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A review on neural networks approach on classifying cancers

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ABSTRACT

Cancer is a dreadful disease. Millions of people died every year because of this disease. Neural networks are currently a burning research area in medical scienc It is very essential for medical practitioners to opt a proper treatment for cancer patients. Therefore, cancer cells should be identified correctly. Current developments in biological as well as in the computer science encouraged more studies to examine the role related to computational techniques in broad sphere regarding certain researches related to cancer. Using different AI approaches with regard to the disease's medical diagnosis has been more general in recent times. Furthermore, there is more concentration on shown advantages of machine learning and AI methods. Cancer can be considered as one of the terrible diseases. Yearly, a lot of humans are dying from cancer. It is very essential for the practitioners of medical field to use suitable treatment regarding patients experiencing cancer. The data on cancer is specified as collection regarding thousands of genes. Thus, the cells of cancer must be properly detected. Currently, neural networks are considered as very significant area of research in the medical science, particularly in urology, radiology, cardiology, oncology, and a lot more. The presented work will survey different techniques of neural networks to classify lymph, neck and head, as well as breast cancer. The major goal of this work in the medical diagnostics has been guiding a lot of studies for developing user-friendly as well as inexpensive techniques, processes, as well as systems for the clinicians.

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1. INTRODUCTION

Recently, the focus of a lot of studies as well as funding was provided to the applications regarding effective computational approach for diagnosing and treatment of cancer [1]. Nowadays, it has been recorded that cancer is the second leading cause of death worldwide [2]. Lung cancer is the most common type of cancer worldwide among men and the fourth most commonly occurring cancer among women [2-3]. The World Health Organization (WHO) confirmed that 8.2 million deaths were caused by cancer in 2012 and 8.8 million in 2015. Moreover, it expected 27 million of new cases of this disease before 2030 [4]. Whereas such approaches were examined for a long time, their cancer applications have currently started to have the focus of academics as well as corporate sectors. Cancer can be considered as main cause of diseases in deaths of humans and a lot of advanced nations. The classification of cancer in the medical practice verified on histopathological and clinical facts might be producing confusing and incomplete results.

DNA microarray has been of high importance in determining expression levels regarding a lot of genes in simultaneous way in cell mixture [5]. The DNA microarray technique was utilized for finding the suitable diagnoses and prediction regarding cancer. Furthermore, the molecular level diagnostic with the gene expression profile might be providing an approach of systematic and precise classification of cancer. There is high importance in the cancer's treatment for classifying tumor correctly. Due to the fact that the gene expression data typically consists of a lot of genes, a lot of studies were examining the obstacles related to the classification of cancer with the use of data mining methods, a lot of statistical approaches as well as algorithms of machine learning for effectively evaluating such data [5-6]. A lot of methods related to machine learning have been utilized for the classification of cancer, like SVM, k-nearest neighbor as well as NN approaches. The methods of NNS are of high importance in detecting and monitoring of the cancer [2]. ANNs is considered to be effective tool utilized to classify or cluster the gene expression data. Supervised models have been utilized for the purpose of classification, whereas the unsupervised models have been utilized with regard to clustering. The models of NNs were effectively utilized in different classification problems. Furthermore, classification is of high importance to diagnosis and treatment of cancer. Classification problem will happen in the case when object require allotting in to class or pre-defined group on the basis of the number regarding identified attributes associated to the object. Clustering might be specified as one of the un-supervised learning problems, it handles discovering structure in the unlabeled data's collection. ANNs were verified as efficient approach with regard to the pattern recognition. This made it as extremely important too diagnosing cancer at early phases [7]. This paper presents a review on neural networks approach on classifying cancers. This made them very useful to simplify and solve diagnosis problems of cancer disease at very early stages.

