

A Novel Model for Diagnosing the Cancerous Skin Diseases using Deep Learning Techniques

B. Renuka¹ and Dr. Sathiya. S²

¹Research Scholar, Computer Science Department, Annamalai University, Chidambaram, Tamil Nadu

²Assistant Professor, Computer Science Department, Annamalai University, Chidambaram, Tamil Nadu

Abstract—In order to predict, diagnose, monitor the disease in the field of dermatology, the traditional expertise leads loss of time and needs resource intensive. Identification and prediction of dermatological disease is prime important in present literature. The techniques of Generative AI (Gen AI) and Deep Learning (DL) plays a vital role from predicting to patient's efficient outcomes. Some common things that affect skin are psychological impact, daily life impact, other disease treatment side effects, financial burden. To get an accurate and efficient results from early stage of identifying of skin disease, the techniques of DL such as Convolutional Neural Networks (CNN) will give high accuracy and reliability in image-based diagnostics. Long Short-Term Memory (LSTM) networks are very effective in predicting the diseases and modeling temporal and sequences in patients' conditions. Added to the above, Gen AI will have more impact. Generative Adversarial Networks (GANs) will decrease the problem of limited datasets by generating high quality realistic images. The aim of the paper is to strengthen the image analysis, efficient workflow, predictive analysis, improved patient monitoring, increased training and realistic data generation.

Keywords— Dermatological Disease, Deep Learning, CNN, LSTM, Generative AI, GAN.

I. INTRODUCTION

The largest organ in the human body is skin and the main important function of skin is to protect the human body from external world. Skin also protects from internal aspects like solar radiations, working environment, medications, genetics, nutritious food etc. Figure:1 shows the layers of the skin.

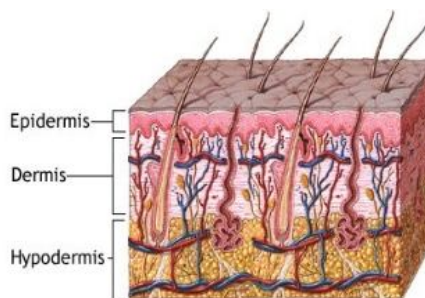


Figure:1 Skin Layers

Skin regulates body temperature through blood flow and sweating. Skin has three layers outer epidermis, the middle layer called dermis, and bottom layer called hypodermis. Skin diseases vary from different parts of the body. Dermatological diseases are growing rapidly and occur in all ages with different problems which bring emotional and psychological illness. Common types of skin diseases are acne, eczema, skin cancer, etc. Factors that cause the disease are bacteria, virus, low immunity and sun exposure. Symptoms can be dry, rough, lesions. Diagnosing manually for damaged skin leads to loss of time and need expertise in classifying or predicting the problems to get better outcomes. To get rid of skin problems, early identification is required and followed by prediction to specific disease, monitoring through out to get accurate and efficient results for prognosis.

Skin Diseases are growth of defected skin cells. The defected skin cells growth will affect the layers of skin namely dermis, epidermis. Depending on the cell type called melanocytes and keratinocytes, the infected skin area will lead to particular disease. Melanocytes are cells in the skin which contain and produce melanin on the outer layer of skin. It produces skin pigmentation and absorbs Ultra Violet rays. Keratinocytes contain and produce keratin in the inner layer of the skin. Keratin protects from other substances entering into the body. The damaged skin called as skin lesion. Based on the skin lesion, the disease is identified, and monitored to get efficient and accurate outcome in the treatment.

As skin is exposed to outside world, the identification and detection of particular skin disease is carried out early. When early detected, effective treatment is processed with accurate results. For identifying skin disease from skin lesions, new technologies were utilized for giving accurate and efficient results in the literature. Technologies like image processing techniques, machine learning, deep learning and Gen AI give accurate results.

The complexity of the image or lesion is further enhanced by texture, color, size and place of lesion that is determined. Based on the lesion, skin diseases are diagnosed visually using a clinical examination. Such testing process is time consuming and slow. For such problems new techniques or algorithm-based diagnosis will give accurate and speedy process with less expenditure. When the disease is early identified there will be improved treatment efficacy, better prognosis, less impact on quality of life, enhanced monitoring, prevention and psychological benefits. Skin infections are chronic, recurrent and sometimes leads to skin cancers. Fungal or allergy disorders are easily treated when they caught in early stage. To treat it before it becomes harmful, identification of tumor requires a series of optimized algorithms that are needed with accurate and efficient results.

