Deep learning in Dermatology for skin Diseases Detection.

Upma Yadav, Ashok Kumar, Anamika Tiwari, Saurabh Mukherjee

Abstract - Dermatology is a medical field that treats skin health and diseases. People feeling disease symptoms of an affecting the skin must consult a dermatologist if this stipulation does not respond to home remedy. Early detection and treatment can correct most skin disorders. Basal Cell Carcinoma (BCC), Melanoma and Squamous Cell Carcinoma (SCC) are typically appearing type of skin cancers.

The purpose of this effort is to provide a system that can be deployed to classify dermatoscopic images to predict skin diseases with early detection and higher accuracy. This work is a concrete effort to accomplish higher degree of accuracy for clinical usage by implementing advances in soft computing and image processing like deep learning and in-depth neural networks in an early stage for 7 class classification for HAM10000 dataset.

Keywords- Dermatoscopic, Imaging modality, Invasive, Non-invasive.

I. INTRODUCTION

The disease of skin and the cause of death in the year 2013 is 18th leading cause of DALYs in 188 countries. The mortality and the disease of the skin are the cause of the death and seen from the Disability-adjusted life years (DALYs).

In 2013, there was a constant increase of approximately 42.7% of patients and at present and a higher vision to learn more about traumatism in their medicine.

About 5 million people are facing the problem of skin cancer and 20% of persons in U.S. is reported to develop in lifetime [1][2].

Skin conditions contributed 1.79% to the global burden of disease measured in DALYs from 306 diseases and i injuries in 2013. Individual skin diseases varied in size from 0.38% of total burden for dermatitis (atopic, contact, and seborrhic dermatitis), 0.29% for acne vulgaris, 0.19% for psoriasis, 0.19% for urticaria, 0.16% for viral skin diseases, 0.15% for fungal skin diseases, 0.07% for scabies, 0.06% for malignant skin melanoma, 0.05% for pyoderma, 0.04% for cellulitis, 0.03% for keratoacanthoma, 0.03% for decubitus ulcer, and 0.01% for alopecia areata. All other skin and subcutaneous diseases composed 0.12% of total DALYs.

II. RELATED WORK

The appraisal and innovation of computing techniques of diagnostic medical experts are for the control of prediction systems of essential importance actions in the meadow of medical analysis and diagnosis that performs early detection and in a result of prevention [3].

Various models available as a robust literature put forward and show significant distortion in an early revealing of skin disorder.

Puja [4] developed a model using Pretrain CNN with VGG16/VGG19 models on 850 images from HAM10000 dataset with 91% accuracy.

Jayasheer Hajigude [5] proposed a SVM and CNN with fully connected classifier architecture and experimented on 408 cases of private dataset with an accuracy of 90.7%.

N Vikranth Kumar [6] contributed his work using SVM with augmentation on 1700 images of kaggle dataset with an accuracy of 90%.

Kyamelia Roy [7] adopted on 45,000 images of primary dataset (a huge level CT screening program in the Netherlands) with segmentation technique on Xiangya Derm dataset with CT scan images.

ZHE WU [8] did his work using CNN on a set of 22000 images from Xiangya Derm dataset of dermatoscopic images with 92.9% accuracy.

Felix Q [9] experimented his work by using Artificial Neural Network on 246 test images.

Jainesh Rathod [10] trained CNN using private dataset and accomplished his work with an accuracy of 70%.

Anabik Pal [11] practiced on a ISIC 2018 dataset of 10015 images and experimented with an accuracy of 77.5% from transfer learning of CNN.

Li-sheng Wei [12] proposed a classification model using SVM and reported his work with performance of an accuracy of 85%.

ShashiRekha G1 [13] proposed SVM classification and performance was reported with 80% accuracy.

R. S.Gound [14] practiced on Edinburgh Research and Innovation dataset using SVM with practical accuracy of 92%.

S.Kalairasi [15] did his work by training artificial neural network for a private dataset.