2. ARTIFICIAL NEURAL NETWORKS (ANNS)

The performance of NN is based on the architecture of NNs as well as certain tasks which is performed via the network. Such performance includes certain properties such as the capability regarding generalization as well as the speed of learning. Trial and error are utilized for finding appropriate architecture of NNs for certain problem, yet such approach consume a lot of time and might not be producing optimal networks. As with the majority regarding applications related to the evolving computations in generations related to the architecture of NN, considerable impact exists on the network's performance, thus utilizing evolving computations and is specified as step up for automating regarding NNs architecture generation [7]. Generally, NNs are utilized in applications like prediction, classification, pattern recognition, clustering as well as a lot of others. Such networks have been trained with the use of application data. The generalization capability in such networks are based on architecture, training, number of neurons and number of layers in each one of the layers. The networks attract for over fitting training set [8]. In the case when increasing the neuron's number in the network, there will be reduction in the capability of interpolation; put differently, a network has not ability of learning all data in the case when the number of neurons is considered to be less in comparison to required number of neurons. Thus, with regard to each one of the applications, there are specific number of neurons that will be maintaining the optimum interpolation generalization balance. Designers are requiring certain approaches to find appropriate choices to keep such balance [8]. For more information about ANN applications, readers can refere to [9-13].

With regard to the figure 1, x1, x2, x3,…,xn are representing inputs of neurons with matching weights w1 ,w2,w3,…,wn which is simulating biological nets neural connections. Often, threshold term b will be added to inputs [7].

The output might be bipolar, real value or binary. For the purpose of creating net input to neuron (Net), inputs will be multiplied by their matching weights and after that added together. This will be achieved via:

$$\text{Net} = \sum_{i=1}^{n} w\,ixi + b = w_1x_1 + w_2x_2 + w_3x_3 + \ldots\ldots + w_nx_n + b \quad (1)$$

For the purpose of producing output Y, neuron representing mapping or activation function f(net), has been determined in the following way [7]:

$$Y = f(\text{net}) = f \sum_{i=1}^{n} w\,ixi + b \quad (2)$$

3. CANCER

Cancers are defined as group of diseases which are involving the abnormal growth of cells with possible invading or spreading to the other body parts [7]. They are dissimilar to the benign tumours, that are

not spreading [8]. Likely symptoms and indications including changes in the movements of bowel, prolonged cough, abnormal bleeding, lump, as well as unexplained weight loss [8]. Whereas such symptoms might be indicating cancer, they could have certain other causes [14]. More than one-hundred types regarding cancers are affecting humans. As soon as diagnosing the cancer, a patient might be requiring medical treatments as well as specialized care for a period of months and sometimes for years. The principal modes regarding therapy – surgery, chemotherapy and radiotherapy – might be provided alone or in combination.

3.1. Breast cancer

The breast cancer can be considered as the major invasive cancer which is affecting women and specified as the second cause regarding deaths of cancer in women after lung cancer. Breast cancer is the top number one cancer in Malaysia. The statistic shows that 1.6 million new cases are diagnosed worldwide and 2,015,560 women will die of breast cancer every year. The majority of breast cancers are starting from the ducts which are carrying milk to nipple (ductal cancers), a few of them starting in glands that are making the breast milk (lobular cancers). Furthermore, there are other breast cancer's type which are not widespread such as angiosarcoma and phyllodes tumour. A few cancers starting in certain other tissues in breast. Such cancers have been referred to as lymphomas and sarcomas and aren't considered as breast cancers [15]. Machine learning has been widely used in breast cancer detection [16-21].

In the next section, a survey with regard to researches that are achieved in area regarding the breast cancer classification utilizing NNs:

L. Álvarez Menéndeza et. al. [22] applies information acquired from breast screening programme conducted in public health area of Aviles (Principality of Asturias, Spain) between the years 1999 and 2007. The public health of Aviles has been created through 9 municipalities with 160,000 inhabitants. The study specified NN-based method for diagnosing breast cancer; the developed model has the ability of determining the women more possibly to be suffering from specific type of tumour prior to undergoing mammography. Using polynomial kernel that is related to SVM in actual clinical diagnosis that are related to the breast cancer. Such models' performance has been examined to classify breast cancer. Chandra Prasetyo Utomo et. al. [23] carried out ANNs with extreme learning approaches to diagnose the breast cancer on the basis of Breast Cancer Wisconsin Dataset which are acquired from University of Wisconsin Hospital. The development regarding such approach is of high importance since the intelligent components in the medical decision support systems as standard Gradient-Based Back Propagation Artificial Neural Networks (BP ANN) having a few limitations. There are certain parameters must be set at the start, long time for the process of training, as well as the possibility to be trapped in the local minima. Sudip Mandal and Indrojit Banerjee [24] utilized multi-layer feed forward NN for detecting cancer from Microarray Data as well as UCI Machine Learning Data. BP rule has been utilized for model's training. In general, there are 2 types of validation have been conducted: the cross validation as well as new case testing with regard to the above 2 data-sets with various combinations regarding hidden layers in addition to the corresponding nodes. It has been indicated that, the model of NN could be classifying the data with extreme accuracy and this is going to result in automated medical diagnosis system regarding specific disease. With regard to the UCI data-set (breast cancer), the study elevated the percentage regarding training data from 0.5% to specific values and indicated that with the increment in the number of samples regarding the training data, there has been gradual increase in the accuracy. Furthermore, the accuracy that is related to the network that is trained with a lot of data-sets is high in terms of that has been trained with not much data-sets. It has been indicated that the accuracy with regard to cross validation has been better in comparison that regarding novel testing cases as same data has been utilized for training throughout cross validation.

Htet Thazin Tike Thein and Khin Mo Mo Tun [25] suggested a method for diagnosing breast cancer from various breast cancer's classes. This method is on the basis of Wisconsin Diagnostic and Prognostic Breast Cancer, also the classification regarding various types of breast cancer data-sets. The suggested system implemented island-based training approach to have better accuracy as well as not much training time through utilizing as well as analysing between two different migration topologies. Differential Evolution algorithm (DE) was utilized for determining the near optimal value or the optimal value regarding parameters of ANN. Utilizing population of points in search for optimum. The size of population has been indicated as NP. Each vector's dimension has been indicated by D. The major operation is NP number of competitions which will be conducted for deciding next generation. Ishwinder K. Sandhu et. al. [26] defined NN method to the diagnosis of breast cancer involving various NN architectures. Also, NNs are providing inputs in various layered perceptions without maintaining any software. Thus, its use in the diagnosis will be diminishing the ample time that is needed for the diagnosis since patients will be checked for the cancer painlessly and rapidly thus identifying the disease at early phase. Integrative method using all developed approaches is of high importance. In such case, ANNs are considered as tools of high importance to diagnose breast cancer since they have been automated with the intelligent decision-making approach that has not be impacted from

the human error factors such as emotions, lack of attention or experience. Zribi M. and Boujelbene Y. [27] have suggested a system for the elimination of unwanted waiting time in addition to the reduction of the technical and human errors in the breast cancer diagnosis. The accurate diagnosing of the breast cancer is a very big problem in medical areas. From literature it is evident that various methods of pattern recognition may be helpful for improving them in this scope. The resulted accuracy of classification has reached 99.95%, a highly encouraging results in comparison to the earlier algorithms which have been applied already and the latest methods of classification which have been implemented on the same data-set.

Nadeem Tariq [28] has suggested a system for designing a system of the Computer Aided Diagnosis (CAD) which is utilized for distinguishing between the malignant (i.e. the cancerous) and the benign (i.e. the non- cancerous) mammograms. The CAD system is utilized for helping the radiologists in increasing the accuracy of their diagnoses. In the suggested system, mammogram features of texture have been calculated with the use of the Grey Level Co-occurrence Matrix (GLCM) along 0°, from the features which have been computed, the most efficient features which have high contributions towards the achievement of the required output have been selected and implemented to the ANN for training and classifications, due to the wide utilization of the ANNs in a variety of fields like, medical diagnosis, pattern recognition, machine learning, etc. For the present study, the mini-MIAS data-base has been utilized and the general specificity, accuracy, and sensitivity, which have been accomplished by the use of the suggested system was respectively 100%, 99.40%, and99.30%. For the reduction of the rate of mortality as a result of the breast cancers, it's quite important for the cancer to be diagnosed at an early stage. miniMIAS data-base mammograms have been utilized in the present study for testing. Dina A. Ragab et. al. [29] proposed a new computer aided system of the detection for the classification of the malignant and the benign mass tumors in the images of the breast mammography. In this study, two methods of segmentation have been utilized. The 1st one has been involved with the manual determination of Region of Interest (ROI), whereas the 2nd one utilized the region based and threshold methods. The Deep Convolutional NN (DCNN) has been utilized for the feature extractions. A common DCNN model which is referred to as the Alex Net has been utilized and is fine-tuned for the classification of two categories rather than 1000.