Prediction and monitoring of the lesion is carried out based on the images captured. The skin lesions are easily accessible for sampling for observation and other treatments. Diagnosing is easier as monitoring is also accessible through images even after treatment. The increase in exposure to sun's ultraviolet rays is becoming more, due to atmospheric imbalance, Sun's UV rays damage the DNA within the skin and there is a chance of getting lesions. Exposure to ultraviolet rays leads to different types of skin diseases, namely Basal Cell Carcinoma, Melanoma, Actinic Keratosis etc. These diseases are unable to identify with naked eyes, as they start with small mole or mark on the skin.

Technologies like Deep learning, Machine Learning and Gen AI are becoming future trends. Algorithms, architectures, methods of the above technologies play an important role in identifying, detecting, predicting and monitoring the skin diseases. Skin is unique and analysis based on the skin lesion is correct when image recognition and different types of images classification approaches are processed on the skin lesion image. Generating realistic images using Gen AI and approaches of Deep Learning will lead to reliable and efficient outcomes. As dermatology field is now depending more on Deep Learning models namely CNN and LSTM networks and Gen AI techniques for image recognition, classification of diagnosis, which helps dermatologists for further prognosis.

In ancient times, the skin diseases are detected and diagnosed based on various methods like observation, hands-on knowledge and pulse diagnose rather than scientific methods. Generic methods like patient history includes lifestyle, diet, recent activities and changes in environment. The affected area is to be tested to assess its texture, which helps in differentiate between different skin diseases.

New methods are required in order to detect skin diseases with advanced technology and to incorporate scientific methods to improve early diagnosis. Techniques like Dermatoscopy, increased visualization of skin lesions, genetic and molecular testing, helps in diagnosing genetic skin problems and infections. Machine and Deep Learning, helps in analyzing images of skin lesions for early detection of skin cancers, also increases diagnostic accuracy, and helps experts to take decisions. 3D imaging and Analysis is an advanced imaging systems which creates three dimensional representations of skin lesions, to provide complete information on lesion depth and affected area for correct treatment.

Machine Learning technologies, Deep Learning models are part of the technologies plays important role. CNNs and other DL models are trained on large datasets of skin lesions or images to classify skin diseases. LSTMs are used for long term monitoring of chronic skin diseases, detecting patterns and forecast the disease progression using past information. Smart skin sensors are used to monitor the skin conditions continuously. When any changes occur in temperature and other parameters related to the skin, the sensor collects data for detecting, classifying and diagnosing. Gen AI generates new realistic images for more accurate treatment based on skin lesion images.

II. LITERATURE SURVEY

Skin disease is most common human complaint that affects the people worldwide. These generates pain, uneasiness and social consequences. Access to dermatological care is not so easy, leads to slow down in diagnosis and treatment. Accurate diagnosing requires scientific knowledge and experience. Only with visual examination by dermatologists gives subjective but lead to irregularity in diagnosis. Involving advancements, methodologies, datasets, challenges and reviewing in the field of dermatology on the detection of skin diseases Deep Learning, Gen AI plays vital role to get accurate results.

The methods of CNN, preprocesses the data which involves image normalization, augmentation and segmentation. In image normalization standardizing the pixel value is carried out by setting them to uniform range or normalizing to have an average of zero to variance of one. In augmentation techniques like rotation, cropping and flipping, in order to increase the variety of training data and its necessary to improve the generality of the model. Segmentation is dividing the image of skin into segments for detailed examination and diagnosis.

The CNNs architectures like LeNet-5 (The Network) basic is the first architecture for small datasets and simple tasks. VGGNet (Visual Geometry Group Network) is simple and effective and starting point for transfer learning from deep layers. Transfer Learning is an approach in which a model trained for one task, will be used for starting point of another new task. DenseNet architecture features tight connections between layers and improves gradient flow, reusability. EfficientNet will adjust the network depth, resolution and width to optimize efficiency and performance.

