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Waste Classification using Deep Learning CNN

Divy Mohan Rai1, Shikha Gupta2
[1]*Student, student, Department of Information Technology, Maharaja Agrasen Institute of Technology, Delhi*[2]*Lecturer,Department of Information Technology, Maharaja Agrasen Institute of Technology, Delhi*

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ABSTRACT:The generation of waste India is becoming a great concern, and it has affected our environment and may even affect the life of people living near these dump sites. The recent study figures show that India generates nearly 26,000 MT of plastic waste on a daily basis and 94 lakh tonnes trash every year. In 2017-18, the Capital generated 6,800 tonnes of municipal waste daily, out of which 690 tonnes of trash was plastic - the highest in the country. This project focuses on building a Deep learning classifier to classify a given waste product into one of the recycling categories such as plastic, glass so that it is easier for people to recycle waste and less waste reaches the wrong place like illegal dumpsites which can lead to not only health issues but also cause a big damage to our surrounding environment. The model is based on the InceptionV3 architecture and uses the concept of transfer learning for training. The system has been tested on the dataset collected from various resources ranging from the TACO dataset to the TrashNet dataset the overall accuracy of the model was around 94.6%.

KEYWORDS: Inception,classifier,TrashNet

I. INTRODUCTION

The world bank report showed that there are almost 4 billion tons of waste around the world every year and the urban alone contributes a lot to this number, the waste is predicted to increase by 70 percent in the year 2025. According to world bank in the next 25 years, the less developed countries' waste accumulation will increase drastically. With the increase in the number of industries in the urban area, the disposal of the solid waste is really becoming a big problem, and the solid waste includes paper, wood, plastic, metal, glass etc. The main method of managing the waste is landfilling, which is inefficient and expensive and polluting natural environment. For example, the landfill site can affect the health of the people who stay around the landfill site. Another common way of managing waste is burning waste and this method can cause air pollution and some hazardous materials from the waste spread into the air which can cause cancer. Hence it is necessary to recycle the waste to protect the environment and human beings' health, and we need to separate the waste into the different components which can be recycled using different ways.

amount of non-recyclable product that they buy. To explain let's imagine a scenario where the user goes to a shopping mart to buy a product, he/she is not very aware of the symbols mentioned at the bottom of the product they use the classifier to determine the nature of the product in an easy way that helps them with their purchase.

II. MOTIVATION

The present way of separating waste/garbage is the hand-picking method, whereby someone is employed to separate out the different objects/ materials.The person, who separate waste, is prone to diseases due to the harmful substances in the garbage. With this in mind, it motivated ustodevelopanautomatedsystem which is able to sort the waste. and this system can take short time to sortthe waste, and it will be more accurate insorting thanthemanualway.Withthesysteminplace,thebenefic ialseparatedwaste can still be recycled and converted to energy and fuel for the growth of the economy.

This product will not only help the user to dispose of an already bought product, the user can use it at the time of his/her purchase to determine whether an item is recyclable or not and reduce the

III. EXPERIMENTATION

The first stage for training the model using transfer learning is to freeze the initial layers and train some of the final layers. As the original inception model was trained on the ImageNet dataset it has 1000 nodes at the output layer. As here we are working with only 20 classes, we replace the last SoftMax layer with a SoftMax unit with 20 nodes only.

The initial model achieved an overall accuracy of around 86%. The next stage was to unfreeze some

