 0.
4. Update cluster center V^t using:
   $\mu_c = (\sum_n r_{nc} x_n) / \sum_n r_{nc}$, c = 1,2,….,C
5. Check the stop criteria. If $\| V^{t-1} - V^t \| < \varepsilon$ or T = t,
   Then the iteration stops. Otherwise t = t+1 and go
   Back to step 2 [15].
6. End [15].

In the above algorithm, C is the number of cluster and Tis the maximum number of iterations[15].

IV. Results and Discussion

The following Table.3 shows the comparative study of research done by many authors and different methodologies and their accuracies. According to this performance, proposed RBF Network gives improved accuracy with different attributes to compared with previous studies accuracies. The following Table.3 shows comparative Study for Blood Disorder and cancer using various techniques.

S. No	Methodologies	Accuracy
1	JNN	99.57%
2	HHNN	98.98%
3	ANN	98%
4	ECNN	96.88%
5	MLNN	91%

Table.3: Comparative Study of Blood Disorder and cancer using various techniques

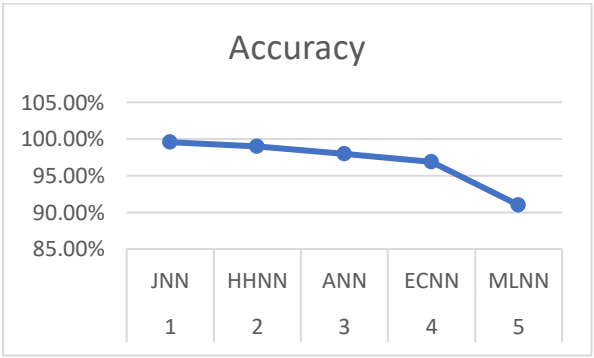

Fig.3 Comparative Study Performance

V. Conclusion

The main aim is to compare with other research works done using artificial neural networks. Different parameters were considered by the researchers to predict the blood disorder and Cancer. In this paper consists of two stages such as feature selection and classification with 15 attributes. Blood disorder and cancer dataset collected from the Kaggle. As the first step, the Correlation Feature Selection is formulate to identify the selected attributes for blood disorder and cancer prediction. Next all the data examine through the RBF Neural Network and apply kernel k-means clustering algorithm. Compared to all previous research artificial neural network methods, RBF approach is best for prediction and it has fast training process. So RBF yields the best accuracy for blood disorder and cancer.

REFERENCES

1. World Health Organization, cancer. http://www.who.int/cancer/en/
2. World Health Organization, Anaemia.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 357-363 | ISSN:2251-6727