Archana Ajith [16] implemented his work by using SVD with DWT and DCT on private dataset. This work was reported with the accuracy of 80%

Nisreen I [17] experimented bright techniques (hybrid of CBR and ANN) on primary data collected from Dermatology Department at Benghazi Hospital, Libya and reported an accuracy of 80%.

III. METHODOLOGY

Strategy implementation refers to the carrying out of the procedures, modules and strategies, so as to complete the overall work as the solution or architecture for the problem statement. It depicts the followed strategy into the steps and actions of the functioning of system to achieve the objectives. Architectures reviewed in most of the potential works registered as a robust work in literature is shown in the following figure "Fig. 1".
Deep learning in Dermatology for skin Diseases Detection.

Pre-processing or augmentation means a set of operations on input images at the first level of notion on given images. The aspire of pre-processing is an enhancement of the given image that suppresses superfluous noises or improving some image features imperative for additional or next level processing. This also includes balancing of number of samples or images used to train a model in each class that is some augmentations for some images.

![Architecture of proposed effort](image)

**Fig. 1: Architecture of proposed effort having tuned parameters batch_size=120, epochs=200, optimizer='rmsprop', loss='categorical_crossentropy' and metrics='accuracy'**.

CNN outperforms for image dataset where spatial features are key to train a model. This has an access layer, an output layer, and hidden layers. Hidden layers are usually convolution layers, ReLU layers, a pooling layers, and a fully connected complete layer.

**Fig. 2: Functioning of proposed model( Initial phase).**

The convolution layer is sometimes called a service subtraction layer because the properties of the image are extracted as a features map by scanning part of the image in this layer.

The pooling layer is generally located after the convolution layer and its role is dropping or down sampling the threshold of the continuous flow to reduce exponentially growing size of features maps that will be multiple of number of filters in convolution layer.

Fully Connected Layer(FC) binds neurons in one layer to all neurons in the other to serve as a fully connected classifier based on flattened data from featured or response maps after convolution and pooling.

**Fig. 3: Functioning of proposed model( Training phase).**

**Fig. 4: Functioning of proposed model( Classification phase).**

IV. RESULT

Different parameters based recital assessment matrix for the validation and reliability evaluation of trained models are classification report, confusion matrix and the AUC. The confusion matrix shows all true positive, false positive, true negative and false negative labels in opposition to predicted ones to compute TP, FP, TN and FN. Classification report is a matrix to present precision, recall(sensitivity) and f-score calculated using specific formulas on TP, FP, TN and FN. ROC or AUC curve depicts rate of True Positive (TP) against False Positive(FP).
For experimentation, we are in installed setup with Python 3.6.5 for preprocessing and augmentation operations on dataset and MATLAB R2018a for deep learning model development on 6th generation i7 processor with 32 GB RAM and 2TB SSD hardware. In this endeavor we are working with HAM10000 (“Human Against Machine with 10000 training images”) dataset [18], a large collection of multi-source dermatoscopic images of common pigmented skin lesions standard research dataset released as a training set for academic machine learning purposes and are publicly available through the ISIC archive [19].

V. CONCLUSION AND FUTURE WORK

Dancing this study, new visions of developments and metrics, and our technology advance in identifying a class of skin cancer automation with the development of information and data for the diagnostic process and the price of decision making for the classification. The system offers a lifetime and validation of the efficiency of the trained model as an overall system for early detection of skin cancer by patients through dermatoscopic images.

Further, this work can be extended for simple hand held devices like mobile cameras and also can be focused to the development of the Expert Diagnostic Intelligence Systems for the new data available in Big Data. In reference to extension of the work a user friendly graphical interface with prescription can be integrated to provide higher degree of friendliness to the end users.

In summary, the metrics and our architectural logic must offer innovative innovations in the advancement of technology to meet result of advancements of technologies to other fields like medical science.
Deep learning in Dermatology for skin Diseases Detection.

