

**IDENTIFYING FAKE RICE USING COMPUTER VISION IN PERSPECTIVE OF
BANGLADESH**

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This Report Presented in Partial Fulfillment of the Requirements for
The Degree of Bachelor of Science in Computer Science and Engineering

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DHAKA, BANGLADESH

SEPTEMBER, 2021

APPROVAL

This Project titled “**Identifying Fake Rice using Computer vision in Perspective of Bangladesh**”, submitted by Md. Asif Mahmud Ridoy, ID No:173-15-10262, Md. Fahim Sarker, ID No:173-15-1668 and Shuvo Datta, ID No:173-15-10401 to the Department of Computer Science and Engineering, Daffodil International University has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 9th September,2021.

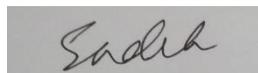
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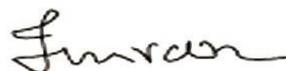
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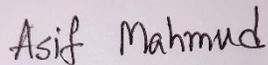
We hereby declare that, this thesis has been done by us under the supervision of **Abdus Sattar, Assistant Professor, Department of CSE** Daffodil International University. We also declare that neither this thesis nor any part of this thesis has been submitted elsewhere for award of any degree or diploma.

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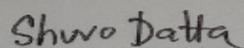
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ACKNOWLEDGEMENT

First we express our heartiest thanks and gratefulness to almighty God for His divine blessing makes us possible to complete the final thesis successfully.

We really grateful and wish our profound our indebtedness to **Abdus Sattar, Assistant Professor**, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of “Machine Learning” to carry out this thesis. His endless patience ,scholarly guidance ,continual encouragement , constant and energetic supervision, constructive criticism , valuable advice ,reading many inferior draft and correcting them at all stage have made it possible to complete this thesis.

We would like to express our heartiest gratitude to **Dr. Touhid Bhuiyan, Professor, and Head**, Department of CSE, for his kind help to finish our thesis and also to other faculty members and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and passion of our parents.

ABSTRACT

Bangladesh is an agricultural country. Rice is one of the major agricultural products of our country. Rice is the staple food of most of the people in the country. As a result, there is a considerable demand for rice in our country. So, there are many types of rice supply in the market. But lately it is seen that fake rice is sold in the market along with real rice. These rice cannot be easily identified with the naked eye whether it is real or fake. Now, it is often seen that people are being deceived by buying fake rice instead of real rice. Which is deadly harmful to health. For this we have collected real and fake rice and made a large dataset by capturing their images. We have preprocessed and augmented our dataset, creating two different computer vision models and checked their accuracy of identification if the rice is real or fake. Two algorithms are being used here one is Artificial Neural Network (ANN) and another one is Convolutional Neural Network (CNN). Among them CNN algorithm gives the highest accuracy which is 98%.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Rice is the staple food of about 135 million people of Bangladesh. Rice sector contributes one-half of the agricultural GDP and one-sixth of the national income in Bangladesh. About 75% of the total cropped area and over 80% of the total irrigated area is planted to rice. Thus, rice plays a vital role in the livelihood of the people of Bangladesh [1]. In last year Bangladesh produced 37.4 million tones rice. In 2021, the projection for production is more than 37 million tones [2]. So, we can easily understand that there is a huge demand for rice in our country. Most of the rice in our country is supplied by marginal farmers. The rice collected from them goes to the warehouse keepers and from there it is supplied to the markets all over the country. But some unscrupulous and lucrative traders often mix fake rice with real rice in the hope of making more profit. As a result, people are deceived by buying fake rice instead of real rice. These fake rice are mainly made with plastic. Plastic rice was first seen in China in 2010. Among Chinese rice, Wuchang rice is famous for its aroma and is also exported to various countries. Chinese authorities have investigated an incident where ordinary rice was transformed into the famous Wuchang rice by adding aroma. Some unscrupulous Chinese traders began to follow this method for more profit. In 2011, a Korean newspaper reported that some rice traders had started selling counterfeit rice in Taiyuan; These fake rice were made from a mixture of potatoes, sweet potatoes and plastic. The report also highlighted the harmful aspects of eating fake rice [3].

