INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume 4, Issue 1)
Available online at www.ijariit.com

Neural Network Ensemble Model with Back Propagation for Classifying Melanoma on Dermoscopy Images-A Survey

Jeena Johnson
College of Engineering Kidangoor, Kottayam, Kerala
jeenajohnson93@gmail.com

Asha Vijayan
College of Engineering Kidangoor, Kottayam, Kerala
ashavijayan86@gmail.com

***Abstract**: Dermoscopy is the examination of the skin using skin surface microscopy. We develop a novel method for classifying melanocytic tumors as benign or malignant by the analysis of digital dermoscopy images.In this paper before classification pre-processing and segmentation, feature extraction is to be carried out. Then introduce the classifier based on neural network ensemble is used to classify the melanocytic tumors as benign or malignant. To improve the neural network's generalization performance proposes an effective neural network ensemble approach with an idea. One is to apply neural network's output sensitivity as a measure to evaluate neural network's output diversity at the input near training samples so as to able to select a diverse individual from a pool of well-trained neural network. Lesions are extracted using SGNN. Lesions are classified using a classifier based on neural network ensemble model.*

Keywords: Lesion, Dermoscopy, Neural Network Ensemble Classifier, Fuzzy Neural Network, SGN.

I. INTRODUCTION

Malignant Melanoma (MM) is the third most frequent type of skin cancer and one of the most malignant cancers. Invasive melanoma alone has an estimated incidence of 73,870 and an estimated total of 9,940 melanoma deaths occurred in the United States in 2015. As compared with the U.S., Europe, and Australia, the incidence of skin cancer in China is lower, but it has still been increasing 3%- 8% annually and has doubled over the past decade. Dermoscopy is a non-invasive skin imaging technique which allows a magnified visualization of the skin surface and sub dermal structures. Dermoscopy images have played a significant role in increasing the survival rate of patients by assisting the early diagnosis of MM. However, diagnoses that are made by human experts, while still the clear gold standards, are nevertheless subjective. Indeed, the accuracy and reproducibility of diagnosis are highly dependent on the expertise of the physician. It has been reported that dermoscopy may actually lower diagnostic accuracy when conducted by inexperienced dermatologists. Most of the existing literature regarding computer-assisted lesion classification has focused on feature extraction and classifier design on images that are either explicitly, or implicitly, assumed to contain a complete lesion object. However, images may not always capture entire lesions. Local features can be used to deal with the complex situations. Extracted local features from 16×16 image patches using wavelets and Gabor-like filters, then analysed the responses using a bag-of-features (BoF) model to recognize MM. Barata et al. extracted texture and colour features, then used a BoF model to code these features to classify lesions.

II. LITERATURE SURVEY

A. Melanoma Classification on Dermoscopy Images using a Neural Network Ensemble Model

Yang Li *et al* developed a novel method for classifying melanocytic tumors as benign or malignant by the analysis of Digital dermoscopy images. The algorithm follows three steps:

1) Lesions are extracted using a self-generating neural network (SGNN);
2) Features descriptive of tumour colour, texture and border are extracted
3) Lesion objects are classified using a classifier based on a neural network ensemble model.

In clinical situations, lesions occur that are too large to be entirely contained within the dermoscopy image. To deal with this difficult presentation, new border features are proposed, which are able to effectively characterize border irregularities on both complete lesions and incomplete lesions. In our model, a network ensemble classifier is designed that combines back propagation

(BP) neural networks with fuzzy neural networks to achieve improved performance. Dermoscopy is a non-invasive skin imaging technique which allows a magnified visualization of the skin surface and sub dermal structures. Usually, a computerized dermoscopy image analysis model includes four aspects:

1) Pre-processing
2) Segmentation
3) Feature Extraction
4) Classification

Pigmented skin lesions are typically evaluated by dermatologists using the "ABCD" rule. Neural Network Ensemble In a neural network ensemble, each network individual is initially trained using the same training sample. Neural network ensembles are effective only when the individual nets make independent errors. A variety of algorithms have been developed to train network ensembles to achieve better generalization capability, which can be broadly classified according to the type of initial conditions, training data, network architecture and individual network types. In an ensemble, the network architecture and network type are completed in the model design stage, while the initial conditions and training data are developed in the generation stage of the individual nets.

B. Melanoma skin cancer detection and classification based on supervised and unsupervised learning

Image processing is having a very important role in the medical domain. Melanoma skin cancer is critical and dangerous for human beings. Early detection of Melanoma skin cancer is very much necessary for the patient because this Melanoma skin cancer directly leads to the death of a person. If it is detected at an early stage then Melanoma skin cancer is completely curable. In this paper, early detection and classification of Melanoma skin cancer are done using different classifiers as Neural Network and Support Vector Machine.