LSTM network is a type of Recurrent Neural Networks aims to capture temporal dependencies and sequential information. The methods utilizing LSTM networks are sequential data integration which involves time series data and patient history which tracks the progression of the disease through images and predict disease propagation respectively. Image Sequence Analysis is one of the methods utilizes LSTM networks to analyze the images of skin captured over period of time to identify and progress to find abnormalities of the skin.

There are important advancements in Gen AI inventions and applications for diagnosis and for treatment of skin diseases. Mainly GANs are analytical models, consists of two neural networks namely generative and discriminative. GANs generate realistic images trained from set of data. GANs can compare different skin diseases and their variants, which helps scientific experts to learn about rare cases and when trained, data is not sufficient for treatment. These will improve image quality by sharpening and removing noise in dermoscopic images.

The computer aided diagnostic system involves steps for analyzing and classification of dermoscopic images of skin lesions. The various steps involved in this process are shown in Figure 2

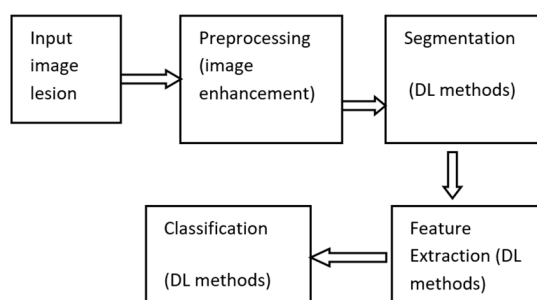


Figure 2: Steps for diagnostic system

Preprocessing step provides the skin lesion analysis model with more important features and to study and also enhances the image brightness [8]. Images are also preprocessed to secure the consistency and resolution. Image is processed by improved fuzzy c-means clustering [2]. Segmentation is the process of splitting the image into different fields or segments, analysis and identifies the specific area or field. Thresholding and clustering are

deployed quickly and do not require spatial management, the feature extraction step is carried out. Extraction is processed for the classification of skin lesions and any other relevant features [28]. For deep feature extraction pre-trained AlexNet and VGG16 issued [45]. Classification automatically detects the disease based on skin lesion or image, which helps experts to diagnose the disease, plan the treatment accordingly and to monitor. K-Nearest Neighbors', Decision Tree, Gaussian Navie Bayes, Support Vector Classifier are some of the classification algorithms [48].

There are many different types of skin diseases namely Acne, Dermatofibroma, Merkel Cell Carcinoma (MCC), Squamous Cell Carcinoma (SCC), Basal Cell Carcinoma (BCC), Melanoma (MEL), Melanocytic Nevus (NV), Actinic Keratosis etc. Skin lesions develops when DNA damage occur to skin cells and leads to cancer, this is mainly due to sun exposure and artificial cosmetic usage or any other reason. If it spreads to internal organs, the severity of the problem increases and improvement decreases.

Acne is a noncancerous and occurs blockage of hair follicles and often due to hormonal changes, bacterial infection and excessive oil production. Figure 3 shows the image of acne on the face [19]. To support automated acne evaluation and enhanced diagnostic accuracy integration of CNN layer models are needed for high performance. In which first layer CNN extracts high level features from images, in second layer, CNN refines features for classification.



Figure 3: Acne

Nevus (NV) is a type of mole, NV is noncancerous, which has tendency to develop nevi by genetics, extended duration in sun also leads to nevi. Some hormonal imbalances and prolonged exposure of chemicals are also risk factors of nevi. The Figure 4 is of Nevus [19], CNN classifies the pigmented nevi, which extracts features and learn for classification tasks.



Figure 4: Nevus

Dermatofibroma (DF) is also one of the noncancerous skin problems. It is benign skin tumors which supports and holds bones, muscles and other parts of the body. DF are connected with previous skin trauma or any insect bites. Extract cause is not yet well understood. DF are mostly found on extremities like hands, legs and trunk. AlexNet, VGGNet, ResNet models of CNN networks which pre-trains the large dataset and fine tune the images for Dermatofibroma Figure 5 [23] detection. Methods like transfer learning and ensemble techniques which helps to precise and effective diagnosis and performance.



