Khazanah Journal of Religion and Technology
Universitas Islam Negeri Sunan Gunung Djati Bandung, Indonesia
https://journal.uinsgd.ac.id/kjrt
Online ISSN: 2987-6060
Volume 1 Issue 2 (2023)
DOI: https://doi.org/10.15575/kjrt.v1i2.296

Prediction of Skin Diseases using Convolutional Neural Networks as an Effort to Prevent Their Spread in Islamic Boarding School Environments

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Abstract— Skin disease is a common health problem in Islamic boarding school environments. This disease can spread quickly among students due to close contact and sharing the same facilities. Preventing the spread of skin diseases is a top priority in efforts to maintain the health and welfare of students in Islamic boarding schools. In this research, we propose the use of machine learning techniques to predict skin diseases in Islamic boarding school students. The main goal of this research is to develop a predictive model that can help identify skin diseases quickly and accurately. It is hoped that this will enable the prevention of the spread of skin diseases in the Islamic boarding school environment. The method used in this research involves the following steps: skin disease image data collection, data processing and cleaning, feature extraction from patient data, and machine learning model training and evaluation. We will use a Convolutional Neural Network (CNN) machine learning algorithm to build a predictive model. The dataset used in this research consists of images of melanoma, acne and acne skin diseases. In addition, validation will be carried out using data that has never been seen before to test the performance of the predictive model. It is hoped that the results of this research can make a significant contribution in preventing the spread of skin diseases in the Islamic boarding school environment. With accurate predictive models, health workers in Islamic boarding schools can take appropriate preventive measures to control skin diseases effectively. Apart from that, this research can also be a basis for developing a health information system that supports preventive measures for skin diseases in Islamic boarding schools more widely.

Keywords- Convolutional Neural Network, Machine Learning, Skin Disease, VGG-16

I. INTRODUCTION

Skin disease is a common health problem in various populations [1], including in the Islamic boarding school environment. Factors such as close contact [2], Sharing facilities, as well as high population density in Islamic boarding schools, can accelerate the spread of skin diseases among students. Therefore, preventing the spread of skin diseases is very important in efforts to maintain the health and welfare of students in Islamic boarding schools.

In the last few decades, technological advances and the development of data analysis methods have made significant contributions in various fields, including the health sector. One emerging technology with great potential is machine learning. Machine learning allows computers to learn from existing data and make predictions or decisions without having to be explicitly programmed [3].

In the context of skin disease prediction, the use of machine learning can help identify diseases quickly and accurately based on hidden patterns in the data [4]. With the right predictive model, prevention of the spread of skin diseases in Islamic boarding school environments can be done more effectively.

Previous research has described the application of machine learning in various health fields, including disease prediction, ranging from minor illnesses to heart disease [5]. However, research that specifically focuses on predicting skin diseases in Islamic boarding school environments is still limited. Therefore, this research aims to fill this knowledge gap by developing a predictive model using machine learning techniques to predict skin diseases in Islamic boarding school students.

Through the use of image datasets with various categories of skin diseases, this research is expected to produce predictive models that can help prevent the spread of skin diseases. With accurate predictive models, health workers in Islamic boarding schools can take appropriate and immediate preventive measures to control skin diseases effectively.

Apart from providing practical benefits in preventing skin diseases in the Islamic boarding school environment, this research can also provide new insights in developing a health information system that focuses on preventing skin diseases more broadly. It is hoped that the results of this research can be used and make a significant contribution in improving the health and welfare of the students and the community around the Islamic boarding school.

Overall, this research aims to utilize the power of machine learning in predicting skin diseases to improve efforts to prevent the spread of disease in Islamic boarding school environments. By integrating this advanced technology into the Islamic boarding school health system, it is hoped that it can create a healthier environment and minimize the negative impact of skin diseases on students.

II. RELATED WORKS

Research related to skin disease prediction using machine learning has been carried out in various contexts and populations. However, research that specifically focuses on predicting skin diseases in Islamic boarding school environments is still limited.

