# Proceeding 7

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# Convolutional Neural Network for Halal Detection of Korean Cosmetic Composition


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***Abstract*—Korean cosmetics occupy the position as the best and most favorite cosmetics in Indonesia with a user percentage of 46.6%, beating domestic cosmetics with 34.1%. Unfortunately, Hangeul's writing on Korean cosmetic packaging often confuses the contents of the cosmetics. In fact, as a country with the most significant Muslim majority in the world, Indonesian people are required to use everything halal. A halal detection application for Korean cosmetic compositions was created by implementing the Convolutional Neural Network. The test results show that the application can detect material doubts with an accuracy rate of 95.56%. This indicates that the Korean cosmetic halal detection application is in a suitable category.**



***Keywords—cosmetic, CNN, halal detection, Korean cosmetic***


## I. Introduction

Korean Cosmetics is the best and most favorite cosmetics in Indonesia. It is proven by the percentage of 46.6% of users, beating Indonesian cosmetics with a portion of 34.1 [1]. Unfortunately, this consumption pattern is not supported by awareness of the ingredients in the cosmetics used. Only 0.1% of millennial women check the label/information about the composition of the beauty products they buy. Most teenagers under 18 pay more attention to price than the safety and halalness of the cosmetic products they buy [1].

In Indonesia, the country with the largest Muslim population in the world [2], Halal regulations for cosmetic products has been regulated since 2013 by the Indonesian Ulema Council in the MUI Fatwa No. 26 concerning Halal Standards for Cosmetic Products and Their Use. In the fatwa, it is written that every Muslim must use cosmetics made from halal and holy fields [3].

Although customers can know the halal standards and ingredients for cosmetic products, this is still difficult for Korean cosmetic products that use the Korean language and writing (Hangeul). Difficulties in understanding foreign languages can certainly be solved by utilizing technology. Many methods can be used to recognize letters or characters, including the Neural Network. This Neural Network method represents human nerves that learn something to achieve high accuracy [4][5]. One of the developments of this Neural Network is the Convolutional Neural Network which can process two-dimensional data to process image data or images [4].

In previous studies, the Convolutional Neural Network has been used for various purposes, for example, detection of compositions on non-halal food packaging [6], facial skin type classification [7], age group classification from face image [8], extraction of recipes from food images [9], et cetera. In terms of the use of foreign language writing, CNN is used to recognize signs in various foreign languages, [10]–[16], and Japanese characters (Hiragana, Katakana, and Kanji) with an accuracy of up to 96.2% with cross-validation reaching 86% [4]. In addition, in 2015, a study successfully applied the Convolutional Neural Network to recognize Chinese handwriting with an accuracy of 96.35% [17]. Therefore, Convolutional Neural Network is the proper method to identify Korean writing (Hangeul). This study aims to create an application to detect the halal composition of Korean cosmetics using the Convolutional Neural Network. Furthermore, the application was tested to determine the accuracy level of CNN in detecting doubtful, haram, and halal materials.

## II. Methodology

### A. Convolutional Neural Network

One of the derivatives of the Neural Network, which is the development of the Multilayer Perception method, is the Convolutional Neural Network (CNN). CNN is widely used for processing grid-shaped data such as digital images because it has a high network depth and is included in the Deep Neural Network [4]. The name convolutional comes from the linear mathematical operation, the convolution operation. This convolution operation is used at least once on each CNN layer [18].

CNN can be used in classifying labeled data using the supervised learning method. In supervised learning, there are training data and target variables where each data will be grouped and targeted to the existing data [19]. Convolutional Neural Networks use three main architectures: local receptive


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fields, shared weight in the form of filters, and spatial subsampling in the form of a pooling [19]. The name convolution comes from the operation of linear algebra, which becomes a layer in CNN, namely the convolution layer. The convolution layer works by multiplying the matrix of the filter on the image to be processed [20] (see Fig. 1).