As we mentioned before that these fake rice's are made of plastic and looked exactly like real rice to the naked eye. These fake rice are deadly harmful to health. Doctors recommend that "Eating plastic rice does not usually cause immediate side effects. But if it is taken in small amounts over a short period of time, it can affect the endocrine system and cause hormonal changes. Eating plastic rice for a long time can also lead to liver cancer [4]." So, we have created a model using computer vision techniques to identify fake and original rice. Thus, we collected real and fake rice. Then we captured its images separately to create a dataset. Normally people cannot distinguish between original and fake rice with the naked eye. That's why we have created

a model by using computer vision algorithms. With the help of this model, we can easily identify whether a rice is original or fake.

1.2 Motivation

Nowadays we often see that rice sellers mix plastic rice with the original price for a large profit. It is too difficult to detect the original one from mixed rice. For this, we choose this topic to find out some method to detect fake rice. So that people can differ between original and fake rice. We can prevent people from buying unhygienic plastic rice and aware them about the harmful effect of plastic rice and also the characteristics of plastic rice.

1.3 Problem Definition

Rice is the main food of the people of Bangladesh. So there is a lot of demand for rice in this country. But some unscrupulous and lucrative traders often mix fake rice with real rice in the hope of making more profit. As a result, people are deceived by buying fake rice instead of real rice. These fake rice are mainly made with plastic. Fake rice are made of plastic and looked exactly like real rice to the naked eye. These fake rice are deadly harmful to health. Doctors recommend that “Eating plastic rice does not usually cause immediate side effects. But if it is taken in small amounts over a short period of time, it can affect the endocrine system and cause hormonal changes. Eating plastic rice for a long time can also lead to liver cancer [4].”

1.4 Research Questions

Here are the main questions those are focuses in this thesis are given below:

- What is the current situation of rice market of Bangladesh?
- What are the limitations to work with ML to identify fake or original rice?
- How to solve the limitations of the identification?

1.5 Research Methodology

Here we will create a dataset with collected image for both original and fake rice. Then we will preprocess the dataset for identification. After preprocessing all the data, we will apply data exploration to visualize our dataset. Then we will create a model and fit our dataset into this model.

After that, we will train all the data and validate these train data with validation dataset. Finally, we will test a particular image by using the model to identify if the rice is original or fake.

1.6 Research Objectives

There are some objectives behind our research. These are:

- Can differ between the original and fake rice.
- To create a model which can identify that a rice is original or fake.
- To prevent people from buying unhygienic plastic rice.
- Can aware people of the harmful effect of plastic rice
- To inform people about the characteristics of plastic rice.

1.7 Research Layout

Chapter 1: Discussion about introduction, motivation, Problem Definition, Research Question, Research Methodology and the expected outcome of our research.

Chapter 2: Discussion about background of this research and the related work and current status based on Bangladesh perspective.

Chapter 3: Describing the situation of rice market in Bangladesh.

Chapter 4: Discussion about the working procedure of our models.

Chapter 5: Will show the result and analysis of this research.

Chapter 6: Will describe the conclusion and future work of this research.

Chapter 7: Citation of references we used for this research.

CHAPTER 2

BACKGROUND

2.1 Introduction

There is no fake rice identification research work in Bangladesh. So, we have thought about creating a model using Computer Vision algorithms which can identify fake or original rice.

2.2 Related Works

Most of the cases CNN is used for detection and identification of an object. That's why we have used CNN algorithm to recognize our image data set.

In the paper [5] works on rice fraud a global problem. For testing authenticity of original rice DNA assays play an excellent rule here. Any tool of analytical is not able for providing an answer of authentication problem to all rice.

In the paper [6] works on fake news detection using ML and proposed a model. Here they explore many textual properties to differentiate fake contents from real.

