DETECTION OF MALIGNANT MELANOMA WITH SUPERVISED LEARNING: A REVIEW

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Abstract: Malignant melanoma is increasing in some countries especially in Australia. Computational systems have been proposed for automatic diagnosis of skin cancer in order to aid dermatologist in early assessment of such disease. Several ways for image analysis targeted on dermoscopy imagery are projected for CAD system. To assist dermatologists in their diagnosis is the main aim of such system at an effective automated diagnosis. Malignant Melanoma needs to be diagnosed at their early stage, when the patient has a higher probability of cure.

Malignant melanoma is a kind of skin cancer whose severity even leads to death. For decreasing the chances of death earlier detection of Melanoma is necessary and the clinicians can treat the patients to increase the chances of survival. For detection of Melanoma using its features there are some machine learning algorithms are developed. This paper presents the review of Malignant Melanoma with supervised learning.

Keywords— Malignant Melanoma, Supervised Learning

I. INTRODUCTION

Melanoma is a lethal form of skin cancer, with an estimated mortality rate of 14% worldwide. 76,690 new cases of melanoma were reported by The American Cancer Society in the United States in 2013, with 9,480 estimated deaths, according to recent annual cancer facts and figures [1]. The global cancer statistics [2] also shows that the incidence and mortality rates of melanoma are in rising trend.

With the utilization of dermoscopy [3] and several other clinical algorithms like ABCD rule [4], the 7-point checklist [5], and the Menzies method [6], the diagnosis accuracy of melanoma has been higher than the simple naked-eye examination [7]. The accuracy of clinical diagnosis is highly depending on experience of dermatologists which is estimated to be about 75-85% because this process is highly subjective and complex[8].

For reduction of subjectivity and complexity of clinical diagnosis, it is necessary to conduct research on quantitative approaches for automated detection of melanoma. For the diagnosis of Melanoma, a large amount of computer-aided approaches have been developed in the last two decades For example, In the approach of discriminating melanoma from melanocytic nevi, A.G. Manousaki et al. [9] have used some parameters like geometry, color and color texture as independent covariates. In Melanoma recognition system H. Ganster et al. [10] has been used some methods like, image processing, segmentation, feature

calculation and selection, as well as k-NN classification. In automatic imaging system, J.F. Alcón et al.[11] have also presented an approach that combines the outcome of the image classification with context knowledge such as skin type, age, gender to add confidence to the classification.

In diagnosis of Melanoma R. Garnavi and M. Aldeen have used border- and wavelet-based texture and four different classifiers. Additionally, many computer applications like SolarScan [12], the DANAOS expert system [13], DermoGenius-Ultra [14], and MelaFind [15], etc have been developed for melanoma diagnosis. From these methods we can achieve good classification accuracy.

Skin cancer generally starts from epidermal layer and invades deeper tissue over time, the information obtained with the current multiple-scattered light-based methods is averaged out and does not reflect the accurate morphology of the specific diseased layer, although encouraging results for skin cancer detection have been recently obtained using multiple-scattered light-only methods in conjunction with classification algorithms [16,17].

II. SUPERVISED LEARNING

Machine Learning (ML) is considered as a subfield of Artificial Intelligence since those algorithms is seen as building blocks to create computers learn to behave a lot of showing intelligence by somehow generalizing instead of simply storing and retrieving data items sort of a database system and alternative applications would do.

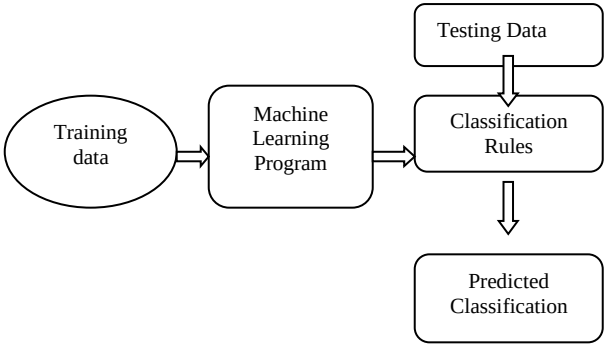

Figure 1 . Classification Architecture

The basic function of Machine learning tries is to inform computers a way to automatically find a good predictor based on experiences and good classifier does

this job. Classification is the process of using a model to predict unknown values (output variables), using a number of known values (input variables).

In the number of different applications, Data mining is one of the most tools of machine learning. Generally people chooses a wrong choice during analysis phase or when trying to establish relationships between multiple features. So its makes difficult for them to explore solutions to certain problems.