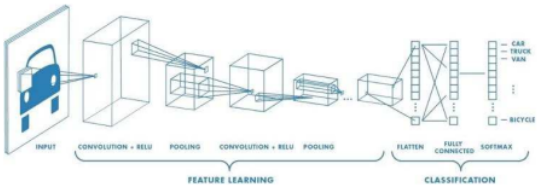



Fig. 1. CNN Architecture

The following are the layers or layers in the Convolutional Neural Network [21]–[23].

*1). Convolution Layer*

The convolutional layer is the layer that is the core of this CNN. In this layer, the image will be represented in the filter matrix and multiplied by each other. This filter has a length, width, and thickness, which are then initialized to a value where this value becomes a parameter that will be updated in the learning/training process [24]. The convolution process represents the image in a box with a specific value. In the box, there is a kernel indicating the convoluted value. This kernel will move from top left to bottom right (Fig. 2) [20].

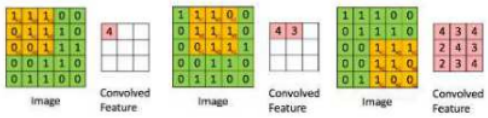



Fig. 2. Convolutional layer process

This convolution layer is a linear transformation of the input data. The result has a weight that specifies the kernels in the convolution layer so that the kernel can be trained based on the input to the CNN.

*2). Pooling Layer*

The next layer is the pooling layer. This layer aims to reduce the results of the previous layer by reducing the number of parameters using down-sampling operations. The max-pooling method is a popular method in applying the pooling layer. Max-pooling is used to take the highest value from the output convolutional layer which is divided into several grids (Fig. 3).

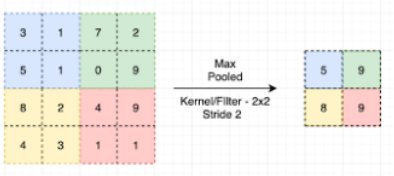



Fig. 3. Max-pooling on pooling layer

Signal will be greater when the grid is large. This layer is applied to each convolutional layer so that it can respond to any changes in the previous layer and increase the spatial abstractness.

*3). Fully Connected Layer*

To be classified, the data must first be processed using the Fully Connected Layer method that applies Multi-Layer Perception. A fully Connected Layer allows all activation neurons from the previous layer to be connected to the next layer.

## B. Non-halal and doubtful cosmetic ingredients

Basically, the problem with non-halal cosmetic ingredients lies in their origin (human or non-halal animal) and the "unclean" status of these ingredients. So from various cosmetic ingredients, the following are non-halal ingredients and doubtful (doubtful) [3]. The list of ingredients for non-halal products can be seen in Table I.

TABLE I. HARAM AND DOUBTFUL COSMETIC INGREDIENTS

| No | *Ingredients Name* | *Product* | *Description* |
|---|---|---|---|
| 1 | Placenta | Lipstick, lip balm, perfume, face cream, lotion, bath soap, powder | Materials become haram if they come from humans or haram animals. It is permissible if it comes from halal animals through childbirth. |
| 2 | Keratin | Hair dye | Protein is found in human hair and soybeans. It becomes haram if it comes from human hair or haram animal protein. |
| 3 | Albumin | Solvent active cosmetic ingredients | Haram because it comes from human serum to be precise in human blood. |
| 4 | Amniotic Fluid | Moisturizer, shampoo, scalp care products. | It is a protective fluid for the fetus. Haram if it comes from humans or animals, is haram. |
| 5 | Glycerin | Body soap, lotion, sunscreen, lipstick, moisturizer, mask, lip gloss, toothpaste | Is a derivative of animal fat, plant, propylene gas, or microbial products (synthetic). Haram if it comes from haram animal fat. |
| 6 | Collagen and Elastin | Moisturizer, hand & body lotion | Is a connective tissue found in the skin of humans, pigs, goats, cows, etc. Haram if it comes from humans or animals, is haram. |
| 7 | Allantoin and its derivatives (Aluminum Chlorhydoxy Allantoinante, Aluminum dihydroxy Allantoinante, Allantoinate N Acetyl DL Methionine, etc.) | Deodorant, anti-irritant for babies, moisturizing, toothpaste, shampoo | Found in living fetuses, dog urine, wheat germ, earthworms, and other organic components. If the material comes from humans or animals, then the law is haram. |
| 8 | Hyaluronic Acid | Whitening cream | Found in eye fluid and fetus. Haram if it comes from humans and animals, are haram. |

### C. Confusion Matrix

Confusion Matrix is a method used to measure the work of Machine Learning. This method compares the classification results from the application with the actual classification. The results of this method are represented in 4 types, namely True Positive (TP), True Negative (TN), False Positive (FP), and False Negative (FN) [25] as shown in Fig. 4 [25].