Figure 5: Dermatofibroma

Actinic Keratosis is a precancerous disease, as it degenerates to Squamous Cell Carcinoma which is a cancer. It is a common skin alignment brought up by extended UV light from sun. These lesions are found on face, neck, ears, back of hands etc. MobileNet model is used for effectiveness in image classification and high efficiency in order to find actinic keratosis. The above approach is used in clinical setting for early detection of actinic keratosis Figure 6 [20], which leads to termination of development of cancer.



Figure 6: Actinic Keratosis

Basal Cell Carcinoma is also one of the frequent skin cancers in today's world. BCC is common among all diseases that occur in deeper layers of epidermis usually rises by high sun exposed regions like face, ear and neck and also other parts of the body and infected also by tattoos even. For diagnosing BCC three different non-invasive methods are used like dermoscopy images, Optical Coherence Tomography (OCT) and Reflectance Confocal Microscopy (RCM). With dermoscopy images the detection of BCC detection is effectively implemented using one of the deep neural networks model U-Net. Figure 7 shows BCC[14].



Figure 7: BCC

Squamous Cell Carcinoma (SCC) is a wide spread form of skin cancer caused by increase in abnormal squamous cell in the top layer of the skin. Squamous cells are thin and flat, prolonged exposure to UV radiation, chemical exposure, sun exposure, high usage of tobacco and existing skin conditions leads to SCC [17]. Figure 8 shows the SCC. The detection of SCC is implemented by a deep learning model called InceptionV4, in which transfer learning approach is for classifying lesions into cancers and VGGNet for feature extraction and ResNet model for training of deep layers.



Figure 8: SCC

Melanoma (MEL) is one of the chronic types of skin cancer, and is been common throughout the world. The risk factors of melanoma are ultra violet exposure, very fair skin type, indoor tanning, family and personal history. MEL occurs in any aged human in the form of mole, when lesions develop pigment cells in the melanocyte, these pigment cells change the existing mole or a new different mole comes on the skin due to high UV rays' radiations or even genetic. For detection of melanoma from the image, many CNNs were used for their effectiveness in the image analysis. CNNs models like VGGNet and ResNet are used for data extraction and classification. For reduced training time and to improve performance, some supporting pre-trained models on large datasets transfer learning is used in detecting melanoma. It is shown in Figure 9.



Figure 9: Melanoma

Merkel Cell Carcinoma is an uncommon but very dangerous cancer with high mortality rate. MCC appears from merkel cells, which are located at the bottom of the epidermis. Merkel cells are connected with the nerve ending with the skin, that gives sense of touch. MCC is shown in Figure 10. Machine Learning techniques like support vector machine and random forests to categorize the immune cells which are connecting with merkel cells and principal component analysis to reduce and visualize the complexity of data.



Figure 10: MCC

III. METHODS, MODELS

John e Le proposed [1] CNNs architecture like LeNet, AlexNet, EfficientNet for various medical imaging tasks including cancer detection, segmentation of image and classification of diseases. An approach developed by Dasari Anantha Reddy combined [2] fuzzy based segmentation with highly classified methods to improve the detection of diseases. For skin lesion analysis S. Gomathi applied [6] advanced machine learning techniques along with LSTM networks which are well suited for sequential prediction problems and hybrid optimization algorithm to improve performance of the system. An approach of skin lesion augmentation style rewrites to handle the missing data, imbalanced data and insufficient data samples [18] was proposed by Chen Zua. Additionally, it increases the quality of images and produces quality skin lesion images to the dermatologists for diagnosing.

Lin Li for continuously monitoring and analyzing [4] the patient's progression through wearable devices and remote sensors artificial intelligence techniques gives accurate results. Some of the methods of machine learning models like K-nearest neighbor algorithm, SVM to classify anticipate outcomes using patient information. Shivang Rana [7] applied segmentation of images using U-Net and SegNet architecture which has encoder and decoder to capture fine images. Ali khan utilized [11] transformer-based architecture to divide the images in fixed length which follows the sequence of actions like patch extension, data embedding, transformer encoding and position encoding. In this process every patch which has extracted from high dimension spaces of images contains complex dependencies and retains some special information with respect to the images for diagnosing disease.