Machine learning will usually be with success applied to those issues, rising the efficiency of systems and therefore the designs of machines. Our main purpose of using supervised or Inductive machine learning, is to learn a target function that can be used to predict the values of a class.

The process of applying supervised Machine Learning to a real-world drawback is described in below figure 2. In supervised learning the primary step is dealing with dataset. So as to perform a better training on data set an appropriate expert could suggest better selection of features.

If concerned expert is not in reach, then the other approach is "brute-force", which means measuring everything available in the hope that the right (informative, relevant) features can be isolated.

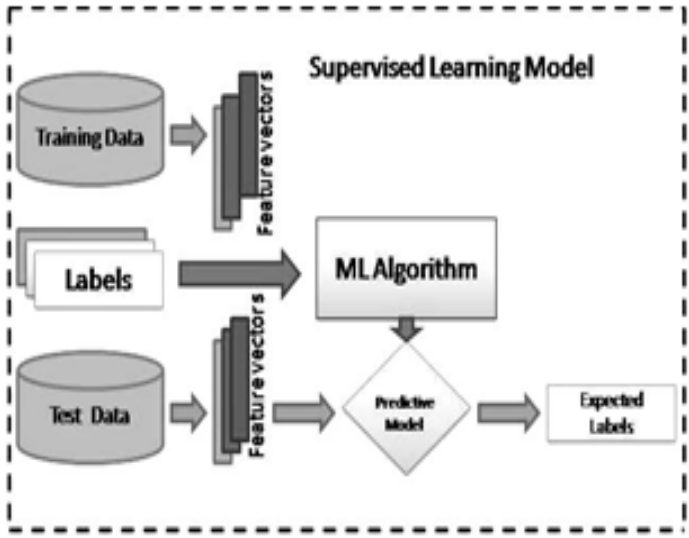

Figure 2. Supervised Machine Learning Model.

III. APPROACHES OF SUPERVISED LEARING

A. Naive bayes classifiers

Bayesian networks are widely used to perform classification tasks. In Bayesian networks there is a directed acyclic graphs which have only one parent (representing the unobserved node) and several children (corresponding to observed nodes) with a strong assumption of independence among child nodes in the context of their parent

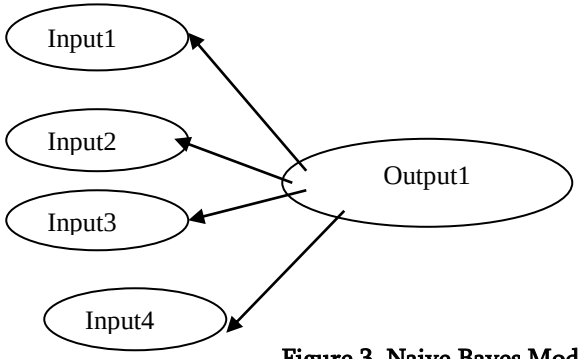

Figure 3. Naive Bayes Model

B. Bayesian networks

Bayesian Networks (BN) are graphical models that are used to illustrate relationships between events or ideas to infer probabilities or uncertainties associated with those ideas or events. Some maon applications of BN are Information retrieval, predictions based on limited input or recognition software.

The Bayesian network structure S is in the form of a directed acyclic graph (DAG) and the nodes in S are in one-to-one correspondence with the features X. During the lack of possible arcs in S encodes conditional independencies These arcs represent casual influences among the features. Moreover, a feature (node) is conditionally independent from its non-descendants given its parents (X1 is conditionally independent from X2).

C. Support vector machines

Support Vector Machines (SVMs) is used for classification, regression and outlier's detection and it is a important Supervised learning method. There are some benefits of using SVM are: i) It is effective for high dimensional space, ii) Uses a subset of training points in the decision function (called support vectors),

so it is also memory efficient, iii) It is versatile because holds different kernel functions can be specified for the decision function.

D. Deep learning

The use of deep artificial neural networks has gain popularity for the last few years in pattern recognition and machine learning. Most of the popular Deep Learning Techniques are built from Artificial Neural Network (ANN). We can define Deep learning as a model (e.g., neural network) with many layers, trained in a layer- wise fashion.