Research on cancer disease using pigment images shows that the performance of convolutional neural network models is influenced by several factors such as the number of layers, kernel_size on the input layer, accuracy of data augmentation, data condition, and data balance. The use of appropriate augmentation techniques and a sufficient number of datasets has an influence in increasing model accuracy. Apart from that, the balance of data frequencies in each class can also affect model accuracy. The proposed model for skin cancer pigment classification obtains an accuracy of 75% [6].

In further research regarding the classification of skin diseases, it can be concluded that the Convolutional Neural Network (CNN) method can be used to carry out a more accurate classification. The resulting model has high accuracy, namely 96.75% [7]. Apart from that, this research has the potential to produce products that can be used to identify skin diseases via mobile devices.

Research on the classification of skin cancer types using CNN-SVM with VGG-19 architecture and ResNet-50 as feature extraction provides good results in skin cancer classification. The test results show that the use of linear kernels with random and grid optimization, as well as patch preprocessing, has the highest accuracy, precision, recall and f1-score values compared to other methods [8].

In research, the skin disease classification system using the texture detection method using the BLOB technique and the LVQ artificial neural network can be used to recognize human skin texture with high accuracy. This method can help in the recognition and identification of skin diseases, including skin cancer [9].

Based on research on the classification of skin diseases conducted at the Dinoyo Community Health Center, Malang City, the BDTSVM method can be implemented well to solve the problem of classifying skin diseases in humans [10]. However, the large amount of data can affect the accuracy results in the classification process.

Although the above studies do not specifically focus on the Islamic boarding school environment, they provide useful insight into the application of machine learning in skin disease prediction. Our research seeks to adapt this method to Islamic boarding school environments that have unique characteristics, such as high population density and close contact between Islamic boarding school students. By utilizing knowledge from related research, we hope to develop an effective predictive model for preventing the spread of skin diseases in Islamic boarding school environments.

III. RESEARCH METHODS

The aim of this research is to predict the types of skin diseases that are distributed in Islamic boarding school environments located in West Java, Indonesia. To achieve this goal, researchers used a Convolutional Neural Network (CNN) model. The data used in this study was taken from the Derment Dataset, Dermnet is a clinical resource site that provides free image data about dermatology based in New Zealand [11]. The dataset was obtained from the Kaggle website. The data analyzed in this research are images of skin diseases.

To train a CNN model, quite a lot of image data from various skin diseases is needed. The data consists of 1,962 images divided into 3 classes, namely Herpes, Scabies, Urticaria.