Dermatology image analysis dataset ISIC Archive (International Skin Imaging Collaboration) is largest dermatological image datasets, which have dermoscopic images of skin lesions in wide range and other skin conditions images like melanoma. Yuang bai Sun approached [12] datasets like ISIC archive, PH dataset which contains high resolution images of skin lesions along with other tumor images and also used MSK dataset with clinical images useful for development and evaluation of cognitive models.

Danueil Sautor used [9] datasets like HAM10000 dataset, DermNet, ISIC archive, PH2, Melanoma Project dataset and clinical and genomic data. For detection and improved outcome deep learning plays vital role in computational dermatopathology of melanoma. Along with some datasets HAM10000, PH2, ISIC another dataset namely MNIST skin cancer dataset was used by Thanga Purni which provides [8] a standard for testing classified models and also combination with other datasets.

Ana Barragan-Montero used [10] ImageNet for general image classification tasks, pre training models were used before fine tuning them on medical image datasets. TCIA (The Cancer Imaging Archive) provides wide range of imaging data that include other related disease images which are used for development of cancer detection algorithm.

Bao-Shan L also used [13] same datasets, along with them another dataset called Graz dataset was also used which contains images of skin lesions used for developing and evaluating algorithms used for classifications of melanoma skin diseases. Ashwin proposed [15] skin disease detection and classification, the technology used was Deep Learning models which includes CNN and LSTM models. Furthermore, to the above technique for image pre-processing libraries such as OpenCV and Scikitimage to pre-process the dermoscopic images used [18] by Chen Zua. Machine Learning libraries were also help to detect disease namely Scikit-learn library for algorithms developed from SVM, KNN to tune the dermoscopic images and mentioned [16] by Ibrahim Abunadi.

Support Vector Machine (SVM) is an efficient method for detecting skin diseases and found to give accurate results. Skin disease classification with deep learning networks gave 85% accuracy [16]. Melanoma skin cancer detection with SVM method with 96.9% accurate outcome [5]. Skin disease detection with Dermoscopic images for feature extraction and CNN method with 89.5% accuracy [23]. Melanoma Detection with Feature extraction using 3D color texture feature and back propagation classifier produced 97% accurate results [37]. Skin cancer Classification problem using ResNet method produces 92% accuracy [41]. Other Skin disease detection using computer vision technique and combination of machine learning methods produces 99% accuracy [22].

IV. CONCLUSION

From the researchers' point of view, it is been evident that the image processing plays a vital role in identifying any disease with respect to human body. The support mechanism with respect to identifying diseases are either scanning images, ECGs, EEGs and many more which works in identifying the different diseases. In human body the largest organ is skin and identification of skin-based cancers or disease is the main focus of this paper. A thorough survey has been made to understand different types of skin diseases which belongs to both cancer and non-cancer.

There were different methods applied in order to find the disease of the skin which is cancer. A small model is presented by considering different methods are explored and came to a conclusion that deep learning techniques are giving more accuracy in diagnosing and recommending about severity of skin cancer.