In the paper [7] works on fake news detection using ML and proposed a model that used carefully and simple selected features to accurately identify fake posts.

In the paper [8] works on Credit Card Fraud Detection and for this they used machine learning approach. Here they worked with European credit card fraud dataset.

In the paper [9] works on fake news detection using Deep Learning approach by using the algorithm CNN and RNN. In their work they combined the both model of convolutional and recurrent neural networks for fake news classification. Their model was successfully validated on fake news.

In the paper [10] works on fake news detection using Machine Learning Algorithm. Their model was based on natural language processing and machine learning. Their model Logistic Regression gave 75% accuracy. The users who want to check the authenticity of the websites they can check it online. Their dynamic system accuracy was 93% and it's also increases with every iteration.

In the paper [11] works on Credit Card Fraud Detection and for this they used Data Science and Machine Learning approach. Their objective was to minimize the incorrect fraud classifications and to detect 100% of the fraudulent transaction. Here Outlier Factor algorithm gives 99.6% accuracy with precision of 5% while Isolation Forest algorithm gives 99.7% accuracy with precision of 33%.

In the paper [12] works on local fish recognition. For this fish recognition they used machine vision. Here they used image segmentation. Here they used three classifiers among the three classifiers the SVM gives the highest accuracy and the accuracy was 94.2%.

In the paper [13] works on leaf spot identification and for this they performed here image processing. They used K-means clustering method for the image segmentation. They used Neural Network classifier. The accuracy for the bacterial leaf, cotton leaf and tomato leaf was respectively 90%,80% and 100%.

In the paper [14] works on detecting rice diseases by using Machine Learning approach. Here they used some algorithms like as KNN, Decision Tree, Naive Bayes and Logistic Regression. Among them the decision tree gives the highest accuracy 97%.

In the paper [15] works on detecting potato leaf diseases for this they used deep learning approach. Here Logistic Regression performed better with the highest accuracy 97.8% over the test dataset.

2.3 Bangladesh Perspective

Rice is the main food of Bangladesh. So there is a lot of demand for rice in this country. Taking advantage of this high demand, some unscrupulous traders are importing plastic rice in the hope of making more profit. These plastic rice are very harmful for human body.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Using Convolutional Neural Network (CNN) with 2 different classes of images of real and fake rice this work achieved 98% accuracy.