Mazin Abed Mohammed et. al. [30] proposed a computerized system which has been used to classify the ROI which would be capable of emulating a decision-support strategy for breast tumor analysis. This computerized system can be defined as an inter-disciplinary approach which reduces the false positive rate and the false negative rate and improves sensitivity, specificity, and accuracy, with the use of the approaches of learning and image handling. The use of the ultra-sound images for the classification and the diagnosis of the breast tumors is challenging. This study has researched the ultra-sound image based approach of the classification of the breast cancer with the use of an automatic NN method with no human interventions. The key objective behind this research was developing an entirely computerized system (ANN-based) for the identification and discrimination of benign from the malignant breast tumours through the combination of ultra-sound images with breast structure experimental domain information. The benefits of this method have been confirmed by results. The classifier has resulted in a high sensitivity of 79.3991%, precision of 82.040%, and specificity of 84.756%. In addition to that, the process of the feature selection has made the classifiers of the ANN direct and with a higher proficiency. Moreover, using only one high quality ultra-sound image from every one of the patients has enabled the classifiers of the ANN in the addressing of a heterogeneous mixture of the pathologies. The suggested system may be enhanced additionally for the sake of optimizing the breast tumour recognition efficiency.

3.2. Head and neck cancer

Head and neck cancer can be considered as a general term in the oncology which is utilized for referring to areas in this region which have the highest susceptibility to the cancer and don't include the eyes, the oesophagus (i.e. the food pipe), the brain, the scalp, thyroid glands, the bones, the skin, or the blood; those aren't categorized as cancers of head and neck. "Head and Neck" mainly indicates the salivary glands, oral cavity, larynx, pharynx, para-nasal sinuses, and nasal cavity. Combined, those parts perform various functions and construct different systems. Machine learning has been widely used in head and neck cancer detection [31-36].

The following is a study survey of the works which have been performed in the head and neck area cancer classification with the use of the ANNs:

Martin Halicek et. al. [37] have developed a CNN classifier for the classification of the excised, squamous-cell carcinoma, thyroid cancers, as well as the normal head and neck samples of the tissue with the use of the Hyper-spectral Imaging (HSI) as the HIS appeared as a beneficial, non-contact approach for the acquisition of the optical and spectral tissue characteristics. This study has demonstrated the fact that the deep learning will be potentially implemented in a classifier of the tissue, entirely trainable on a hyper-spectral image data-base from the specimens of the tissue which may result in almost real-time labelling of

the tissues for the intra-operative detection of the cancer. 50 patients of the head and neck cancer who have been undergoing the surgical resection of the cancer have been recruited for the sake of collecting 88 excised samples of the tissues. The collaboration has been made with "Emory University Hospital Midtown" the pathology and surgical teams for obtaining three samples of tissues from every one of the patients, in other words, a normal tissue sample, a tumour sample, and a tumour–normal interface sample. Following the resection of tissues, samples are imaged with the HSI for the sake of obtaining the hyper-cube. The average age of the patients was 57 years old. The two sites of the origin which have been included for the resection of the cancer have been the sites of the upper aerodigestive tract, which are, the larynx, tongue, mandible, pharynx, and thyroid. 29 of 50 patients, had squamous-cell carcinoma (SCCa) and 21 of them had the thyroid carcinoma, which is the medullary thyroid carcinoma and the papillary thyroid carcinoma. The suggested approach was fast and required no more additional post processing for the enhancement of results. In addition to that, the 37-fold, leave-one-out external-validation have shown that the method of the classification has been reliable and may be implemented to new images of the patients. The initial results have indicated the fact that HIS's potential and deep learning for the surgical samples' automatic tissue-labelling of the patients of head and neck cancers.

