Skin Cancer Classification Using Pre-trained Deep Learning Model

J. ANDREW, VARUN UNNIKRISHNAN NAIR, K. MARTIN SAGAYAM, MOHD HELMY, NOR’AISAH
Key Objectives

- Creating a deep learning model using CNN to classify skin cancer images.
- Using different performance metrics to analyse the model accuracy.
- Compare the results of final, completely implemented model with results in other research papers.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Accuracy</th>
<th>Specificity</th>
<th>Sensitivity</th>
<th>Research Focus</th>
</tr>
</thead>
<tbody>
<tr>
<td>[1]</td>
<td>79.5%</td>
<td>-</td>
<td>-</td>
<td>Classification of skin lesions</td>
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<tr>
<td>[2]</td>
<td>93.64%</td>
<td>55.18%</td>
<td>92.1%</td>
<td>Skin mole lesion classification</td>
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<td>[3]</td>
<td>81.33%</td>
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<td>Classification of skin lesions</td>
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<td>[4]</td>
<td>62.5%</td>
<td>88%</td>
<td>58%</td>
<td>Skin Imaging Collaboration. Verifying the accuracy of the automated systems with the dermatologist’s manual</td>
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<td>[5]</td>
<td>95.4%</td>
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<td>Skin cancer diagnosing from dermatologic spots</td>
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<td>[6]</td>
<td>82.95%</td>
<td>81.5%</td>
<td>89%</td>
<td>AI based skin cancer classification</td>
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<tr>
<td>[7]</td>
<td>65% for melanoma</td>
<td>89.2</td>
<td>98.8</td>
<td>CNN based skin cancer classification</td>
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<td>[8]</td>
<td>77% - 81%</td>
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<td>-</td>
<td>CNN based Skin lesion diagnosis</td>
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<td>[9]</td>
<td>96.86%</td>
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<td>96.9%</td>
<td>Classification of skin lesions through pretrained networks</td>
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<td>[10]</td>
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<td>k-means technique for skin cancer detection</td>
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<td>[12]</td>
<td>98.89</td>
<td>86.6%</td>
<td>86.6%</td>
<td>Deep learning based skin cancer detection</td>
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The dataset used in the initial implementation was from the ISIC (International Skin Imaging Collaboration).

Main goal for them was to reduce melanoma related deaths by providing verified sources of data about all kinds of skin images. Cancerous and non-cancerous.

The dataset was first segregated and structured in a tree format.

then function `flow_from_directory()` reads from the passed argument directory and automatically identifies subfolders as classes and content as images.
Dataset Details
IMPLEMENTED MODULE

[Diagram showing a neural network architecture with layers including Conv1, Conv2, Conv3, Conv4, Conv5, Pooling, and a fully connected layer followed by Softmax.]
System Architecture
Proposed Skin Cancer Classification Model Architecture
Activation function and Fully Connected layer used in CNN

- ReLU - rectified linear unit
- Softmax
- Flatten out (Flattening is converting the data into a 1-dimensional array for inputting it to the next layer) and follow up with fully connected layer 256 output neurons.
- Dropout rate
Adam can be looked at as a combination of RMSprop and Stochastic Gradient Descent with momentum. It uses the squared gradients to scale the learning rate like RMSprop and it takes advantage of momentum by using moving average of the gradient instead of gradient itself like SGD with momentum. Let’s take a closer look at how it works.

Adam is an adaptive learning rate method, which means, it computes individual learning rates for different parameters. Its name is derived from adaptive moment estimation, and the reason it’s called that is because Adam uses estimations of first and second moments of gradient to adapt the learning rate for each weight of the neural network.
Experimental Results
Performance evaluation of the proposed model.

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<thead>
<tr>
<th>Reference</th>
<th>Accuracy</th>
<th>Specificity</th>
<th>Sensitivity</th>
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<tr>
<td>Pomponiu et al. [20]</td>
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<td>Hekler et al. [18]</td>
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<td>Maron et al. [19]</td>
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<td>Our Model</td>
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Skin cancer is one of the major diseases prevailing and millions of humans are expected to be diagnosed.

Early detection of malignancy in the skin lesions can greatly reduce the mortality rate and for successful treatments.

A deep learning based skin cancer classification model is proposed based on pretrained models. VGG-16 model is utilized and trained with skin lesion images.

The proposed model is focused to detect and classify three major types of skin cancer namely melanoma, basal cell carcinoma, and squamous cell carcinoma.

The model is experimented with commonly available skin cancer datasets and performance of the model is evaluated based on accuracy, specificity, and sensitivity.

Experimental and performance analysis shows that the proposed model is performing better compared to the state-of-the-art deep learning techniques.


References


Thank You