Melanoma skin cancer develops in melanocytes skin cells those are responsible to produce melanin. Already research has been done on detection of Melanoma skin cancer but still, the issue exists for higher accuracy for the detection and classification of Melanoma skin cancer. In this paper both supervised and unsupervised classification is done using supervised learning based classifiers as Neural Network, Support Vector Machine, and unsupervised learning based classification as K-means clustering algorithm.

C. A survey on recent computer-aided diagnosis of Melanoma

This paper reviews the earlier period and current technologies for skin cancer detections. Malignant melanoma is one of the most common and the deadliest type of skin cancer. Skin cancer is commonly known as Melanoma. Skin Cancers are two types- Benign and Malignant Melanoma. Melanoma can be cured completely if it is detected early. Both benign and malignant melanoma resembles similar in appearance at the initial stages. So it is difficult to differentiate both. This is a main problem with the early skin cancer detection. Only an expert dermatologist can classify which one is benign and which one is malignant. This work focuses on developing a new computer- aided diagnosis method for melanoma. With the aim of improving some of the existing methods and developing new techniques to facilitate exact, prompt and dependable computer- based diagnosis of melanoma, this makes contributions in various stages of a computer-aided diagnostic system of melanoma; namely, image segmentation or border detection, feature extraction, feature selection, and classification.

The occurrence of malignant melanoma has increased severely over the past few decades. Malignant melanoma is the toxic form of skin cancer. The worldwide steady increase in the incidence of melanoma in recent years, its high mortality rate and the massive respective medical cost has made its early diagnosis a continuing priority of public health. Early diagnosis of melanoma is particularly important for two reasons: First, the prognosis of melanoma patients depends highly on tumour thickness. If melanoma is detected at an early stage, when the tumour thickness is less than 1 mm, it is highly curable, with a 10-year survival rate between 90 and 97%. However, thickened melanoma is lethal and diagnosis at more advanced stage decreases the five-year survival rate to 10–15%. Second, melanoma is a skin cancer that in a majority of cases is localized to the skin and is therefore detectable by simple examination. However, it is more likely to metastasis and spread to other organs compared to other skin tumors. Early signs of melanoma are summarized by the mnemonic "ABCDE".

D. Improving Dermoscopy Image Classification Using Colour Constancy

Robustness is one of the most important characteristics of computer-aided diagnosis systems designed for dermoscopy images. However, it is difficult to ensure this characteristic if the systems operate with multisource images acquired under different setups. Changes in the illumination and acquisition devices alter the colour of images and often reduce the performance of the systems. Thus, it is important to normalize the colours of dermoscopy images before training and testing any system. In this paper, we investigate four colour constancy algorithms: Gray World, max-RGB, Shades of Gray, and General Gray World. Our results show that colour constancy improves the classification of multisource images, increasing the sensitivity of a bag-of-features system from 71.0% to 79.7% and the specificity from 55.2% to 76% using only 1-D RGB histograms as features.

E. **Automatic Segmentation Of Dermoscopy images using self-generating neural networks seeded by genetic algorithm**

A novel dermoscopy image segmentation algorithm is proposed using a combination of a self-generating neural network (SGNN) and the genetic algorithm (GA). Optimal samples are selected as seeds using GA; taking these seeds as initial neuron trees, a self-generating neural forest (SGNF) is generated by training the rest of the samples using SGNN. Next, the number of clusters is determined by optimizing the SD index of cluster validity, and clustering is completed by treating each neuron tree as a cluster. Since SGNN often delivers inconsistent cluster partitions owing to sensitivity relative to the input order of the training samples, GA is combined with SGNN to optimize and stabilize the clustering result. In the post-processing phase, the clusters are merged into lesion and background skin, yielding the segmented dermoscopy image. A series of experiments on the proposed model and the other automatic segmentation methods (including Otsu's thresholding method, *k*-means, fuzzy *c*-means (FCM) and statistical region merging (SRM)) reveals that the optimized model delivers better accuracy and segmentation results.

F. **Effective Neural Network Ensemble Approach for Improving Generalization Performance**

Jing Yang *et al*, presented with an aim at improving neural networks' generalization performance, proposes an effective neural network ensemble approach with two novel ideas. One is to apply neural networks' output sensitivity as a measure to evaluate neural networks' output diversity at the inputs near training samples so as to be able to select diverse individuals from a pool of well-trained neural networks; the other is to employ a learning mechanism to assign complementary weights for the combination of the selected individuals. Experimental results show that the proposed approach could construct a neural network ensemble with better generalization performance than that of each individual in the ensemble combining with all the other individuals, and then that of the ensembles with simply averaged weights. In Machine learning, ensemble has been paid more attention recently, due to its powerful ability to solve

Complex problems. An ensemble is a composite model like a committee, which combines a set of learners to deal with a problem that could hardly be tackled by an individual one. From a problem solving point of view, ensembles could generally be categorized into two types: pure ensemble systems, which solve the problem by a set of learners, and modular systems, which break down the original problem into several sub-problems and each learner solves one sub problem. A pure ensemble system usually has two goals: Improve training accuracy by upgrading weak learners to be a combined strong learner, improve the generalization performance by combining well-trained complementary learners.