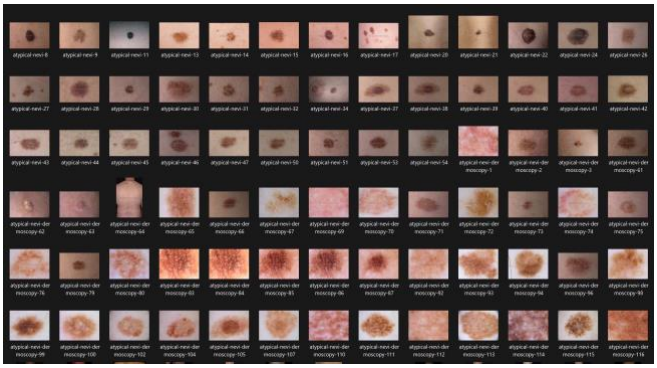

Fig 1. Example of a melanoma image dataset

Fig 2. Example of an actitic image dataset

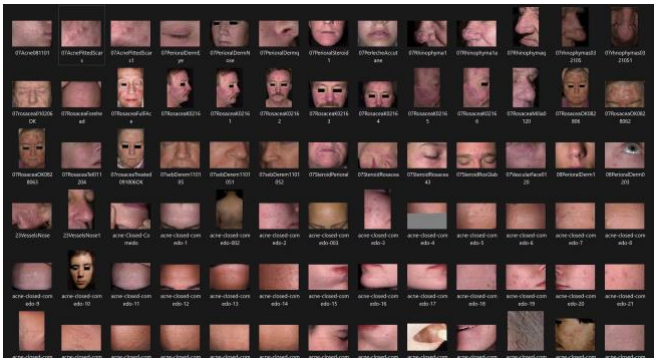

Fig 3. Example of an acne image dataset

IV. RESULT AND DISCUSSION

A. *Implementation*

In its implementation, this research uses the Convolutional Neural Network (CNN) algorithm. CNN is a convolution operation that combines several processing layers, using several elements operating in parallel and inspired by biological nervous systems [12][13]. The CNN architecture consists of several convolution layers, pooling layers, and fully connected layers [14].

Convolution layers are one of the important types of layers in convolutional neural networks (CNN). This layer is responsible for performing convolution operations on its input. The convolution operation involves using a kernel (filter) to perform a scan on the input by performing dot products between the kernel and the corresponding part of the input in each scanning step. The results produce a feature map that highlights important features of the input [15].

Pooling Layer is a component in a CNN model that accepts blind features as input and performs statistical operations based on nearby pixel values [16]. Typically, Pooling layers are placed regularly after several convolution layers in a CNN architecture. By placing Pooling layers between successive convolutional layers, we gradually reduce the size of the resulting feature map, reducing the number of parameters and computations in the network, and helping to control Overfitting [17].

Data will be processed using the VGG16 model. VGG16 is a vision model that is considered very good at the moment [18]. VGG16 has a convolution layer with 3x3 filters and a maxpool layer with 2x2 filters. This convolution and maxpool layer configuration is applied consistently across the architecture. This network has 2 fully connected layers followed by softmax for output. The VGG-16 architecture has 16 layers that have weights. This network is quite a large network and has around 138 million parameters [19]. VGG-16 architecture is illustrated in Figure 4.