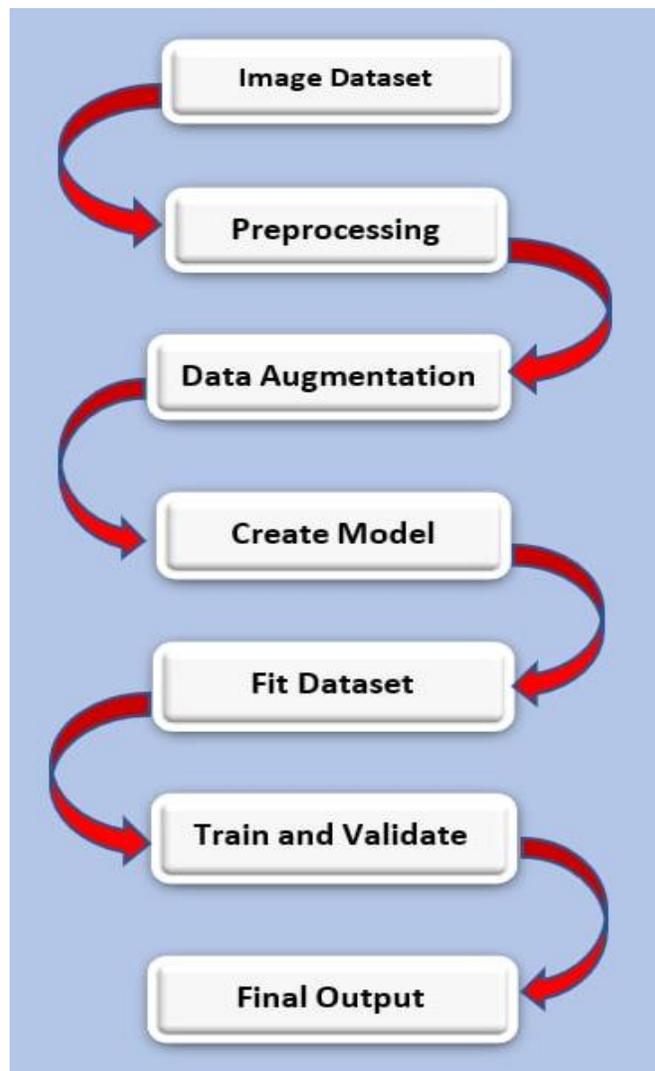


Figure 3.1.1 Steps of working procedure

In Fig 3.1.1, we have shown steps of working procedure of our research. Firstly, we will create a dataset with collected image for both original and fake rice. Then we will preprocess the dataset for identification. After preprocessing all the data, we will apply data exploration to visualize our dataset. Then we will create a model and fit our dataset into this model. After that, we will train all the data and validate these train data with validation dataset. Finally, we will test a particular image by using the model to identify if the rice is original or fake.

3.2 Experiment Data Set

To identify whether a rice is original or fake, we have collected samples of original rice and fake rice. Then we captured its image and created three separate datasets called Train, Validation and Test. We have placed images of original rice and fake rice in separate folders between Train and Validation dataset, which we will use to train and validate our model. In the test dataset we have randomly placed images of some real and fake rice, with which we will identify whether the rice is real or fake.



Figure 3.2.1 Dataset of Rice Image

3.3 Data Preprocessing

In this segment we have preprocessed our dataset to explore the data. The images we kept in Train, Test and Validation dataset are all of different sizes. That's why we have resized all the images of these datasets into 300×300 pixel for better visualization of the dataset.

3.4 Data Augmentation

As we all know data augmentation is a technique to increase the amount of data. We have increased our data by adding slightly modified copies of the existing data. To augment our dataset, we have imported ImageDataGenerator class from Keras. We have applied horizontal and vertical shift, horizontal and vertical flip, random brightness, random zoom augmentation using ImageDataGenerator to augment our dataset. Again, we have rotated the images at different angles with the help of ImageDataGenerator to expand our dataset using random rotation augmentation. After this, we have rescaled all the images pixel values from 0-255 range to 0-1 range, dividing 1 by 255 using the ImageDataGenerator class.

3.5 Architecture of the Model

To create two different models, we have used two Neural Network Algorithms to identify the images from our dataset. These two algorithms are as follows:

- i. Artificial Neural Network (ANN)
- ii. Convolutional Neural Network (CNN)

For applying Artificial Neural Network (ANN), we have imported Sequential model from TensorFlow. We have also imported Activation, Flatten and Dense layers. In the case of ANN, we don't need layers like Conv2D, MaxPooling2D layers. So, only Activation, Flatten and Dense layers will be used as feature extractor of the input images in ANN Architecture.

