



## A Review on Melanoma Skin Cancer Detection Using Deep Learning

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### دراسة حول اكتشاف السرطان الميلانيني باستخدام التعلم العميق

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#### Abstract:

An area of skin that differs from the encompassing pores and skin in terms of boom or appearance is called a pores and skin lesion. whilst most of the people are not harmful, a few may be an early indicator of malignancy. One kind of pores and skin cancer that may be detected early and potentially enhance survival is cancer. this can be performed via thermal microscopic imaging. most of the best techniques for identifying cancer early on are clinical standards (diameter more than 6 mm, asymmetry, choppy margins, and wonderful hue). For the subsequent motives, among others, it's miles nonetheless distinctly tough to as it should be classifying cancer: slight variations in pores and skin and scars, visual similarities between cancer and non-melanoma skin, etc. There can be an ever-developing want for accurate and dependable detection of pores and skin cancers. Advances within the subject of deep reading deem it pleasant for the mission of automated detection and can be very beneficial to pathologists as they aid them in terms of overall performance and accuracy. in this paper, diverse state-of-the-art deep knowledge of frameworks is used. An assessment of their parameters is done, and contemporary strategies are carried out to deal with the worrying conditions faced in the obligations, segmentation, and category in pores and skin lesions. • Segmentation is the venture of dividing out regions of interest. that is used to handiest hold the ROI and cancer (maximum cancers) and Nevus (no longer most cancers). A pre-trained version is used and fine-tuned as according to the goals of the given hassle announcement/dataset. Experimental results show promise because the achieved strategies reduce the faux negative price, i.e., the neural community is much less possibly to misclassify a melanoma.

**Keywords:** Melanoma, Deep Learning, Neural Networks, Skin Melanoma Detection.

#### الملخص

تُسمى المنطقة من الجلد التي تختلف عن الجلد المحيط بها من حيث النمو أو المظهر بأفة جلدية. وفي حين أن معظم الناس ليسوا مصابين، إلا أن البعض منهم قد يكون مؤشرًا مبكرًا لوجود ورم خبيث. أحد أنواع سرطانات التي يمكن اكتشافها مبكرًا والتي قد تزيد من فرص النجاة على قيد الحياة هو سرطان الجلد. ويمكن إجراء ذلك من خلال التصوير المجهر الحراري. ومن أفضل الطرق لتحديد السرطان في وقت مبكر هي المعايير السريرية (القطر أكبر من 6 مم، عدم التماثل، الهوامش المتقطعة، واللون الرانع). ولا يزال من الصعب للغاية تصنيف السرطان كما ينبغي وذلك للاختلافات الطفيفة في الجلد والندبات، والتشابهات المرئية بين السرطان والجلد غير الميلانيني، وما إلى ذلك وهناك أيضًا حاجة متزايدة للكشف الدقيق والموثوق عن سرطانات الجلد ويعتبر التقدم في موضوع القراءة العميقة ويمكن أن يكون مفيدًا جدًا لعلماء الأمراض لأنه يساعدهم بشكل مفيد من حيث الأداء العام والدقة. في هذه الورقة سوف يتم استخدام مجموعة متنوعة من أحدث المعارف المتعمقة بموضوع القراءة العميقة وسوف يتم إجراء تقييم لمعاييرها، ويتم تنفيذ استراتيجيات معاصرة للتعامل مع الظروف المعقدة التي تواجه الالتزامات والتجزئة والتصنيف في آفات الجلد. التجزئة هي مشروع تقسيم مناطق الاهتمام. يتم استخدامها فقط للاحتفاظ بمنطقة الاهتمام والسرطان (السرطانات القسوى) والوحمة (ليست سرطانات). يتم استخدام نسخة مدربة مسبقًا

وضبطها وفقاً لأهداف بيان المشكلة/مجموعة البيانات المقدمة. تظهر النتائج التجريبية وعدداً لأن الاستراتيجيات التي تم تحقيقها تقلل من معدل السلبيات الزائفة، أي أن الشبكة العصبية أقل عرضة لتصنيف الورم الميلانيني بشكل خاطئ.