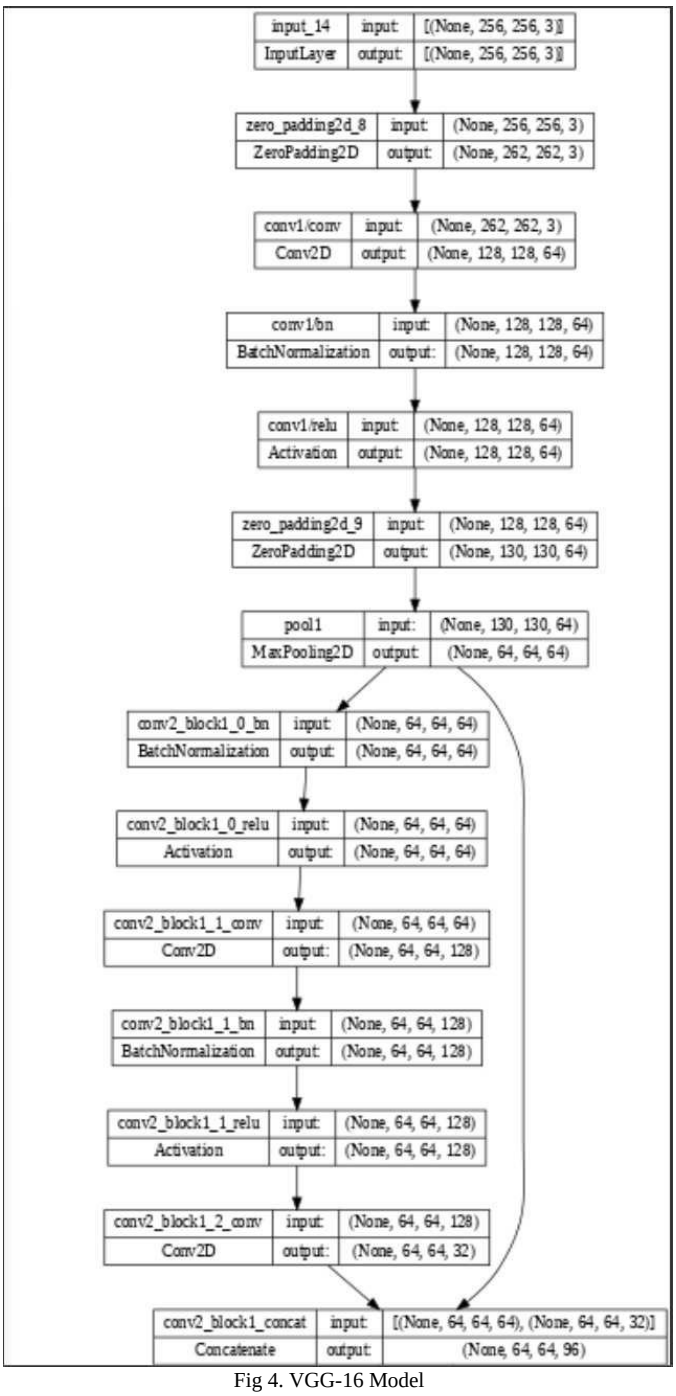

Fig 4. VGG-16 Model

B. Evaluation

This study used image data from various skin diseases totaling 1,962 images. The data collected and analyzed is data sourced from Dermnet which is available on the Kaggle site. The analyzed data is divided into 3 classes. Data training is provided in Figure 5.

```
[464] batch_size = 8
      train_generator = train_data_gen.flow_from_dataframe(
          dataframe=final_df,
          x_col="Image",
          y_col="Label",
          target_size=(256, 256),
          batch_size=batch_size,
          class_mode="categorical",#sparse
          subset='training',
          shuffle=True,
          seed=42
      )
      valid_generator = train_data_gen.flow_from_dataframe(
          dataframe=final_df,
          x_col="Image",
          y_col="Label",
          target_size=(256, 256),
          batch_size=batch_size,
          class_mode="categorical", #sparse
          subset='validation',
          shuffle=True,
          seed=42
      )
      test_generator = test_data_gen.flow_from_dataframe(
          dataframe=final_test_df,
          x_col="Image",
          y_col="Label",
          target_size=(256, 256),
          batch_size=1,
          class_mode='categorical',
          shuffle=False,
      )

      Found 1962 validated image filenames belonging to 3 classes.
      Found 490 validated image filenames belonging to 3 classes.
      Found 716 validated image filenames belonging to 3 classes.
```

Fig 5. Data Analysis Result

```
[ ]  true_classes = test_generator.classes
     class_indices = train_generator.class_indices
     class_indices = dict((v,k) for k,v in class_indices.items())


     vgg_acc = accuracy_score(true_classes, vgg_pred_classes)
     print("VGG16 Model Accuracy: {:.2f}%".format(vgg_acc * 100))

     VGG16 Model Accuracy: 80.59%
```