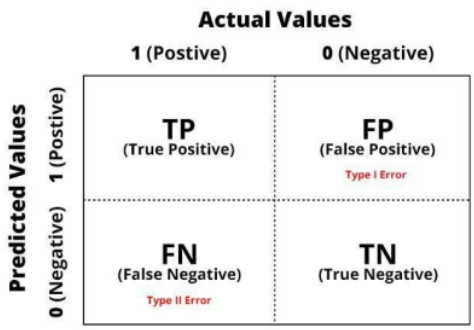



Fig. Confusion Matrix Representation

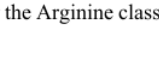
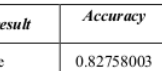
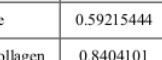
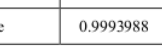
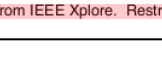
## III. RESULT

The implementation stage is where the application is built according to the design. In developing applications for the detection of halal Korean cosmetics, there are three implementation processes: dataset implementation, CNN algorithm implementation, and interface implementation.

### A. Dataset Implementation

The dataset is a collection of data used during the model training process. The data is in the form of images of Korean cosmetic ingredients/composition pieces in .jpg format. The total data collected is 900 images consisting of 9 classes of doubtful material. Each class has 100 images which are contained in a folder with the folder name according to the name of the subject matter of the class. Table II below is a breakdown of the class and the amount of data used.

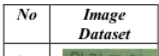
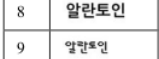
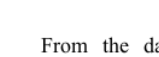
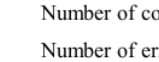
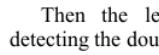
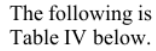
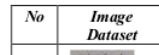
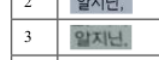
TABLE II. CLASS DETAILS AND AMOUNT OF DATA

| *No* | *Ingredients Name* | *Name of Ingredients in Korean* | *Image Example* | *Amount of Data* |
|---|---|---|---|---|
| 1 | Glycerin | 글리세린 |  | 100 |
| 2 | *Niacinamide* | 나이아시나마이드 |  | 100 |
| 3 | *Allantoin* | 알란토인 |  | 100 |
| 4 | *Ethyl hexyl glycerin* | 에틸헥실글리세린 |  | 100 |
| 5 | *Hydrolyzed Collagen* | 하이드로라이즈드 콜라겐 |  | 100 |
| 6 | *Polysorbate (10, 20, 60, 80)* | 폴리소르바이트 (10, 20, 60, 80) |  | 100 |
| 7 | *Xanthan Gum* | 산탄곰 |  | 100 |
| 8 | *Sodium Hyaluronate* | 소듐하이알루로나트 |  | 100 |
| 9 | *Arginine* | 알지닌 |  | 100 |

### B. Precision Test Result

Precision testing is an algorithm test using test data that has been split when creating the dataset. This test is carried out after the model has been trained. This test aims to validate the training results' correctness and the maximum level of accuracy obtained. This test is carried out in each class to measure the algorithm's precision in predicting each class. The following is a test table for each class.