REFERENCES

- [1] Artificial intelligence and machine learning for medical imaging: A technology review Ana Barragan-Montero a, *, Umair Javaid a, Gilmer Valdes b, Dan Nguyen c, Paul Desbordes d, Benoit Macq d, Siri Willems e, Liesbeth Hanewinckel f, Mats Holmstrom g, Fredrik Loman g, Steven Michiels a, Kevin Souris a, Edmond Sterpin am, John A. Lee
- [2] Improved Fuzzy Based Segmentation with Hybrid Classification for Skin Disease Detection Dasari Anantha Reddy, Swarup Roby, *, Sanjay Kumara, Rakesh Tripathi, Neel Prabhat Department of Information Technology, NIT, Raipur, India, Department of Computer Applications, Sikkim University, Gangtok, India, Department of Dermatology, All India Institute of Medical Sciences, Raipur, India.
- [3] A Generative Adversarial Network (GAN) Technique for Internet of Medical Things Data Ivan Vaccari 1, *, Vanessa Orani 1, Alessia Paglia longa 2, Enrico Cambiano 1 and Maurizio Mongelli 1
- [4] Remote patient monitoring using artificial intelligence: Current state, applications, and challenges Thanveer Shaik1 | Xiaohui Tao1 | Niall Higgins2,3 | Lin Li4 |Raj Gururajan5 | Xuejian Zhou5 | U. Rajendra Acharya6
- [5] Melanoma of the skin cancer diagnosis using support vector machine, Zeina Rayan* Computer Science Department, Faculty of Computer and Information Sciences, Ain Shams University, Cairo, Egypt zeinarayan@cis.asu.edu.eg Islam Hegazy Computer Science Department, Faculty of Computer and Information Sciences, Ain Shams University, Cairo, Egypt islhag@cis.asu.edu.eg Mohamed Roushdy Computer Science Department, Faculty of Computer and Information Sciences, Ain Shams University, Cairo, Egypt mroushdy@cis.asu.edu.eg Abdel-Badeeh M. Salem Computer Science Department, Faculty of Computer and Information Sciences, Ain Shams University
- [6] Skin Lesion Prediction and Classification Using Innovative Modified Long Short-Term Memory-Based Hybrid Optimization Algorithm S. Gomathi1 · N. Arunachalam1 Received: 18 January 2024 / Accepted: 8 July 2024 © The Author(s) 2024
- [7] Skin CAN AI: A deep learning-based skin cancer classification and segmentation pipeline designed along with a generative model
- [8] EOSA-Net: A deep learning framework for enhanced multi-class skin cancer classification using optimized convolutional neural networks J.S. Thanga Purni, R. Vedha Priya Vadhana
- [9] Deep learning in computational dermatopathology of melanoma: A technical systematic literature review Daniel Sauter a, *, Georg Lode b, Felix Nenad, Dirk Schade Dorf b, Elisabeth Livingstone Markus Kukuk
- [10] Artificial intelligence and machine learning for medical imaging: A technology review Ana Barragan-Montero a, *
- [11] SkinViT: A transformer-based method for Melanoma and Nonmelanoma classification Somaiya KhanI1📧, Ali Khan