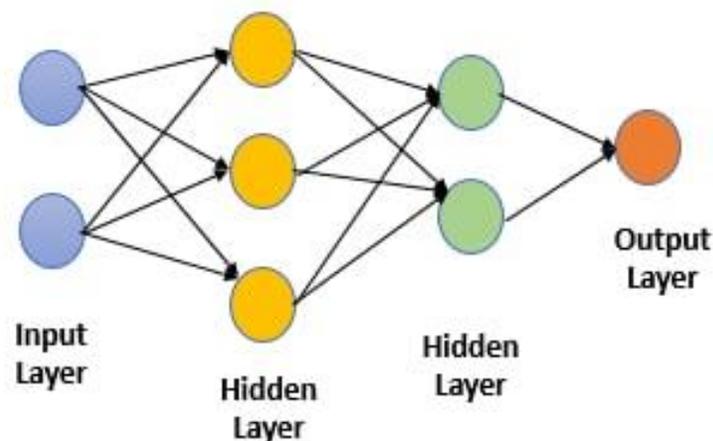


Figure 3.5.1 Basic Architecture of ANN

Firstly, we will take our rice images as input and convert it into a filter matrix using this model. As we converted our images into 300×300 pixel, so the images filter matrix will be of 300×300 dimension. Secondly, our model will select some featured filter from the image filter matrix which dimension will be 3×3. After this, we will segment the filter matrix into 3×3 dimension and multiply each matrix by the feature filter matrix. This multiplication is known as filter operation. Then it will generate a featured map for each feature represented by the images. Thirdly we will apply ‘relu’ activation to bring nonlinearity in our model. It will take our feature map and if there is any negative value then it will replace it by 0. If the value is more than 0 than it will keep it as it is. After converting all the feature map, we will flatten all the features by using Flatten layer. Finally using Dense layer, our model will produce only 1 dimensional array of ‘0’ or ‘1’ to generate the output as fake or original rice using ‘sigmoid’ activation. Let, the inputs are $x_1, x_2, x_3, \dots, x_i$ and the corresponding weights of the images are $w_1, w_2, w_3, \dots, w_i$, then the sum of the inputs and its corresponding weights will be represented by the function f which is:

$$f\left(\sum_{i=1}^n w_i x_i\right) \dots \dots (1)$$

But if we apply ANN algorithm, then we will have to calculate a huge amount of data. As we have (300×300)-dimension image, so we will need to calculated each 300×300 times to generate each feature map. Then we need to calculate 300×300 times again to convert the feature map into Flatten layer which is very difficult and also time consuming for computer. Moreover, there are more parameter used in this model, so most of the cases the data will be overfitted. So, we can use Convolutional Neural Network (CNN) instead of Artificial Neural Network (ANN) to reduce the computation.

For applying Convolutional Neural Network (CNN), we have imported Sequential model from TensorFlow. We have also imported Conv2D, MaxPooling2D, Activation, Dropout, Flatten, Dense layers which are used as feature extractor of the input images in CNN Architecture.

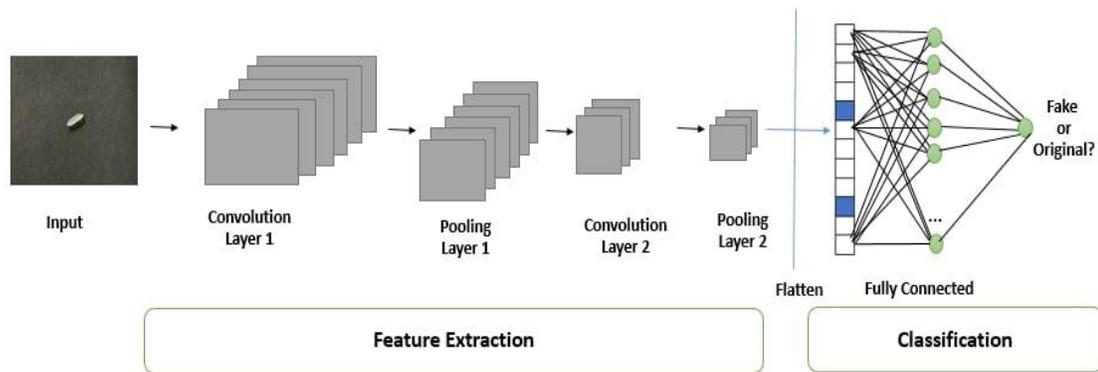


Figure 3.5.2 Basic Architecture of CNN

In this architecture, we will give the rice images as input. Then we will use Convolutional layer which will convert all the pixels into a single pixel for each image. Though the image size will be decreased but all the features of images will be same as the original input image. Then we will apply Pooling layer to reduce the dimension of our data. As there are less parameters used in Pooling layer so overfitting of data will also be reduced. In that case, we will use MaxPooling which will check the Convolutional layer by 3×3 . Then it will generate a new 3×3 filter and fill each layer by the Maximum value of Convolutional layer. After this another Convolutional layer and Pooling layer will be used to reduce the dimension and computation. Then we will flatten all the layers and connect all the layers into a fully connected Dense layer. By comparing all the filters with flatten layer, another Dense layer will produce a 1-dimensional array of '0' or '1' using 'sigmoid' activation to identify if the rice is original or fake.