TABLE III. TESTING FOR THE INGREDIENT ALLANTOIN

| *No* | *Image Dataset* | *Prediction result* | *Accuracy* | *Result* |
|---|---|---|---|---|
| 1 |  | Allantoin | 0.9911972 | Right |
| 2 |  | Xanthan Gum | 0.9997435 | Wrong |
| 3 |  | Allantoin | 0.9979227 | Right |
| 4 |  | Allantoin | 0.9976618 | Right |
| 5 |  | Allantoin | 0.9983827 | Right |
| 6 |  | Allantoin | 0.9879749 | Right |
| 7 |  | Allantoin | 0.99725014 | Right |
| 8 |  | Allantoin | 0.9978654 | Right |
| 9 |  | Allantoin | 0.9934006 | Right |
| 10 |  | Allantoin | 0.9976101 | Right |

From the data above, the following information is obtained:

Number of correct (TP) = 9

Number of errors (TN) = 1

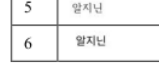
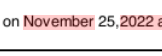
Total data = 10

Then the level of precision/precision algorithm in detecting the doubtful material Allantoin is as follows.

$$precition = \frac{9}{10} \times 100\% = 90\%$$

The following is a test table for the Arginine class/material in Table IV below.

TABLE IV. TESTING FOR THE INGREDIENT ARGININE

| *No* | *Image Dataset* | *Prediction result* | *Accuracy* | *Result* |
|---|---|---|---|---|
| 1 |  | Arginine | 0.82758003 | Right |
| 2 |  | Arginine | 0.93719894 | Right |
| 3 |  | Arginine | 0.59215444 | Right |
| 4 |  | Hydrolyzed Collagen | 0.8404101 | Wrong |
| 5 |  | Arginine | 0.8315795 | Right |
| 6 |  | Arginine | 0.9993988 | Right |

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 7 | 알지닌 | Arginine | 0.98720807 | Right |
| 8 | 알지닌 | Arginine | 0.80537516 | Right |
| 9 | 알지닌 | Hydrolyzed Collagen | 0.7876047 | Wrong |
| 10 | 알지닌, | Arginine | 0.82758003 | Right |

From the data above, the following information is obtained:

- Correct number (TP) = 7

- Number of errors (TN) = 2

- Total data (TP+TN) = 9

Then the level of accuracy of the algorithm in detecting Arginine doubtful materials is as follows.

$$precision = \frac{7}{9} \times 100\% = 77{,}7778\%$$

The following is a test table for the EthylHexylGlycerin class/material in Table V as follow.

TABLE V. TESTING FOR THE INGREDIENT *ETHYLHEXYLGLYCERIN*

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 1 | 에칠헥실글리세린, | Ethylhexylglycerin | 0.999999 | Right |
| 2 | 에칠헥실글리세린, | Ethylhexylglycerin | 0.999999 | Right |
| 3 | ,에칠헥실글리세린, | Ethylhexylglycerin | 0.99999917 | Right |
| 4 | ,에칠헥실글리세린, | Ethylhexylglycerin | 0.9994729 | Right |
| 5 | 에칠헥실글리세린, | Ethylhexylglycerin | 0.9999988 | Right |
| 6 | ,에칠헥실글리세린, | Ethylhexylglycerin | 0.9999995 | Right |
| 7 | 에틸헥실글리세린 | Ethylhexylglycerin | 1.0 | Right |
| 8 | 에틸헥실글리세린 | Ethylhexylglycerin | 1.0 | Right |
| 9 | 에틸헥실글리세린 | Ethylhexylglycerin | 0.9999999 | Right |
| 10 | 에틸헥실글리세린 | Ethylhexylglycerin | 1.0 | Right |
| 11 | 에틸헥실글리세린 | Ethylhexylglycerin | 0.9999999 | Right |
| 12 | 에틸헥실글리세린 | Ethylhexylglycerin | 1.0 | Right |

From the data above, the following information is obtained:

- Correct number (TP) = 12

- Number of errors (TN) = 0

- Total data (TP+TN) = 12

Then the accuracy level of the algorithm in detecting doubtful materials Ethylhexylglycerin is as follows.

$$precision = \frac{12}{12} \times 100\% = 100\%$$

Table VI is the test results for the Glycerin class/material.