**الكلمات المفتاحية:** سرطان الجلد، التعلم، شبكة الأبحاث العميقة، سرطان الميلانيني.

## 1- Introduction

Melanoma represents the maximum intense kind of skin cancer and, if ignored, can unfold to precise body elements. The purpose of around 75% of deaths are skin and pores cancers. As a result, it is crucial to pick out it accurately at a miles in advance level, increasing the likelihood that sufferers will live to tell the tale. most cancers can only be scientifically recognized with 60% accuracy with the bare eye. Deep knowledge of in computer vision has been the concern of many studies and improvements, and it has performed very good supremacy. These days, it can perform much less than 5% worse than people in a variety of responsibilities like digital picture classification and recognition. Pathologists gain from a correct and reliable atomic approach for cancer detection because it will increase productiveness and accuracy and may be without difficulty operated on without difficulty to have hardware, increasing its reach. photographs of probably cancerous pores and skin regions may be taken virtually and enlarged using a non-invasive technique called dermoscopy. similarly, to growing their importance, this allows detection of the pores and pores and skin lesions. however, the usage of deep getting-to-know techniques to discover most cancers has a few drawbacks. numerous reasons consist of but are not limited to, modifications in pores and skin conditions and pores; minute variations inside the evaluation between the pores and lesions; minute visible differences among non-cancerous and cancerous patches; e. G. B. The skin tone, hair, and pores within the location. for this reason, awesome traits, shades, and so forth are present in most of the people of cancerous patches.

Segmentation proves to be a critical phase in many categorizing processes. One can find an extensive evaluation of the algorithms utilized for automatic skin lesion segmentation within certain publications. It's possible that through utilizing segmentation, one could enhance classification accuracy. A considerable amount of research have been carried out to secure precise outcomes from segmentation. Dependent on these results features pertinent to detecting cancer can be derived. Despite the fact that tons work has been executed, there may be still plenty capability for overall performance development in pores and skin lesion segmentation and type. The worldwide pores and skin Imaging Collaboration melanoma challenge makes a specialty of facilitating using virtual pores and skin imaging to reduce mortality from cancer. seeing that 2016, they had been developing and increasing their skin photograph dataset archive. that is a publicly handy open supply archive meant to facilitate the improvement and testing of automated diagnostic structures. they have got set new requirements inside the field of dermoscopic characteristic extraction.

## 2- Literature Survey

this article suggests a technique that makes use of image processing and device-gaining knowledge of to categorize and section pores and skin lesions as benign or malignant. based on pixel mean and well-known deviation techniques, a novel comparison stretching technique for dermoscopic pictures is presented. After that, the OTSU threshold algorithm is used to segment pics. Following segmentation, functions are taken out of the segmented photos, which include capabilities for color identification, the HOG (Histogram of orientated Gradients) object, and GLCM (grey stage Co-occurrence Matrix) functions for texture identity. important factor evaluation (PCA) is used to reduce the HOG functions so that you can reduce dimensionality [1]. SMOTE (artificial Minority Oversampling approach) sampling is used to solve the elegance imbalance problem. Standardization and scaling of the characteristic vector comply with. An authentic characteristic choice approach that totally relies on the wrapper method is usually recommended previous to class. Random forest, SVM (Medium Gaussian), and Quadratic Discriminant are a number of the classifiers used inside the discipline. The proposed technique is confirmed using the publicly available ISIC-ISBI 2016 dataset. The maximum accuracy is produced by the Random wooded area classifier. The proposed machine's class accuracy with the Random forest classifier at the ISIC-ISBI 2016 dataset is ninety three.89 percent. consequences from segmentation are quality when contrast stretching is used first, as cautioned. moreover, the counseled wrapper-based feature choice method together with the random wooded area classifier produces promising results when in comparison to different popular classifiers. One of the most dangerous types of cancer is skin cancer. This is primarily an abnormal skin cell explosion that happens when the skin's pores and skin come into contact with sunlight. It now also appears on areas of the skin and pores that are shielded from the light. Most cancers must be detected early on in order to prevent them from slowly spreading to other parts of the body [2]. Here, we provide a variety of machine gaining knowledge of strategies that can be implemented to differentiate among benign and malignant forms of most cancers. Preprocessing, segmentation, function extraction, and classification are the four primary steps within the manner. The comparison of diverse approaches that may be applied to the aforementioned steps is the principle attention of the object. The most standard kind of cancer is by a long way skin most cancers. If detected early, this will be successfully handled. Early cancer detection comes at a very excessive fee. The aberrant increase of pores and

skin cells is called pores and skin cancer. If they're discovered and handled speedy, these are easily treatable[3]. The four most common types of skin cancers are cancer, dermatofibroma, basal cell carcinoma (BCC), and actinic keratosis (AK). Before they are detected too late, the majority of tumors spread to other organs. Convolutional neural networks can be used to analyze the pores and skin in the photos, which will allow for the identification of most tumors. The HAM10000 and ISIC picture datasets are used in this implementation. In CNNs, switch getting to know enhances model performance. features that are then used to categorize pores and skin cancers are extracted using pre-trained models. in this implementation, Random Forest, SVM, CNN, and Dense internet are the system studying and deep mastering strategies used.