CHAPTER 4

RESULT AND ANALYSIS OF THIS RESEARCH

4.1 Training and Validation of the model

In this segment, firstly we have trained our preprocessed and augmented data set. Then fitted this train and validation dataset into the ANN model. Then we have run our model with fitted train and validation dataset for 20 epochs. we have shown comparison of ‘accuracy’ graph of ANN model between train and validation dataset for each epoch. Then we have shown comparison of ‘loss’ graph of ANN model between train and validation dataset for each epoch.

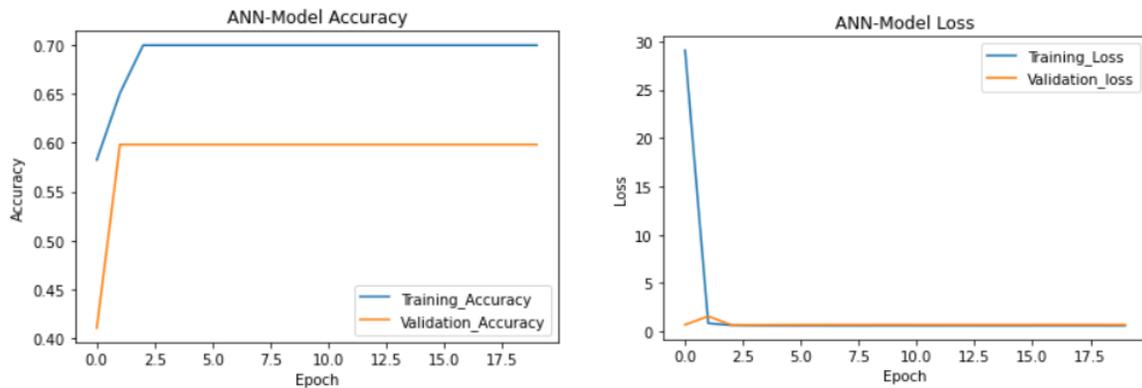


Figure 4.1.1 Accuracy and Loss of ANN

In this segment, firstly we have trained our preprocessed and augmented data set. Then fitted this train and validation dataset into the CNN model. Then we have run our model with fitted train and validation dataset for 20 epochs. we have shown comparison of ‘accuracy’ graph of CNN model between train and validation dataset for each epoch. Then we have shown comparison of ‘loss’ graph of CNN model between train and validation dataset for each epoch.