TABLE VI. TESTING FOR THE INGREDIENT *GLYCERIN*

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 1 | 글리세린, | Glycerin | 0.9803774 | Right |
| 2 | 글리세린, | Glycerin | 0.9850916 | Right |
| 3 | 글리세린, | Glycerin | 0.99663264 | Right |
| 4 | 글리세린, | Glycerin | 0.5912468 | Right |
| 5 | 글리세린, | Glycerin | 0.96999985 | Right |
| 6 | 글리세린, | Glycerin | 0.9781351 | Right |
| 7 | 글리세린, | Glycerin | 0.9895275 | Right |
| 8 | 글리세린, | Glycerin | 0.94521165 | Right |

From the data above, the following information is obtained:

- Total correct (TP) = 8

- Number of errors (TN) = 0

- Total data (TP+TN) = 8

Then the level of accuracy of the algorithm in detecting the doubtful material Glycerin is as follows.

$$precision = \frac{8}{8} \times 100\% = 100\%$$

The following is a test table for the class/material of Hydrolyzed Collagen in Table VII below.

TABLE VII. TESTING FOR THE INGREDIENT *HYDROLYZED COLLAGEN*

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 1 | 하이드롤라이즈드콜라겐, | Hydrolyzed Collagen | 0.9999678 | Right |
| 2 | 하이드롤라이즈드케라틴, | Hydrolyzed Collagen | 0.99997485 | Right |
| 3 | 하이드롤라이즈드콜라겐 | Hydrolyzed Collagen | 0.9999863 | Right |
| 4 | *하이드롤라이즈드콜라겐, | Hydrolyzed Collagen | 0.99720746 | Right |
| 5 | 롤라이즈드콜라겐, | Hydrolyzed Collagen | 0.9910115 | Right |
| 6 | 하이드롤라이즈드콜라겐, | Hydrolyzed Collagen | 0.9995907 | Right |
| 7 | 하이드롤라이즈드콜라겐, | Hydrolyzed Collagen | 0.99996984 | Right |
| 8 | 하이드롤라이즈드콜라겐, | Hydrolyzed Collagen | 0.99992645 | Right |
| 9 | ,하이드롤라이즈드콜라겐, | Hydrolyzed Collagen | 0.9996718 | Right |
| 10 | 하이드로라이즈드콜라겐 | Hydrolyzed Collagen | 0.99912745 | Right |

$$precision = \frac{10}{10} \times 100\% = 100\%$$

The following is a test table for the Niacinamide class/material in Table VIII below.

TABLE VIII. TESTING FOR THE INGREDIENT *NIACIMIDE*

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 1 | ,나이아신아마이드, | Niacinamide | 0.99930704 | Right |
| 2 | 나이아신아마이드, | Niacinamide | 0.9996182 | Right |

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 3 | 나이아신아마이드, | Niacinamide | 0.9997949 | Right |
| 4 | 나이아신아마이드 | Niacinamide | 0.9998691 | Right |
| 5 | 나이아시나마이드 | Niacinamide | 0.99976546 | Right |
| 6 | 나이아시나마이드 | Niacinamide | 0.9999455 | Right |
| 7 | 나이아신아마이드 | Niacinamide | 0.9992181 | Right |
| 8 | 나이아신아마이드, | Niacinamide | 0.9998487 | Right |

$$precision = \frac{9}{9} \times 100\% = 100\%$$

The following is a test table for the Polysorbate class/material in Table IX below.

TABLE IX. TESTING FOR THE INGREDIENT POLYSORBATE

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 1 | 폴리소르베이트 | Polysorbate | 0.9986094 | Right |
| 2 | 폴리소르베이트 | Polysorbate | 0.9999957 | Right |
| 3 | 폴리소르베이트 | Polysorbate | 0.9999985 | Right |
| 4 | 폴리소르베이트 | Polysorbate | 0.9999857 | Right |
| 5 | 폴리소르바이트 | Polysorbate | 0.9999684 | Right |
| 6 | 폴리소르바이트 | Polysorbate | 1.0 | Right |
| 7 | 폴리소르바이트 | Polysorbate | 1.0 | Right |
| 8 | 폴리소르바이트 | Polysorbate | 0.9999807 | Right |
| 9 | 폴리소르바이트 | Polysorbate | 0.9999993 | Right |
| 10 | 폴리소르바이트 | Polysorbate | 0.9999976 | Right |

$$precision = \frac{10}{10} \times 100\% = 100\%$$

The following is a test table for the class/material of Sodium Hyaluronate in Table X below.