Benjamin H. et. al. [38] showed that the recognition of the nodal metastasis and tumour Extra Nodal Extension (ENE) is necessary for the management of the head and neck cancer, however, it currently can only be recognized through the post-operative pathology. Pre-treatment, particularly, the radiographic ENE identification, has proved to be of an extreme difficulty for the clinicians, however, it would be of a great influence to guide the patient management. In this study, researchers have shown that a DCNN may be trained for the sake of identifying the ENE and the nodal metastasis with exceptional efficiency, surpassing what the clinicians have accomplished historically. They have trained a 3D CNN with the use of a data-set of 2875CT-segmented samples of the lymph nodes with labels of correlating pathology, which have been subjected to cross-validation and fine-tuning on 124 samples, a testing on the blinded testing set of 131 samples has been carried out. On blinded testing set, this model has made the prediction of the ENE and the nodal metastasis every one of which is with the area under receiver operating characteristic curve (AUC) of 0.91 (95%CI: 0.85–0.97). The model can be possibly used like tool for the clinical decision-making for the sake of helping in guiding the management of the head and neck cancer patients.

Martin Halicek et. al. [39] have progressed a classifier of the tissues with the use of three separate architectures of the CNN on the data of the HSI for the sake of investigating the capability for classifying cancer margins from the ex-vivo human surgical samples, which have been obtained from 20 patients which have undergone surgical resections of the cancer as an initial group of validation. A new method for the generation of HSI ground truth with the use of a registered histological margin of the cancer has been applied for the sake of creating a data-set of validation. The CNN-based approach has classified tumour-normal margin of the SCCa vs. the normal oral tissue with an AUC of 0.86 for the inter-patient validations, which has performed with an accuracy equal to 81%, sensitivity equal to 84% and specificity which is equal to 77%. The cancer-normal margins of the thyroid carcinoma are categorized with a 0.94 AUC for the inter-patient validations, and has performed with a 91% sensitivity, 90% accuracy, and an 88% specificity. The classification of the thyroid inter-patients with a 3-DCNN is equivalent to the intra-patient classifications with only a 2-DCNN. On the other hand, SCCa inter-patient classification needs a 3-D-inception-based Convolutional NN for the sake of achieving results which are equivalent to the 2-DCNN intra-patient classifications. CNNs are capable of classifying tumour-normal boundary with an accepted precision.

André Diamant et. al. [40] showed that the Convolutional NNs are capable of enhancing the efficiency of the conventional radiomics, through the detection of patterns of the image which might not be covered with the conventional model of the radiomics. The suggested Convolutional NN that has contained four main operations: convolution, non-linearity, pooling and classification. The layer comprises a varying number of the convolution filters, every one of those filters plays the role of the sliding window (small size, such as, 5x5 pixels) which apply convolution over input data. Through the learning several different filters (for instance 64), the network can be incorporating many different characteristics. With the increase in the chosen filters for learning, increases the features of the image which the network can obtain ultimately and identify in the unseen images. Numerous Convolutional NNs have used a rectified linear unit (ReLU), simply replacing every negative value of the input (from previous layer of convolution) with zero. Instead of that, using a parametrized ReLu (PReLU) that has largely an identical impact, however it permits a small number of negative inputs to spread over the network through the multiplication of the negative part of input domain through the learnt non-0 slope. After that, the operation of the pooling progressively reduces spatial input information size. Which is valuable for the computational efficiencies, for the sake of ensuring the fact that this model may be generalized and with the most importance, for the introduction of the invariance of the location. The suggested model utilizes the "max-pooling", a process replacing each one of the 4x4 area of the input data with maximal value amongst them. The testing of the proposed model is done through the training

of a Convolutional NN for the prediction of the results of the treatment of the head and neck SCC patients, completely based on their pre-treatment calculated image of the tomography. The training (i.e. 194 patients) and sets of validation (i.e. 106 patients) that are mutually exclusive and comprise four institutions, coming from Cancer Archive of Imaging. In comparison with a conventional radiomic model which has been applied to an identical cohort of the patient, the suggested approach gives a 0.88 AUC in the prediction of the distant metastasis. In the case of the combination of the suggested model with the earlier framework, AUC is enhanced to 0.92. The suggested model has been shown explicitly recognizing the conventional radiomic characteristics, directly visualized and providing precise predictions of the result.