G. **Computerized analysis of pigmented skin lesions: A review**

Konstantin korotkov *et al* Computerized analysis of pigmented skin lesions (PSLs) is an active area of research that dates back over 25 years. One of its main goals is to develop reliable automatic instruments for recognizing skin cancer from images acquired in vivo. This paper presents a review of this research applied to microscopic (Dermoscopic) and macroscopic (clinical) images of PSLs. Melanocytes. Dendritic cells found in the basal layer of the epidermis. They distribute packages of melanin pigment to surrounding keratinocytes to give skin and hair its colour. Although cancer can develop from almost any cell in the body, certain cells are more cancer-prone than others. And the skin is no exception: most skin cancers develop from non-pigmented cells and not from pigmented melanocytes. Thus, the two most common skin cancers are basal cell carcinoma and squamous cell carcinoma which develop from basal and squamous keratinocytes, accordingly. However, an aggressive malignancy of melanocytes, malignant melanoma, is a less common but far more deadly skin cancer. Melanoma is characterized by the most rapidly increasing incidence and causes the majority of deaths related to skin cancer. In its advanced stages (with signs of metastasis) melanoma is incurable, and the treatment, being solely palliative, includes surgery, immunotherapy, chemotherapy, and/or radiation therapy. It is precisely due to these unfortunate statistics that the vast majority of research published in the field of computerized analysis of dermatological images is dedicated to developing automatic means of melanoma diagnosis. Another reason for such research efforts is the fact that early-stage melanoma is highly curable.

This highlights the critical importance of timely diagnosis and treatment of melanoma for patient survival. The most valuable prognostic factor of malignant melanoma is Breslow's depth or thickness. This means of measuring the vertical growth of melanoma was proposed by Alexander Breslow in 1970. In general, the deeper the measurement (depth of invasion), the more chances there are for metastasis and the worse the prognosis. A comparison with an older prognostic factor, Clark's levels, which is less precise for thicker primary melanomas, can be found.

III. CONCLUSIONS

This paper presents a literature survey of various classification techniques for classifying the melanocytic tumours as benign or malignant. Images containing large and incomplete lesion objects are often obtained by dermoscopy, resulting in the failure of systems that rely on common shape features. The proposed border features described here were designed to be insensitive to the incompleteness of lesion objects. Feature dimensionality reduction was used to eliminate less relevant or noisy features, thereby improving classification performance. PCA was used to reduce the feature dimensions and to select the optimal feature set.

REFERENCES

1. F.Y. Xie, A.C. Bovik, "Automatic segmentation of dermoscopy images using self-generating neural networks seeded by genetic algorithm, Pattern Recognition, vol. 46, no. 3, pp. 1012-1019, 2013.
2. F.Y. Xie, S.Y. Qin, Z.G. Jiang, R.S. Meng, "PDE-based unsupervised repair of hair-occluded information in dermoscopy images of melanoma," Computerized Medical Imaging and Graphics, vol. 33, no. 4, pp. 275-282,2009.
3. H.L. Yu, G.F. Chen, et al., "A Novel Neural Network Ensemble Method Based on Affinity Propagation clustering and Lagrange Multiplier," in Computational Intelligence and Software Engineering, 2009, pp. 1-5, 2009.
4. T. Schindewolf, W. Stolz, R. Albert, et al., "Classification of melanocytic lesions with color and texture analysis using digital image Processing," American Society of Cytology, vol. 15, no. 1, pp. 1-11, 1993.
5. A. Ghodsi, "Dimensionality reduction a short tutorial," Department of Statistics and Actuarial Science, Univ. of Waterloo, Ontario, Canada,2006.
6. J.F. Alcon, C. Ciuhu et al., "Automatic Imaging System With Decision Support for Inspection of Pigmented Skin Lesions and Melanoma Diagnosis," IEEE Journal of Selected Topics in Signal Processing, vol. 3, no.1, pp. 14-25, 2009.
7. C. Barata, E. M. Celebi, J. S. Marques. "Improving dermoscopy image classification using color constancy," Biomedical and Health Informatics, IEEE Journal of, vol. 19, no.3, pp.1146-1152, 2015.