- [12] Artificial Intelligence in Dermatology Image Analysis: Current Developments and Future Trends Zhou Iao Li 1,2, †, Konstantin Christoph Koban 2, †, Thilo Ludwig Schenck 2, Riccardo Enzo Giunta 2, Qingfeng Li 1, * and Yangban Sun
- [13] Deep Learning in Skin Disease Image Recognition: A Review LING-FANG LI1, XU WANG1, WEI-JIAN HU 1, NEAL N. XIONG 2, (Senior Member, IEEE), YONG-XING DU 1, AND BAO-SHAN L
- [14] The application of artificial intelligence in the detection of basal cell carcinoma: A systematic review Y. Widaatalla1 | T. Wolswijk2 | F. Adan2 | L. M. Hillen3 | H. C. Woodruff1,4 | I. Halilaj1 | A. Ibrahim5 | P. Lambin1,4 | K. Mosterd2
- [15] Deep Long- and Short-Term Memory with Tunicate Swarm Algorithm for Skin Disease Detection and Classification Ashwin Narasimha Murthy 2 Ramesh Krishnam Neni 3 T. Prabhakara Rao 4 V. Vidyasagar 5 Dr. Ambika. C 6 I. Naga Padmaja 7 Manasa Bandlamudi 8 Dr. Amit Gangopadhyay
- [16] Skin Cancer Detection Using Image Processing Uzma Bano Ansari1 M.E. Student, Department of Computer, TSEC, Mumbai Tanuja Sarode2 Associate Professor, Department of Computer, TSEC, Mumbai
- [17] Squamous Cell Carcinoma of Skin Cancer Margin Classification From Digital Histopathology Images Using Deep Learning Beshatu Debela Kokeb Dese, Roba Elala Ulfata, Tilahun Alemayehu Nigatu6, Solomon Kebede Turunbedu4, and Timothy Kwa.
- [18] Dermascopy Image Classification Based on StyleGAN and DenseNet201 Chen Zua.
- [19] Acne Vulgaris Detection and Classification: A Dual Integrated Deep CNN Model Md Baharul Islam1,2,* , Masum Shah Junayed2,3 , Arezoo Sadeghzadeh2 , Nipa Anjum4 , Afsana Ahsan Jeny2,3 , A. F. M. Shahen Shah5 1Department of CSE, Florida Gulf Coast University, Fort Myers, FL, USA 2Department of Computer Engineering, Bahçeşehir University, Istanbul, Turkey 3Department of CSE, University of Connecticut, Storrs, CT, USA 4Department of CSE, Khulna University of Engineering & Technology, Khulna, Bangladesh 5Department of Electronics and Communication Engineering, Yildiz Technical University, Turkey E-mail: bislam.eng@gmail.com *Corresponding Author.
- [20] An Actinic Keratosis Auxiliary Diagnosis Method Based on an Enhanced MobileNet Model Shivang Li 1, Chenguang Li 2, Qicai Liu 3,4, Yilin Pei 2, Loyang Wang 2, * and Zhu Shen
- [21] Dermoscopic Image Classification of Pigmented Nevus under Deep Learning and the Correlation with Pathological Features Shuang Yang ,1 Chumney Shu ,1 Haiyou Hu ,1 Guanghua Ma ,1 and Min Yang.
- [22] A novel end-to-end deep convolutional neural network-based skin lesion classification framework Razia Sulthana A a, Vinay Chamola b, Zain Hussain c, Faisal Albay d, e, *, Amir Hussain
- [23] Skin lesion classification of dermoscopic images using machine learning and convolutional neural network Bhuvaneshwari Shetty1, Roshan Fernandes2, Anisha P. Rodrigues2, Rajeswari Chengoden3, Sweta Bhattacharya3 & Kuruva Lakshmana
- [24] Deep Learning Methods for Accurate Skin Cancer Recognition and Mobile Application Ioannis Kousis 1, Isidoros Perikos 1, Ioannis Hatzilygeroudis 1, * and Maria Virvou.
- [25] Generative artificial intelligence and its applications in materials science: Current situation and future perspectives Yue Liu a, d, Zhengfei Yang a, Zhenyao Yu a, Zitu Liu a Dahui Liu a HailongLinbMingqingLi, Shuchang Ma a Maxim Avdeev e, f, Siqi Shi b.
- [26] Medical image fusion method by deep learning Yi Li a, b, *, Junli Zhao a, ZhihanLv a, Jinhua L
- [27] Artificial intelligence and machine learning for medical imaging: A technology review Ana Barragan-Montero a, *, Umair Javaid a, Gilmer Valdes b, Dan Nguyen c, Paul Desbordes d, Benoit Macq d, Siri Willems e, Liesbeth Hanewinkel f, Mats Holmstrom g, Fredrik L'ofman g, Steven Michiels a, Kevin Souris a, Edmond Sterpin a, f, John A. Lee
- [28] Classification of Skin Disease Using Deep Learning Neural Networks with MobileNet V2 and LSTM Parvathaneni Naga Srinivasu 1, †, Jalluri Gnana Siva Sai 2, Muhammad Fazal Ijaz 3, †, Akash Kumar Bhoi 4, Wonton Kim 5, * and James Jin Kang 6
- [29] Smart Health Monitoring Using Deep Learning and Artificial Intelligence Jeetu Philip1, Suma Kamalesh Gandhimathi2, Silpa Chalichalamala3, Balaji Karnam4, Suresh BabuChandanapalli5, Srinivasulu Chennupalli
- [30] Text-to-image Diffusion Models in Generative AI: A Survey Chen Shuang Zhang, Chaoning Zhang, Mengchun Zhang, In So Kweon
- [31] Generative AI Stefan Feuer Riegel • Jochen Hartmann • Christian Janiesch • Patrick Zschech
- [32] Machine Learning and Deep Learning Integration for Skin Diseases Prediction Samir Kumar Bandyopadhyay1, Payal Bose2, Amiya Bhaumik3, Sandeep Poddar4
- [33] Automated Skin Cancer Detection and Classification using Cat Swarm Optimization with a Deep Learning Model Vijay Arumugam Rajendran Department of Computer Science, Government Arts and Science College, India vijaynew@gmail.com (corresponding author) Saravanan Shanmugam Department of Computer and Information Science, Annamalai University, India.
- [34] Generative artificial intelligence in the metaverse era ZhihanLv
- [35] Frontier machine learning techniques for melanoma skin cancer identification and categorization: An in-Depth review Viomesh Singh a, Kavita A. Sultanpure b, Harshwardhan Patil
- [36] Deep Learning-Based Classification of Dermoscopic Images for Skin Lesions Ahmet Furkan SÖNMEZ1, Serap ÇAKAR2, Feyza SELAMET2, Muhammed KOTAN3, İbrahim DELİBAŞOĞLU4, Gülizar ÇİT
- [37] Melanoma Diagnosis with Spatio-Temporal Feature Learning on Sequential Dermoscopic Images Zhen Yu1,2, Jennifer Nguyen3, Xiaojun Chang4, John Kelly3, Catriona Mclean2, Lei Zhang2, Victoria Mar3, Zongyang G