3.3. Lymph cancer

Lymphoma can be defined as the cancer which starts in immune system cells which fight infection, referred to as the lymphocytes. This cancer is a set of the blood cancers developing from the lymphocytes (a white blood cells' type) [41]. Its name usually indicates only cancerous versions instead of all such tumor types. Those cells reside in lymph nodes, thymus, spleen, bone marrow and other body parts. In the case where the person has lymphoma, an out of control change and growth of the lymphocytes occurs. There are two key lymphoma types: Non-Hodgkin: the majority of the patients that have lymphoma have this type and the other type is the Hodgkin. The Hodgkin and the Non-Hodgkin lymphoma include various lymphocyte cell types. Each lymphoma type grows at a distinct rate and gives different responses to the treatments. Lymphoma is quite treatable and the outlook may be different according to the lymphoma type and stage. The physician is capable of helping to find the correct treatments for Lymphoma type and stage. The Lymphoma differs from the leukemia. Every one of those cancers begins in a different cell type. The Lymphoma begins in lymphocytes which fight infections. The Leukemia begins in the blood-forming cells within the marrow of the bone. Lymphoma differs as well from the lymphedema, which is a set of fluid forming in the tissues of the body in the case where there is blockage or a damage in the system of the lymph [41]. Machine learning has been widely used in head and neck cancer detection [42-47].

Below is a survey for the research that are done in the area of lymph cancer classification using neural networks:

T. Wollmann, K. Rohr [48] described an innovative approach for the effective performance of classifying the whole slide images and grading of the patient level breast cancers. The suggested approach has used a DNN to classify small patches and has utilized an averaging of the model for the boosting. In the initial step, patches of ROI is specified and automatically cropped through colour threshold and after that, categorized through the deep NN. The results of the classification have been utilized for the determination of as lied class of the level and for additional aggregations for the prediction of the level grade of a patient. The fast speed of the processing of the presented approach has provided the ability of a high throughput image analyses utilizes a DNN for sparsely classifying the WSIs. The suggested method has specified the ROIs in WSIs with the use of color threshold and the morphological operations which have been succeeded with a sparse classification with the use of a DNN. The network undergoes training and testing with the use of similar image resolution. Due to the fact that WSIs have different factors of the downsampling, utilize normalization. The suggested method uses an ROI approach of selection and a densely interconnected DNN for performing sparse classifications. The results of the sparse classification will be aggregated with the use of the decision rules. The algorithm has specified a grade of patient level which has been based on 5 WSIs in approximately 4 sec.

Yun Lu, et. al. [49] have performed the training of a faster region-based CNN (Faster R-CNN) with 28080 images of the MRI of the metastasis of the lymph nodes, which allow Faster RCNN to be capable of reading these images and for making the diagnoses. For the clinical verifications, 414 rectal cancer cases at a variety of the medical centers have been gathered and a Faster RCNN–based diagnosis cases have been compared to the diagnoses of the radiologist with the use of receiver operating characteristic curves (ROC). The area under the Faster RCNN ROC has been 0.9120, which has indicated a more objective and efficient diagnosis. The diagnosis time of the Faster RCNN has been 20s/case, that has been considerably less compared to the average speed (600s/case) of radiologist diagnosis. Initially, the lymph node MRI images have been gathered from several large-scale Chinese medical institutions and a large data-base has been constructed. After that, trained and tested the Faster R-CNN and carried out a rigorous practical verification of the clinical with the use of a Faster RCNN. This research has been the first one proposing that the deep learning is more sufficient in comparison with the general radiologists in diagnosing and identifying the metastatic lymph nodes concerning both the quality and the speed of the diagnostic. This study was helpful for the radiologists in making higher accuracy metastatic lymph node diagnoses and is profoundly important with a clinical value in rectal cancer TNM staging, particularly for selecting programs of patient treatments. Even though the study results have indicated the fact that the platforms of the deep learning are similar to or more sufficient compared to the average diagnosis radiologists' skills, this study has the aim of developing an