TABLE X. TESTING FOR THE INGREDIENT SODIUM HYALURONATE

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 1 | 소듐하이알루로네이트, | Sodium Hyaluronate | 0.9944179 | Right |
| 2 | 소듐하이알루로네이트, | Sodium Hyaluronate | 0.99846673 | Right |
| 3 | 소듐하이알루로네이트 | Sodium Hyaluronate | 0.99839526 | Right |
| 4 | 소듐하이알루로네이트, | Sodium Hyaluronate | 0.99744844 | Right |
| 5 | 소듐하이알루네이트 | Sodium Hyaluronate | 0.99947196 | Right |
| 6 | 소듐하이알루네이트 | Sodium Hyaluronate | 0.9998222 | Right |
| 7 | 소듐하이알루네이트 | Sodium Hyaluronate | 0.9967847 | Right |

$$precision = \frac{7}{7} \times 100\% = 100\%$$

The following is a test table for the class/material Sodium Hyaluronate in Table XI below.

TABLE XI. TESTING FOR THE INGREDIENT POLYSO

| No | Image Dataset | Prediction result | Accuracy | Result |
|---|---|---|---|---|
| 1 | 잔탄검, | Xanthan Gum | 0.9987534 | Right |
| 2 | 잔탄검, | Xanthan Gum | 0.99999213 | Right |
| 3 | 잔탄검, | Xanthan Gum | 0.9999968 | Right |
| 4 | 잔탄검, | Xanthan Gum | 0.9999995 | Right |
| 5 | 잔탄검, | Xanthan Gum | 0.99998736 | Right |
| 6 | 잔탄검, | Xanthan Gum | 0.9999821 | Right |
| 7 | 잔탄검, | Xanthan Gum | 0.9996784 | Right |
| 8 | 잔탄검 | Xanthan Gum | 0.99999464 | Right |
| 9 | 잔탄검 | Xanthan Gum | 0.9999963 | Right |
| 10 | 잔탄검 | Xanthan Gum | 0.9996275 | Right |
| 11 | 잔탄검 | Xanthan Gum | 0.9999981 | Right |

$$precision = \frac{11}{11} \times 100\% = 100\%$$

From all the precision test results in each class, it can be taken the average of the precision values as follows.

$$means = \frac{90 + 77{,}7778 + 100 + 100 + 100 + 100 + 100 + 100 + 100}{9}\% = 96{,}4\ 198\%$$

### C. Recall Test Result

Recall testing is an algorithm testing with halal or doubtful criteria. This test is carried out by entering the data of halal ingredients per the LPPOM MUI Decree. The application will assess the accuracy of the input, if it is less than 0.59 in any class then the material is categorized as halal material. This is determined by referring to the minimum value of accuracy obtained when testing precision using test data.

The data used is an image of pieces of halal material with a total of 50 images. Furthermore, the level of accuracy is calculated using the Recall formula in the confusion matrix method. The following is a table of the results of tests on the application. Table XII show the recall test result.

TABLE XII. RECALL TEST RESULT

| No | Ingredients Name | Image | Prediction Result |
|---|---|---|---|
| 1 | Aloe Barbadensis leaf Juice | 알로에베라잎즙, | Syubhat |
| 2 | 1,2- Hexanediol | 1,2-헥산디올, | Syubhat |
| 3 | Acrylate Copolymer | 크릴릭애씨드코폴리머, | Syubhat |
| 4 | Butylethyglycol | 부틸렌글라이콜, | Syubhat |
| 5 | C13-14 Isoparaffin | ,C13-14이소파라핀, | Syubhat |
| 6 | Chlorophenesin | ,클로페네신, | Halal |
| 7 | Cyclohexasiloxane | 사이클로헥사실록산, | Syubhat |
| 8 | Dimethicone | 디메치콘, | Halal |
| 9 | Disodium EDTA | 디소듐이디티에이, | Halal |
| 10 | hydroxyethylcellulose | 하이드록시에칠셀룰로오스 | Syubhat |
| 11 | Methyl Propanediol | 메칠프로판디올, | Halal |
| 12 | Phenoxy Ethanol | 페녹시에탄올, | Halal |