Table 2: Performance statistics

| S.N. | AUTHOR(S) | YEAR | DATASET      | TECHNIQUE                                   | No of images | Imaging Modality | ACCURACY |
|------|-----------|------|--------------|---------------------------------------------|--------------|------------------|----------|
| 1    | Puja [4]  | 2019 | HAM10000     | Pretrain CNN with VGG16/VGG19               | 850          | Dermatoscopic    | 91%      |
| 2    | Jayashree Haigude and Aishwarya Bhavsar[5] | 2019 |             | SVM and CNN                                | 408          |                  | 90.70%   |
| 3    | N Vikranth Kumar, P Vijeeth Kumar[6]      | 2019 | kaggle       | SVM                                        | 1700         |                  | 90%      |
| 4    | Kyamelia Roy, Sheli Sinha Chaudhuri[7]    | 2019 | Xiangya Derm | Segmentation techniques                     |              | CT               |          |
| 5    | ZHE WU, SHUANG ZHAO, YONGHONG, XIAOYU HE, XINYU and YI LI[8] | 2019 | Xiangya Derm | CNN                                       | 2656         | Dermatoscopic    | 92.90%   |
| 6    | Felix Q. Jin and Michael Postiglione[9]  | 2019 |             | Neural Network                             | 246 test     | USG              |          |
| 7    | Jainesh Rathod and Vishal Waghmode[10]    | 2018 | CNN          |                                            |              |                  | 70%      |
| 8    | Anabik Pal, Sounak Ray and Utpal Garain[11] | 2018 | ISIC 2018    | Pre-trained CNN                            | 10015        |                  | 77.50%   |
| 9    | Li-sheng Wei, Quan Gan and Tao Ji[12]    | 2018 | SVM          | CT                                         |              |                  | 85%      |
| 10   | Shashi Rekha G1, Prof. H. Srinivasa Murthy[13] | 2018 | SVM          |                                            |              |                  | 80%      |
| 11   | R. S. Gound and Priyanka S. Gadre[14]    | 2018 | Edinburgh Research and Innovation     | SVM           | 100           |                  | 92%      |
| 12   | S. Kalaiarasi, Harsh Kumar[15]           | 2018 | ANN          |                                            |              |                  |          |
| 13   | Archana Ajith, Vrinda Goel[16]           | 2018 | SVD with DWT and DCT                      |               |              |                  | 80%      |
| 14   | Nisreen I. Abo Dabowsa and Nasser M. Amaitik[17] | 2017 | Dermatology department, Benghazi Hospital, Libya | CBR, ANN     |              |                  | 80%      |
REFERENCES

1. Chante Karimkhani, MD; Robert P. Dellavalle, MD. Global Skin Disease Morbidity and Mortality: An Update From the Global Burden of Disease Study. JAMA Dermatol. 2017;153(5):406-412. doi:10.1001/jamadermatol.2016.5538.

2. https://www.medicalnewstoday.com/

3. M. F. Akay, “Support vector machines combined with feature selection for breast cancer diagnosis,” Expert Syst. Appl., vol. 36, no. 2, pp. 3240–3247, Mar. 2009.

4. Puja, Survey on Skin Disease Detection using Convolutional Neural Network Using International Journal for Research in Applied Science & Engineering Technology (IJRASET), Vol.7, Issue IV, Apr 2019 ISSN: 23 21-9653.

5. Jayashree Haigude, Ashishwarya Bhavsar, Harsha Achara, Nisha K hubchandani, Skin Disease Detection Using Image Processing with Data Mining and Deep Learning, International Research Journal of Engineering and Technology (IRJET), Volume: 06 Issue: 04 | Apr 2019 e-ISSN: 2395-0056 p-ISSN: 2395-0072.