skin most cancers is a risky condition that impacts people of almost every age, however it is extra not unusual inside the elderly. This effects from the pores and skin's epidermal layer growing abnormally or fast, which promotes the increase of a tumor. seeing that most cancers influences the tissue stage and different sicknesses only affect the higher layer of epidemics, it have to be distinguished from other pores and skin diseases [4]. Technology can help in predicting cancer in its early tiers, that can lower the price of most cancers detection for athletes and also save time, as remedy and detection are highly-priced. it's far hard to develop a cancer level detection system that is absolutely accurate, but even in that case, a probability can be furnished, permitting the scientific check to continue even in the occasion that the gadget's accuracy is subpar. As a result, we cautioned the use of a CNN (Convolutional Neural network) as opposed to a standard support vector gadget to predict and classify pores and skin cancer with more accuracy. For the early identity of skin lesions, the counseled set of rules makes use of characteristic extraction with the ABCD rule, GLCM, and HOG characteristic extraction. Preprocessing in the counseled paintings aims to beautify the readability and nice of the pores and skin lesions for you to lessen artifacts like pores and skin tone, hair, and so on. Geodesic active Contour (GAC), which segments the lesion element separately, changed into used for the segmentation and proved beneficial for characteristic extraction [5]. In order to extract features like symmetry, edge, color, and diameter, the ABCD scoring method was applied. To extract texture features, GLCM and HOG were applied. Various machine learning techniques, including SVM, ANN, and Naive Bayes classifier, are used to classify skin lesions between benign and melanoma based on the extracted features. The International Skin Imaging Collaboration (ISIC) provided images of skin lesions for this project, including 672 images of melanoma and 328 images of benign skin lesions. Using SVM classifiers, the category effects displayed a 0 point94 spot under the curve and an accuracy of 97.eight percent. Furthermore, 86.2% sensitivity and 85% specificity have been achieved using artificial neural networks.

### 3- Methodology

One of the most important subjects in computer vision and picture processing is photo segmentation. It is crucial to many application areas, including photo compression, augmented reality, clinical image assessment, robotic thinking, and many more. To analyze a visual enter simply, segmentation includes breaking it up into smaller parts. We select best the most sizable regions or items for our analysis out of all those who divide the networks. a collection of wonderful pixels makes up the picture. Pixels which are within the same class or class are grouped together. generally, a bounding box approach is used for this, in which a box is drawn around the location of interest or a label is placed pixel through pixel. This allows for the spotlight of wonderful lessons with one-of-a-kind colors. Our objective is to identify the mole's region in a given image and eliminate the background using a segmentation algorithm, i.e. E. the exterior. The ISIC-2018 dataset, comprising 2594 images and masks, is utilized for the segmentation task. The mask is the enter photograph's floor reality; that is, it holds pixel-through-pixel information approximately which pixels have the magnificence "mole" and which do now not. The mask is binary in terms of numerical values, because of this its pixel values are 0 and 1. If the pixel has a value of one, it is a mole; otherwise, it is not. it is an unmarried-channel, grayscale image that looks to be in black and white. figure 1 displays an instance of a photograph and its mask.



**Figure 1:** Image and Mask.

### 3-1 Pre-Processing

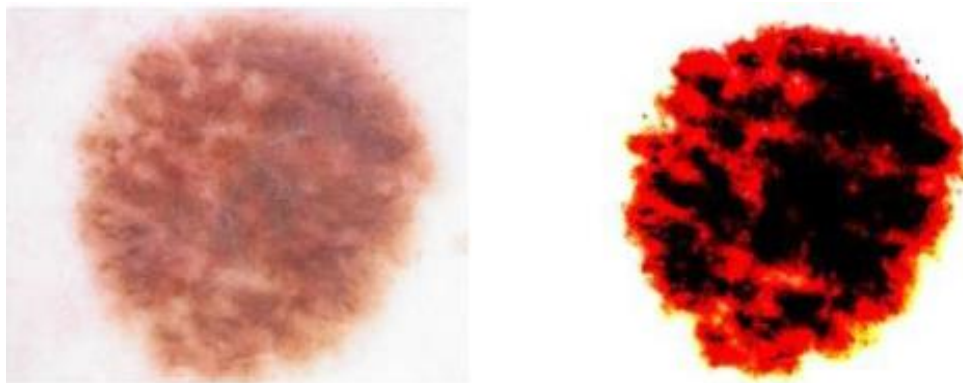
prior to training, the input images for the deep learning version have been normalized. This lowers skewness [15], continues it inside a sure threshold variety, and quickens and improves the network's gaining knowledge of technique. For the crimson, inexperienced, and blue color channels, the predicted values for the mean pixel cost and well-known deviation were received. Equation 2.1 become applied to normalize the data, and the subsequent values were carried out.