3. Y. j. Tan, K. S. Slim, F. F. Ting. Breast cancer detection using convolutional neural networks for mammogram imaging system, International Conferernce on Robotics, Automation and Sciences(ICORAS), (2017).
4. Kuo Men, Jianrong dai, Yexiong Li. Automatic segmentation of the clinical target volume and organs at risk in the planning CT for rectal cancer using deep dilated convolutional neural networks, The International Journal of Medical Physics Research and Practice, Vol .44, (2017), 6377-6389.
5. Shekoofeh Azizi, Sharareh Bayat, Pingkun Yan, Amir Tahmasebi, Jin Tae Kwak,Sheng Xu, Baris Turkbey Peter choyke, Peter pino, Bradford. Deep recurrent neural networks for prostate cancer detection: Analysis of temporal enhanced ultrasound, IEEE transactions on Medical Imaging, Vol.37 (2018).
6. Steven Walczak, Vic Velanovich. Improving prognosis and reducing decision regret for pancreatic cancer treatment using artificial neural networks, ElSEVIER Decision Support Systems, Vol. 106, (2018), 110-118.
7. Ashok kumar, Dwivedi. Artificial Neural Network model for effective cancer classification using microarray gene expression data, Neural Computing and Applications, (2018),29,1545-1554.
8. Alexander Rakhlin, Alexey Shvets, Vladimir Iglovikov, Alexandr A. Kalinin. Deep convolutional neural networks for breast cancer histology image analysis, International Conference Image Analysis and Recognition(ICIAR), (2018), 737-744.
9. Krazysztof J. Geras, Stacey Wolfson, Yiqiu shen, Nan wu, S. Gene kim, laura Heacock, Ujas parikh, Linda Moy, Kyunghyun cho. High resolution breast cancer screening with multi-view deep convolutional neural networks, Computer Vision and Pattern Recognition, (2018).
10. Dr. S. Senthil, B. Ayshwarya. Lung cancer prediction using Feed forward back propagation neural networks with optimal features, International Journal of Applied Engineering Research(IJAER), Vol.13, No.1, (2018).
11. Zhixiong zhang, Lili chen, Brock Humphires, Riley Brien, Max S. Wicha, Kathryn E. Luker, Gary D. Luker, Yu-chih chen and Euisik Yoon. Morphology-based prediction of cancer cell migration using an artificial neural network and random decision forest, Integrative Biology, (2018).
12. Dr. T. Vijayakumar. Neural Network analysis for tumor investigation and cancer prediction, Journal of Electronics and Inf ormatics (2019) Vol.01, No. 02, 89- 98.
13. Yiwen Xu , Ahmed Hosny, Roman Zeleznik1, Chintan Parmar ,Thibaud Coroller, Idalid Franco , Raymond H. Mak, and Hugo J.W.L. Aerts. Deep Learning Predicts Lung Cancer Treatment Response from Serial Medical Imaging, Precision medicine and imaging, (2019).
14. Agus Maman Abadi, Dhoriva Urwatul Wustqa, Nurhayadi. Diagnosis of brain cancer using radial basis function neural network with singular value decomposition method, Vol .9, (2019).
15. Zuherman Rustama, Sri Hartini, Rivan Y. Pratama, Reyhan E. Yunus, Rahmat Hidayat. Analysis of Architecture Combining Convolutional Neural Network (CNN) and Kernel K-Means Clustering for Lung Cancer Diagnosis, International journal on advanced science engineering information technology, Vol.10, No. 3, (2020), No. 3, 2088-5334.
16. Mohammed Abdul Hay Abu Bakr, Haitham Maher Al-Attar, Nader Kamal mahra, Samy S. Abu-Naser. Breast cancer prediction using JNN, International Journal of Academic Information systems Research(IJAISR) 4(10), (2020), 1-8.
17. Erdem yauvz and Can Eyupoglu. An effective approach for breast cancer diagnosis based on routine blood analysis features, Medical & Biological Engineering & Computing, 58, (2020), 1583-1601.
18. Ola Mohammed Abu Kweik, Mohammed Atta Abu Hamid, Samer osama Sheqlieh, Bassem S. Abu-nasser, Samy S. Abu-Naser. Artificial neural network for lung cancer prediction, International Journal of Academic Engineering Research (IJAER), Vol.4, (2020), 1-7.
19. Subrato Bharati, prajoy Podder, M. Rubaiyat Hossain Mondal. Artificial Neural Networks based breast cancer screening: A comprehension Review, Image and Video Processing, (2020).
20. K. Deepa, and R. Dharani. A journal of cervical cancer prediction using artificial neural networks, Turkish Journal of Computer and Mathematics Education (TURCOMAT), Vol 12, No.2, (2021), 1085-1091.
21. Luthfi Ramadhan Radial Basis Function Neural Network Simplified, a short introduction to radial basis function neural network, 2021.
22. V. Kumararaja, K. Deepa. PAP smear Image Classification to Predict Urinary Cancer Using Artificial Neural Networks, Annals of R.S.C.B., Vol. 25, (2021), 1092 – 1098.

Journal of Chemical Health Risks

www.jchr.org

JCHR (2024) 14(2), 357-363 | ISSN:2251-6727

23. Dr. Asadi Srinivasulu1, Dr. Umesh Neelakantan, Tarkeshwar Barua. Early Prediction of lung cancer detection using extended convolutional neural networks, (2021), 58(1) 5614-5624.
24. M. Ramkumar, R. Manikandan, M. Punithavalli, V.S. Akshaya and Shanmugaraj Madasamy. Classification of cervical cancer in women using convolutional neural networks, ICTACT Journal on Image and Video Processing, (2021), Vol 11, Issue 03.
25. DR. M. Sujatha, DR. K.V. Bindu, D. Nageswari, G. Geethamahalakshmi, DR. T .Jayasankar. Classification of standard oral cancer using textural analysis and hybrid Hopfield neural networks, Turkish Journal of Physiotherapy and Rehabilitation, 32(2), (2021).
26. Matteo Santoni, Francesco Piva, Camillo Porta, Daniel Y. Heng, Marc R. Matrana, Enrique Grande, Veronica Mollica, Gaetano Aurilio, Mimma Rizzo, Miatteo Giulietti, Rodolfo Montironi, Francesco Massari. Artificial Neural Networks as a way to Predict future kidney cancer incidence in the united states, ELSEVIER Clinical Genetourinary Cancer, Vol 19, (2021).
27. Yan-Wei Lee, Chiun-Sheng Huang, Chung-Chih Shih, Ruey-Feng Chang. Auxillary lumph node metastasis status prediction of early-stage breast cancer using convolutional neural networks, Vol. 130, (2021).