6. N Vikranth Kumar, P Vijeth Kumar, K Pramodh, Prof. Yepuganti Karuna, “Classification of Skin diseases using Image processing a nd SVM, International Conference on Vision Towards Emerging Trends in Communication and Networking (VITECon), 978-1-5386-9353-7/19/$31.00 ©2019 IEEE.

7. Kyamelia Roy, Sheli Sinha Chaudhuri, Sanjana Ghosh, Swarna Kamal Dutta, Proopgya Chakraborty, Rudradeep Sarkar, Skin Disease detection based on different Segmentation Techniques, 978-1-7281-0070-8/19/$31.00 ©2019 IEEE.

8. ZHE WU, SHUANG ZHAO, YONGHONG PENG, XIAOYU HE, XINYU ZHAO, KAI HUANG, WU, WEI FAN, FANGFANG LIMING LIANG, CHEN, JIE LI, WEIHONG HUANG, XIANG YU, LI, Studies on Different CNN Algorithms for Face Skin Disease Classification Based on Clinical Images, SPECIAL SECTION ON DATA-ENABLED INTELLIGENCE FOR DIGITAL HEALTH, VOLUME 7, 2019.

9. Felix Q. Jin, Michael Postiglione, Anna E. Knight, Adela R. Cardon esy, Kathryn R. Nightingale, Mark L. Palmer, Comparison of Deep Learning and Classical Image Processing for Skin Segmentation - International Ultrasonics Symposium (IUS) October 6-9, 2019.

10. Jainesh Rathod, Vishal Wagmode, Aniruddh Sodha, Dr. Prasenjit Bhavathankar, Diagnosis of skin diseases using Convolutional Neural Networks, Proceedings of the 2nd International Conference on Electronics, Communication and Aerospace Technology (ICECA 2018).IEEE Conference Record # 42487; IEEE Xplore ISN: 978-1-5386-09651.

11. Anabik Pal, Sounak Ray, Uttal Garain, Skin disease identification from dermoscopy images using deep convolutional neural network, 2018.

12. Lisheng Wei, Quan Gan, and Tao Li, Skin Disease Recognition Method Based on Image Color and Texture Features, Hindawi Comutational and Mathematical Methods in Medicine, Volume 2018.

13. Shash Rekh G1, Prof. H. Srinivas Murthi, Dr. Sudarso Jena, Digital Dermatology Skin Disease Detection Mode Using Image Processing, Internatio An Journal of Innovative Research in Science and Engineering Vol 7 Issu 7 Jul 2018.

14. R. S. Gound, Priyanka S. Gadre, Jyoti B. Gaikwad, Priyanka K. Wagh, Skin Disease Diagnosis System Using Image Processing and Data Mining, International Journal of Computer Applications (0975 – 8887) Volume 179 – No. 16. January 2018.

15. S. Kalaiarasi, Harsh Kumar Sounav Patra, Dermatological Disease Detection Using Image Processing and Neural Networks, International Journal of Computer Science and Mobile Applications, Vol. 6. Issue 4, April- 2018. ISSN: 2321-8363.

16. Archana Ajith, Vrinda Goel, Priyanka Vazirani, M. Mani Roja, Digital Dermatology Skin Disease Detection Model using Image Processing, International Conference on Intelligent Computing and Control Systems, 978-1-5386-2745-7/17/$31.00 ©2017 IEEE.

17. Nisreen I. Abo Dabowsa, Nasser M. Amatik, Abdelsalam M. Maatuk, Shadi A. Aljawarneh, A Hybrid Intelligent System for Skin Disease Diagnosis, IET2017 978-1-5386-1949-0/17/$31.00 ©2017 IEEE.

18. Tschandl, Philipp, 2018, The HAM10000 dataset, https://doi.org/10.7910/DVN/DBW86T, Harvard Dataverse.

19. Tschandl, P. et al. The HAM10000 dataset, a large collection of multi-source dermatoscopic images of common pigmented skin lesions. Sci. Data 5:180161 doi: 10.1038/sdata.2018.161 (2018).