assisting tool for aiding the radiologists for the more effective and accurate determination of the metastases of the lymph node, not to be substituting the doctors.

Iam Palatnik de Sousa et. al. [50] generated explanation on the way the CNNs detect tumor tissues in the patches that have been obtained from the histology of the whole slide images. Which is accomplished with the use of the "locally-interpretable model-agnostic explanations" method. Two of the publicly available CNNs, which have been trained on Patch Camelyon Benchmark, have been analysed. Three of the common algorithms of segmentation have been compared for the generation of the super pixel and a 4th parameter-free simpler segmentation approach has been suggested. The key features of explanations have been discussed, in addition to the fact that the main pattern sidentifiedintrue positive predictions. There are compared against the medical literature and annotations and have suggested the fact that CNN the comparing of the usually-used algorithms of image segmentation and their impacts on generating the LIME explanations for the classifications of the tumor. A simpler strategy of the image segmentation which involves the square grids, devoid of any of the fine tuning parameters, has been suggested and tested as well. A variety of the algorithms of segmentation have been utilized for the generation of the super pixels, which include a new suggested method of the simple square grid. Post the comparison of the behaviour of every one of the segmentation algorithms, explanations have been produced for a set of the true positive projections. The properties of those images have been analysed and some of the patterns where the structures affect the positive prediction have been observed. The method which has been utilized and described in this study may be adapted to other tasks of the classification of the medical images. Those explanations have been compared as well with the medical annotations on similar images. None-the-less, the analysis demonstrating the fact that the model of the AI in this case has been following a minimum of some of the key human approach premises for similar tasks; which means, the focus on the abnormal tissues in the case of the prediction of existence of the tumors, with anomalies which usually consist of the enlarged and the deformed cell bodies or nuclei inside the tissues. The presented analysis considerably motivated the collaborations with the expert pathologists in the upcoming researches for the evaluation of the AI explanations in more depth and with a larger models' ensemble, in addition to the application of the method that has been presented here to other data-sets of the medical imaging.

4. CONCLUSIONS

This paper presents a review on neural networks approach on classifying cancers. This survey clearly demonstrates the effectiveness of neural network technologies in the detection of cancer. The present survey of the researches which involved NNs and classification of cancer has clearly demonstrated the efficiency of the NNs to detect cancer. The majority of NNs have shown exceptional results for the accurate classification of the tumor cells. Cancer can be considered as a very dreadful disease. Cancer diagnosis is of high importance in the initial stages for in order to be treated proper. ANNs are one of numerous different computation approaches which could be implemented on the diagnosis and treatment of cancer and as more funding is being presently given to the researches of the computer science via efforts. Technologies of the ANNs could be utilized for the more effective and easy diagnosis of cancer compared to the conventional approaches due to the fact that they reduce the needs for the invasive processes and interpreting the imaging approaches' results. In addition to that, NNs were trained for the analysis of the individual prognoses and plans of the treatment with an accuracy which is equivalent to the accuracy of the experienced doctors. Advances like those are helpful to the doctors as well as the patients to make the optimum healthcare decisions. Therefore we can construct the automated diagnosis system using neural network that can predict the status of human body very accurately. Moreover neural network can be applied in any field of engineering or science where there is problem of classification. Neural networks was successfully applied without human intervention. Thus, ANN is an effective option for cancer diagnosis so to help clinicians and oncologists in the prediction and prognosis of cancer.

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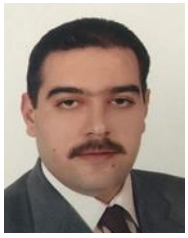

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