Mean R-G-B value: (0.708, 0.582, 0.536)

Standard deviation: (0.0978, 0.113, 0.127)

$$Output[Channel] = \frac{Input[Channel] - Mean[Channel]}{Standard\ Deviation[Channel]}$$

An example of original image and normalized image can be found in Figure.2.



**Figure 2:** Original Image and Normalized Image.

### 3-2 Data-Augmentation & Dice Index

A collection of techniques called "facts augmentation" are meant to amplify the number of records that is available using either adding duplicates of records which have been slightly altered or developing artificial facts from the prevailing facts. via serving as a regularization, this lessens over fitting [16] throughout model training [17]. numerous facts augmentation techniques exist, and each has been randomly assigned a 50% danger of going on. This segment discusses the strategies used along with a few illustrations.

- Horizontal flipping: Horizontal flip augmentation is when the columns of the input image are reversed.



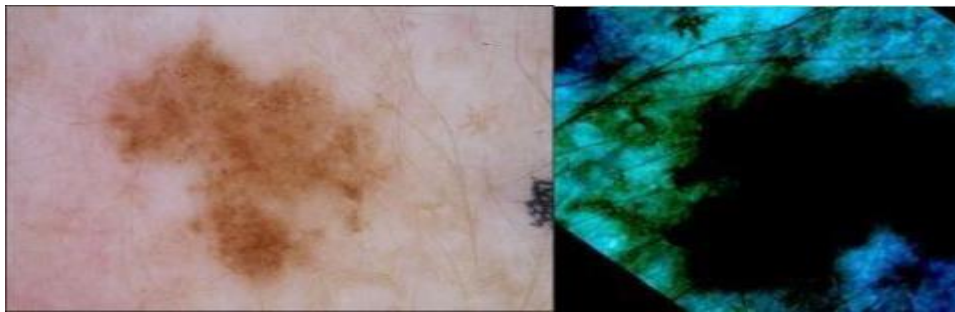
**Figure 3:** Original Image and Flipped Image.

- Rotation: Rotation augmentation is done by rotating the image between -180° and 180°.



**Figure 4:** Original Image and Rotated Image.

- Resized crop: Resized crop augmentation is when a random subset is created from the original image and scaled back to a given size.
- All images are all resized to 400x400 for training purpose. All the previous techniques combined generate an image the same as in figure 5.



**Figure 5:** Original Image and Transformed Image.

The masks undergo identical spatial statistics expansion. This suggests that the alignment of the photograph and masks stays the same. The version would now not analyze something from it and the prediction would be almost random if both have been orientated otherwise for schooling. The accuracy of the dice Index, a statistical device for comparing two images' similarity, was measured.

#### 4- Conclusion

This paper provides an overview of earlier research on the categorization of melanoma. From diagnosis to treatment, we have confirmed that DL has a wide range of potential uses in dermatologists' workflow. Personalized medicine and diagnosis are two areas in which dermatologists' practices can benefit from DL. The availability of vast data sets has recently improved (e.g. G. the development of DL algorithms with human-like intelligence in dermatology has been aided by several factors, including electronic medical records, image databases, omics), quicker data processing, and more affordable data storage. The field of dermatology offers DL a whole lot of thrilling potentialities. because of its capability to beautify dermatologists' workflow and make pores and skin cancer screenings more handy, CNN photograph category has garnered the dermatology offers DL a wide variety of thrilling opportunities. The CNN image class has attracted the most interest due to its capability to enhance dermatologists' workflow and make pores and skin cancer screenings more handy.ost attention. Transparency in DL research must be ensured with the aid of making datasets and algorithms on hand to the public for further checking out and validation. Thorough, peer-reviewed prospective clinical trials should be executed prior to its release into the market. All things considered, improved dermatologist participation in DL development and checking out is critical to the advent of useful and clinically relevant technology.

Smartphones, PDAs, and drugs are examples of cellular devices which are becoming necessary to modern existence. future traits will see a large growth in the integration of AI-powered skin disorder diagnosis and remedy into sensible machines. though, powerful pix processors are used to diagnose the majority of pores and skin conditions. To ensure that the algorithm is easy to use on cellular phones and wearable clever gadgets, its computational complexity have to be kept to a minimal even as its reputation capability is enhanced. The prognosis and treatment of skin sicknesses with the aid of AI will significantly benefit from this examination. Even though lesion segmentation, function segmentation, function introduction, and class are important processes, there should also be sufficient recognition on the additional stages that, in most instances, yield pleasant effects.

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