- [38] Performance Improvement of Convolutional Neural Network Architectures for Skin Disease Detection Hasan Maher Ahmed¹ and Manar Younis Kashmola
- [39] Deep Learning in Skin Disease Image Recognition: A Review0 Recent Researches on Image Classification Using Deep Learning Approach Nayan Kumar Sarkar¹, Moirangthem Marjit Singh¹ and Utpal Nand
- [40] Deep Learning Techniques for the Dermoscopic Differential Diagnosis of Benign/Malignant Melanocytic Skin Lesions: From the Past to the Present Linda Tognetti ^{1, *, †}, Chiara Miracapillo ¹, Simone Leonardelli ¹, Alessio Lushi ², Ernesto Iadanza ², Gabriele Cevenini ², Pietro Rubegni ¹ and Alessandra Cartocci
- [41] Skin Lesion Analysis for Melanoma Detection Using the Novel Deep Learning Model Fuzzy GC-SCNN
- [42] deep learning-based dermatological condition detection: a systematic review with recent methods, datasets, challenges, and future 4directionsstephanie s. Noronha ¹, Mayuri a. Mehta ², (senior member, IEEE), Deepan garg³, Ketan Kotecha ⁴, and Ajith Abraham ^{5,6}, (IEEE)
- [43] Genetic algorithm optimized stacking approach to skin disease detection. Ananthakrishnan Bala Sundaram ^{1,2}, Yesha Shaik ^{1,2}, b. Rohan alroy², Amogh Singh ², and s. j. Shivaprakash
- [44] An Automatic Dermatology Detection System Based on Deep Learning and Computer Vision Shaimaa e. sojour ^{1,2}, Amr abo Hany ³, Mohamed s. elreden⁴, Ahmed sedik^{5,6}, and Reda m. Hussein ³, (IEEE)
- [45] Recent Advancements and Future Prospects inactive Deep Learning for Medical Image Segmentation and classification Ari Mahmood ^{1,2}, Amjad rehman¹, (senior member.), Tanzila Saba ¹, (IEEE), Lubna Nadeem ³, and Saeed Ali Omer Baha
- [46] Artificial Intelligence in Cosmetic Dermatology: A Systematic Literature Review, Parvati Wutipong, Sirawichvachmanus, Thanaponnoraset, and Suppawongtuarob, (IEEE).
- [47] analysis, prediction and classification of skin cancer using artificial intelligence – a brief study and review Madhavi Latha Pandala and s. perinatal
- [48] Automated Diagnosis of Skin Lesions using CNN and LSTM Priya Kohli Asst. Professor, School of Computing, Graphic Era Hill University, Dehradun, Uttarakhand India 248002
- [49] The power of generative ai to augment for enhanced skin cancer classification: a deep learning approach Mudassir Saeed ¹, Asma Naseer ¹, Hassan masood¹, Shafiq Ur Rehman ², and Velkerri
- [50] An efficient approach to detect melanoma skin cancer using a custom CNN model by k. Maidu rahman^{22241036tanjim bin amin17301220mahdi sahib rahman21101349g m shaman Hossain Sakib 1730109}
- [51] Artificial intelligence in dermatology image analysis: current developments and future trends Zhou Iao li ^{1,2, †}, konstantinchristophKoban ^{2, †}, Thilo Ludwig Schenck ², Riccardo Enzo Giunta ², Qingfeng Li ^{1, *} and Yangban Sun