| No | Ingredients Name | Image | Prediction Result |
|---|---|---|---|
| 13 | Poly Acrylate 13 | 폴리아크릴레이트-13, | Syubhat |
| 14 | Propylane Glycol | 프로필렌글라이콜, | Syubhat |
| 15 | Propyl Paraben | 프로필파라벤 | Syubhat |
| 16 | Silika | 실리카, | Syubhat |
| 17 | Steartrimonium Chloride | 스테아트리모늄클로라이드, | Syubhat |
| 18 | Titanium Dioxide | 티타늄다옥사이드, | Syubhat |
| 19 | Triethanolamine | 트리에탄올아민, | Syubhat |
| 20 | Cyclopentasiloxane | 사이클로펜타실록산, | Syubhat |

From these tests, only 5 were categorized as halal ingredients. Then the recall from the test is as follows.

$$Recall = \frac{5}{20} \times 100\% = 25\%$$

The results of the training model process on the training data produce an accuracy level of 0.9708 with a validation accuracy of 0.9667 and a training loss level of 0.1337 with a validation loss = 0.0650. The evaluation and testing of the algorithm using test data show an accuracy level of 0.9556 with a loss of 0.2396. The results of validating doubtful materials show the average precision of 9 classes of precision using test data of 96.4198%. The results of testing using halal material data show a result of 25%.

## CONCLUSION

An application has been built to detect the halal composition of Korean cosmetics. The system is created by applying the CNN algorithm. The process of detecting the halal ingredients of Korean cosmetics is carried out in several stages: creating a dataset, defining the training model, the training model stage, predicting the image, and creating the interface. The level of system accuracy testing is at 96%. This shows that the system can function correctly.

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## REFERENCES

[1] Z. Beauty, "Beauty Index 2019," 2019.

[2] V. B. Kusnandar, "Indonesia, Negara dengan Penduduk Muslim Terbesar Dunia (Indonesia, the Country with the World's Largest Muslim Population)," *Https://Databoks.Katadata.Co.Id/Datapublish/2019/09/25/Indonesia-Negara-Dengan-Penduduk-Muslim-Terbesar-Dunia*, p. 1, 2019, Accessed: Dec. 13, 2019. [Online]. Available: https://databoks.katadata.co.id/datapublish/2019/09/25/indonesia-negara-dengan-penduduk-muslim-terbesar-dunia.

[3] M. U. Indonesia, "Standar Kehalalan Produk Kosmetika dan Penggunaannya," p. 92, 2013, [Online]. Available: http://mui.or.id/wp-content/uploads/files/fatwa/No.-26-Standar-Kehalalan-Produk-dan-Penggunaan-Kosmetika.pdf.

[4] M. M. Susilo, D. M. Wonohadidjojo, N. Sugianto, and E. Al., "Pengenalan Pola Karakter Bahasa Jepang Hiragana Menggunakan 2D Convolutional Neural Network," *J. Inform. dan Sist. Inf. Univ. Ciputra*, vol. 03, no. 02, pp. 28–36, 2017.

[5] M. Andrijasa *et al.*, "Penerapan Jaringan Syaraf Tiruan Untuk Memprediksi Jumlah Pengangguran di Provinsi Kalimantan Timur Dengan Menggunakan Algoritma Pembelajaran Backpropagation," *J. Inform. Mulawarman*, vol. 5, no. 1, 2010.

[6] H. Fadhilah, E. C. Djamal, R. Ilyas, and A. Najmurrokhman, "Non-halal ingredients detection of food packaging image using convolutional neural networks," in *2018 International symposium on advanced intelligent informatics (SAIN)*, 2018, pp. 131–136.