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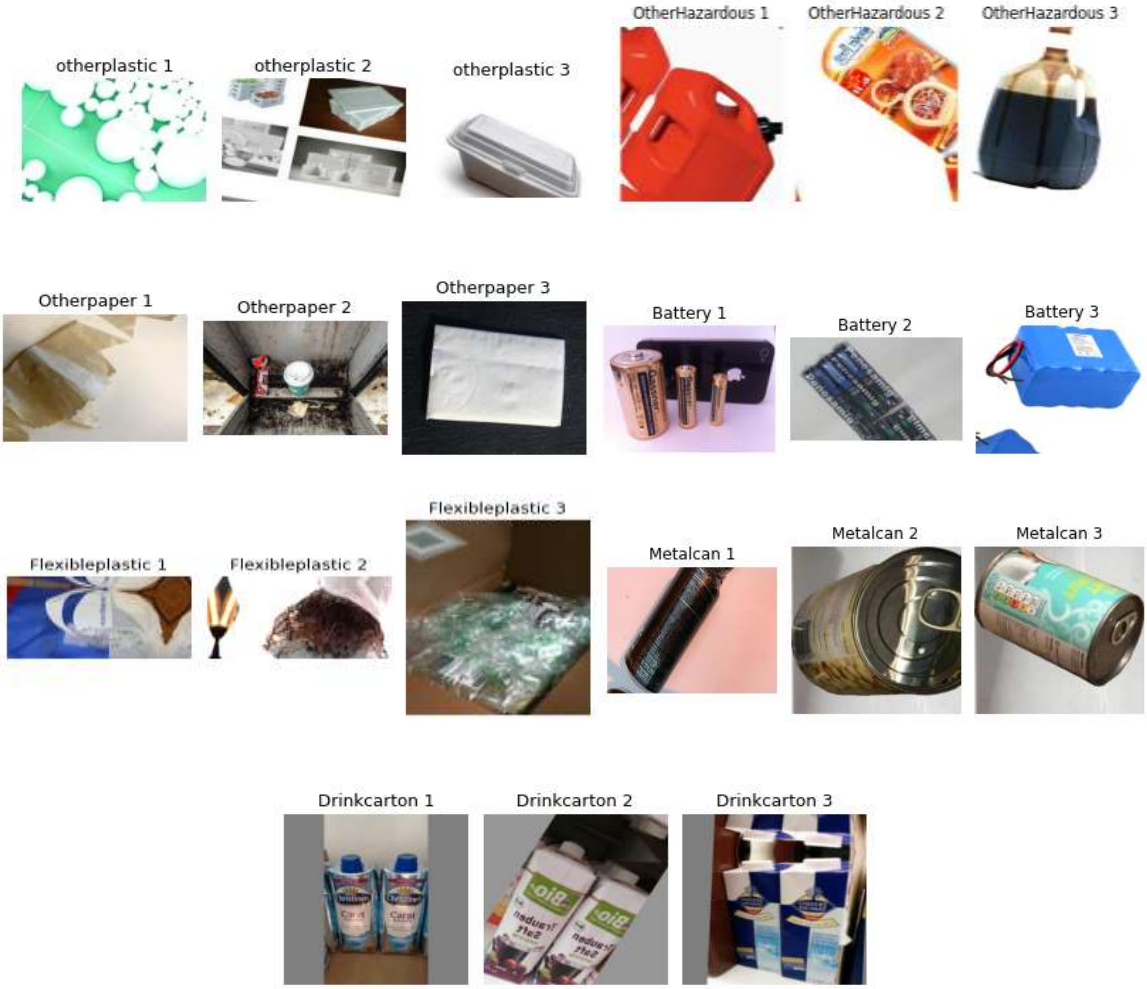
more layers and retrain the model. Following this the model's accuracy was increased to 90% but the model started to overfit.

To overcome this a dropout layer was added with a dropout probability of 0.3 which means out of every 10 nodes 3 will be dropped this helps the model to generalize rather than overfit on the training data.

The accuracy was increased to 94% and further changes and iterations to the model did not have a significant effect on the accuracy.

Some of the images from the original dataset can be seen in the figure below along with their categories:



IV. CONCLUSION

The model achieved an overall accuracy of 94.6% in training phase on the testing data. The model was trained for around3000 iterations in the test set

Here is a graph representing the overall training phase percentages:

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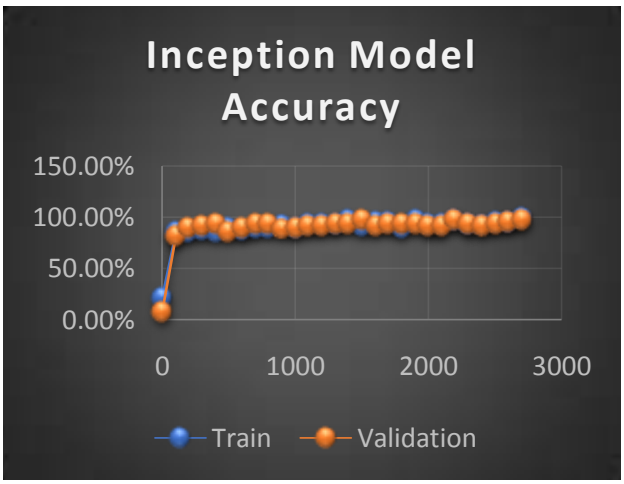

V. PREDICTIONS:

Here are some of the Sample predictions from the model:

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