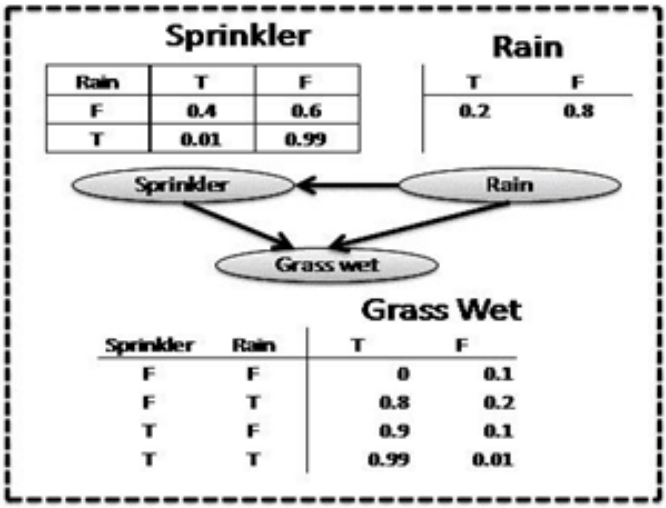

Figure 4. Bayesian network with conditional probability tables

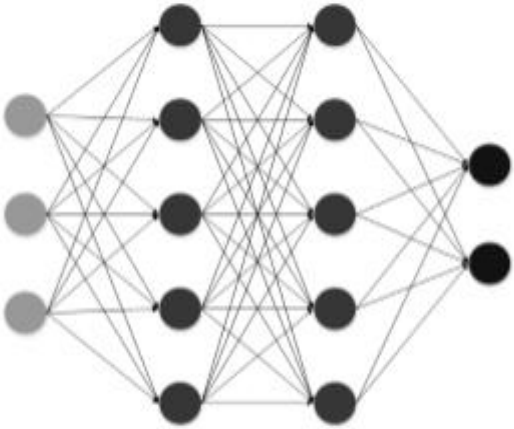

Figure 5. Deep Network Architecture

IV. Related Study

[H. R. Mhaske , et. al 2013] Image processing is having very important role in 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 lead to the death of a person. If it is detected at early stage, then Melanoma skin cancer is completely curable. In this paper early detection and classification of Melanoma skin cancer is done using different classifiers as Neural Network and Support Vector Machine.

[S. Sujitha 2015] has used some computer aided image processing techniques for melanoma diagnosis. For preprocessing method she has used a combination of Median filtering and Karhunen-Loeve transform and for segmentation process she has used a combination of Active contours and Watershed Transformation algorithms. When this combined method is applied on skin lesion images, the problems like over smoothing and over segmentation were solved

[Ammara Masood 2015] An active area of research is an Automated diagnosis of skin cancer with different classification methods proposed so far. However, if there is no self-advising and semi supervising capability in the model then these classification models supported by insufficient labeled training data will badly influence the diagnosis process.

This paper presents a semi supervised, self-advised learning model for automated recognition of melanoma using dermoscopic images. Deep belief architecture is constructed using labeled data together with unlabeled data, and fine tuning done by an exponential loss function in order to maximize separation of labeled data. Generally a self-advised SVM algorithm is used in parallel to enhance classification results by counteracting the effect of misclassified data.

To increase generalization capability and redundancy of the model, polynomial and radial basis function based SA-SVMs and Deep network are trained using training samples randomly chosen via a bootstrap technique. Then the results are aggregated using least square estimation weighting.

The proposed model is tested on a collection of 100 dermoscopic images. The variation in classification error is analyzed with respect to the ratio of labeled and unlabeled data used in the training phase. The classification performance is compared with some popular classification methods and the proposed model using the deep neural processing outperforms most of the popular techniques including KNN, ANN, SVM and semi supervised algorithms like Expectation maximization and transductive SVM.

[Maria João M. Vasconcelos ,et al ,2015]The incidence of melanoma has been increasing steadily over the past few decades throughout most of the world. The dermoscopic images used by the computer diagnosis system can be a great help for the diagnosis of melanoma.

This paper presents an supervised classification for image processing and analysis methodology for independently assess the Asymmetry, Border, Color and Dermoscopic Structures score according to the ABCD rule, and the corresponding Total Dermatoscopy Score of a skin lesion using dermoscopic images..

Accuracy rates of 74.0%, 78.3% and 53.5% were achieved for the estimation of the ABCD score of the Asymmetry, Border and Color criterion, as well as accuracy rates for the presence of the five Differential Structures of 72.4%, 68.5%, 74.0%, 74.0% and 85.8% for dots, globules, streaks homogeneous areas and pigment network. Moreover, for the classification of the dermoscopic images as melanoma or non-melanoma, the achieved score for sensitivity and specificity were 93.3% and 69.1% .

V. LIMITATION AND FUTURE WORK

Need to work in large database.In future this work can be extended to investigate further on enlarged database so as to hypothesize diagnostic model on the melanoma population.

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