Fig 6. Accuracy Result

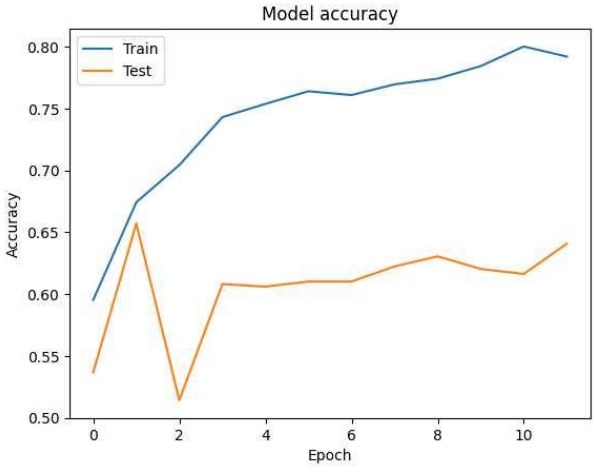

Fig 7. Model Accuracy

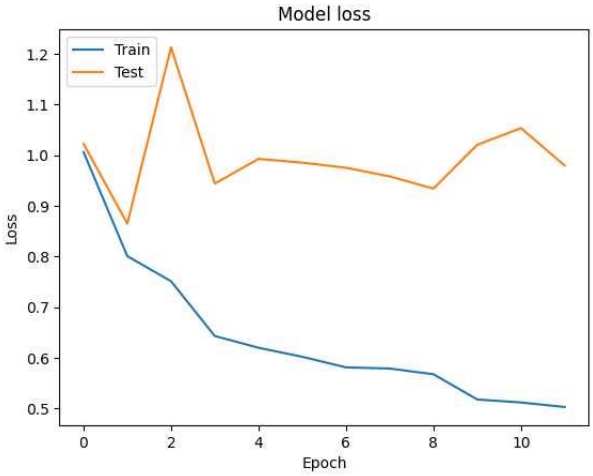

Fig 8. Model Loss

After training the data using the VGG16 model, it was discovered that this research had a fairly good level of training accuracy at 80.59% (Figure 6). Categorical accuracy increases as the train progresses. However, there are still some differences in values between train data and validation data. As an effort to increase performance, other techniques can be tried, such as regulation or resetting the model architecture. Figures 7 and 8 describe the model accuracy and loss results.

The trial was carried out using skin photo samples from several students in West Java who were sick. The results as illustrated in Figure 9 show that the photos tested predicted accurate disease categories.

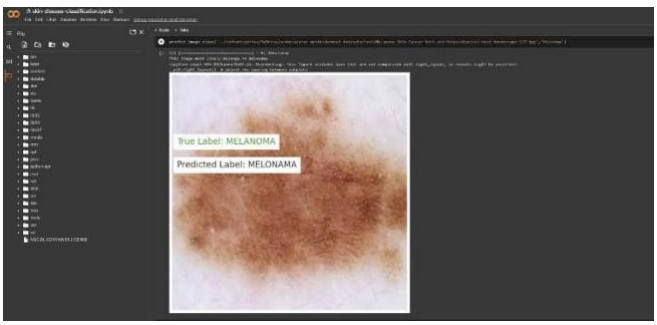

Fig 9. Testing result

C. Discussion

In the research, we created a skin disease detection system using the Convolutional Neural Network (CNN) algorithm with the VGG16 model which can be used in Islamic boarding school environments as a prevention effort. We managed to achieve an accuracy rate of 80.58% in classifying skin diseases based on images.

The high level of accuracy we obtained indicates that the use of CNN with the VGG16 model in skin disease detection has significant potential. These results provide evidence that image-based approaches and deep learning techniques can aid

in the early identification of skin diseases, thereby enabling more effective and timely preventive measures.

The success of our model can be attributed to the CNN architecture used. The VGG16 model, with its deep structure and strong hierarchical feature extraction capabilities, is proven to be able to learn discriminative representations from skin disease images. By performing several layers of convolution and pooling, and using fully connected layers to connect the extracted features to the classification output, our model is able to extract important features from images and classify skin diseases with a good level of accuracy.

However, this study also has several limitations that need to be considered. First, the dataset used in this study may be limited in variety and sample size. In future research, it is necessary to expand the dataset so that the model can better learn and classify various conditions and variations of skin diseases.

V. CONCLUSION

This research uses the VGG16 model in the Convolutional Neural Network (CNN) algorithm for skin disease detection through images in the Islamic boarding school environment. The level of accuracy achieved reached 80.58%. The use of image-based skin disease detection technology and machine learning has great potential in preventing skin diseases. Overall, this research shows that skin disease detection using CNN with the VGG16 model in the image approach has good accuracy. This provides a strong foundation for the application of image-based skin disease detection technology in preventing skin diseases in Islamic boarding schools. Further research and development needs to be conducted to overcome limitations and increase the practical applicability of this approach.

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