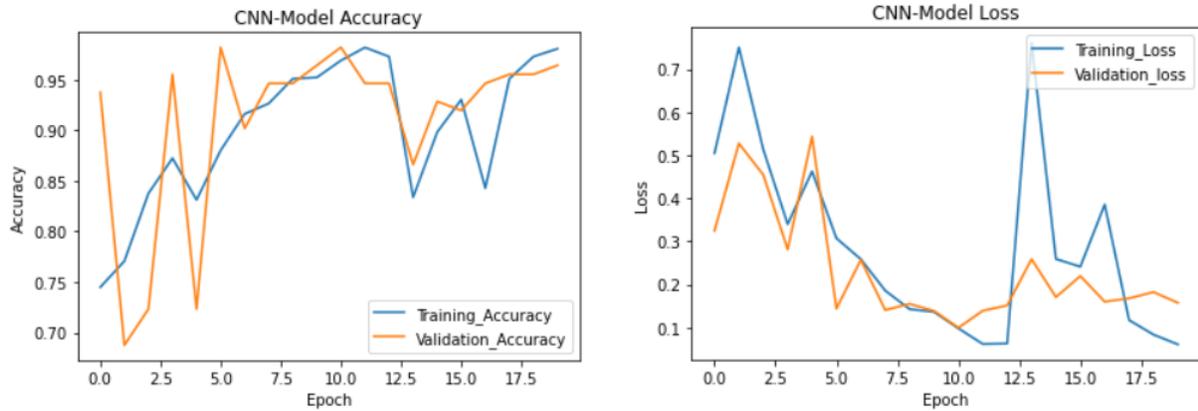


Figure 4.1.2 Accuracy and Loss of CNN

From the above accuracy and loss figures of both models we can see that, Artificial Neural Network (ANN) algorithm shows more consistency in terms of accuracy and loss than Convolutional Neural Network (CNN) algorithm. But CNN shows higher accuracy than ANN. That's why we can say that, CNN Algorithm performs better than the ANN Algorithm.

4.2 Comparison between Algorithms

By comparing the accuracy of both CNN and ANN algorithm in Table-1, we can see that the CNN algorithm shows 98% accuracy whereas ANN shows accuracy of 60%. So, CNN algorithm performs better than ANN algorithm to identify whether a selected rice is original or fake.

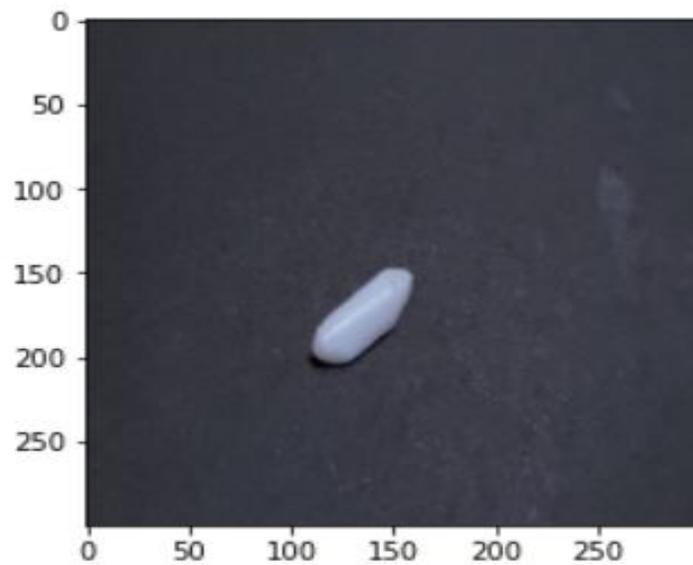
Table 4.2.1: Accuracy Algorithms used in Other Papers

Algorithm	Accuracy
Logistic Regression (Fake News)	75%
Outlier Factor (Credit Card Fraud)	99.6%
Isolation Forest (Credit Card Fraud)	99.7%
SVM (Local Fish Recognition)	94.2%
Decision Tree (Rice Leaf Disease)	97%
Logistic Regression (Potato Leaf Disease)	97.8%

Table 4.2.2: Comparison between ANN and CNN

Algorithm	Accuracy
CNN	98%
ANN	60%

4.3 Final Output



This is Fake Rice

Figure 4.3.1 Final Output of Rice Identification

Here, we have taken some random images from our test dataset and load the image into a form of array. If the value of the image returns '1' then it shows "This is Original Rice" otherwise it shows "This is Fake Rice".

CHAPTER 5

CONCLUSION AND FUTURE WORK

Our main objective was to identify the counterfeit rice in the market. So that the unscrupulous traders selling these rice cannot deceive the common buyers with fake rice. We have been able to identify whether a rice is fake or genuine using two different models using ANN and CNN. Among them, the CNN algorithm has shown more accuracy. So, we can say that using the CNN algorithm we can easily identify whether a rice is real or fake. As, we have identified real or fake rice here. In future we will classify rice varieties of Bangladesh using computer vision. In addition, in the future we will create an app for this model that will be able to detect real or fake rice instantly.

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