[7] S. Saidah, Y. N. Fuadah, F. Alia, N. Ibrahim, R. Magdalena, and S. Rizal, "Facial Skin Type Classification Based on Microscopic Images Using Convolutional Neural Network (CNN)," in *Proceedings of the 1st International Conference on Electronics, Biomedical Engineering, and Health Informatics*, 2021, pp. 75–83.

[8] L. M. Demajo, "Evaluation of CNN-and COSFIRE-based age group classification from face images." University of Malta, 2018.

[9] A. Channam, B. R. Swarup, and S. G. Rao, "Extraction of Recipes from Food Images by Using CNN Algorithm," in *2021 Fifth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC)*, 2021, pp. 1308–1315.

[10] O. Sevli and N. Kemaloğlu, "Turkish sign language digits classification with CNN using different optimizers," *Int. Adv. Res. Eng. J.*, vol. 4, no. 3, pp. 200–207, 2020.

[11] U. Nandi, A. Ghorai, M. M. Singh, C. Changdar, S. Bhakta, and R. Kumar Pal, "Indian sign language alphabet recognition system using CNN with diffGrad optimizer and stochastic pooling," *Multimed. Tools Appl.*, pp. 1–22, 2022.

[12] A. Sarkar, A. K. Talukdar, and K. K. Sarma, "CNN-based real-time Indian sign language recognition system," in *International Conference on Advances in Computational Intelligence and Informatics*, 2019, pp. 71–79.

[13] T. Goswami and S. R. Javaji, "CNN model for american sign language recognition," in *ICCCE 2020*, Springer, 2021, pp. 55–61.

[14] S. Katoch, V. Singh, and U. S. Tiwary, "Indian Sign Language recognition system using SURF with SVM and CNN," *Array*, vol. 14, p. 100141, 2022.

[15] A. Elhagry and R. Gla, "Egyptian Sign Language Recognition Using CNN and LSTM," *arXiv Prepr. arXiv2107.13647*, 2021.

[16] O. B. Hoque, M. I. Jubair, M. S. Islam, A.-F. Akash, and A. S. Paulson, "Real time bangladeshi sign language detection using faster r-cnn," in *2018 international conference on innovation in engineering and technology (ICIET)*, 2018, pp. 1–6.

[17] Z. Zhong, L. Jin, and Z. Xie, "High performance offline handwritten Chinese character recognition using GoogLeNet and directional feature maps," *Proc. Int. Conf. Doc. Anal. Recognition, ICDAR*, vol. 2015-Novem, pp. 846–850, 2015, doi: 10.1109/ICDAR.2015.7333881.

[18] Y. Lecun, Y. Bengio, and G. Hinton, "Deep learning," *Nature*, vol. 521, no. 7553, pp. 436–444, 2015, doi: 10.1038/nature14539.

[19] T. F. Kusumaningrum, "Implementasi Convolution Neural Network (Cnn) Untuk Klasifikasi Jamur Konsumsi Di Indonesia Menggunakan Keras," 2018.

[20] D. Britz, "Understanding convolutional neural networks for NLP," *URL http//www. wildml. com/2015/11/understanding-convolutional-neuralnetworks-for-nlp/(visited 11/07/2015)*, 2015.

[21] P. Kim, "Convolutional neural network," in *MATLAB deep learning*, Springer, 2017, pp. 121–147.

[22] S. Albawi, T. A. Mohammed, and S. Al-Zawi, "Understanding of a convolutional neural network," in *2017 international conference on engineering and technology (ICET)*, 2017, pp. 1–6.

[23] K. O'Shea and R. Nash, "An introduction to convolutional neural networks," *arXiv Prepr. arXiv1511.08458*, 2015.

[24] R. N. Izah, "Klasifikasi Nominal Uang Kertas Rupiah Tahun Emisi 2017 dengan Algoritma Convolutional Neural Network Menggunakan MXNET," 2018.

[25] K. S. Nugroho, "Confusion Matrix untuk Evaluasi Model pada Supervised Learning," *medium.com*, 2019.

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