Food Classification

Data Mining Sessional (CSE-454)

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Introduction

There are many potential applications for a successful food classification algorithm. However, we have dealt with a specific classification problem. Given a set of images of different types of food, we wish to find an algorithm that can show an image and correctly categorize it into one of the pre-defined categories

In the past few years, the general machine learning techniques have been replaced by new approaches based on Deep Learning, and in particular models called Convolutional Neural Networks. We are going to show how this CNN model has been used in our project.

Data and Libraries

A total of 298 images were used as training and validation dataset.

Keras library was used to develeop and evaluate the deep learning model. It is an easy to use free and open python library. Tensorflow was used for backend development.

Figure : An example of our food images dataset

Models

The CNN (Convolution Neural Network) model is used in food classification. The four steps are required to build a CNN:

1. Convolution
2. Max Pooling
3. Flattening
4. Full Connection

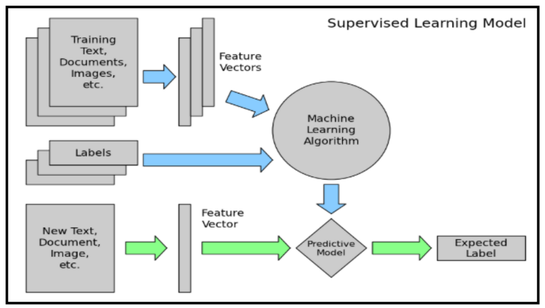


Figure : The visualized learning model

Activation Function

Activation function is needed for the neural network model. We have used Sigmoid (Restricted Linear Unit) as the last layer and ReLU (Rectified Linear Unit) which is a logistic activation.

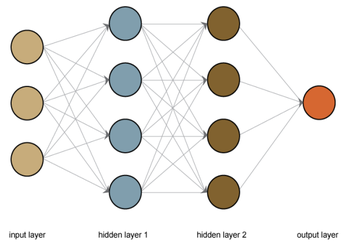
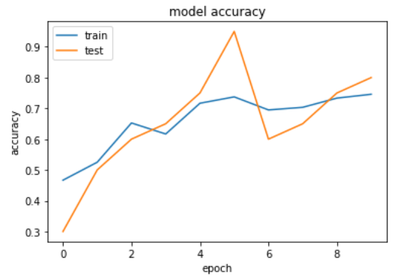


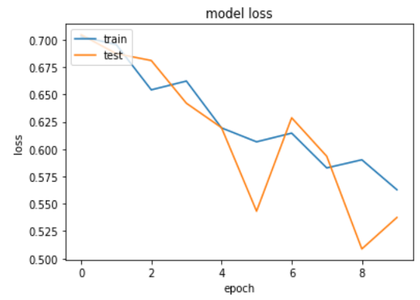
Figure : Fucntion activation

Results

- Overall highest accuracy of 74% was achieved using epoch 10
- The highest loss on a food category was 70%

The data history is summarized in the plots below:





Conclusions

Convolutional Neural Networks, or CNNs for short, are currently considered to be "state of the art" in computer vision, and have also achieved success in many other areas and applications. The initial layers of a CNN become tuned to detect very basic features, patterns and colours that are likely to exist in many different types of images. That is why it is best for use in food classification

Future Work

Here, the categories were fixed and predefined. But, there is still a lot of work that could be done to achieve even better results for classifying food pictures, including:

1. Expanding the approach to use almost all food categories
2. Fine-tuning a more recent network that has achieved better results
3. Training multiple models and aggregating the predictions
4. Expanding the methods to include object detection for identifying multiple food types in one image.

References

1https://simonb83.github.io/machine-learning-food-classification.html

2https://github.com/simonb83/food_classification

3https://towardsdatascience.com/the-4-convolutional-neural-network-models-that-can-classify-your-fashion-images-9fe7f3e5399d#:~:text=Convolutional%20Neural%20Networks%20(CNNs)%20is,used%20for%20image%20classification%20problem.&text=Instead%20of%20a%20fully%20connected,small%20patch%20of%20the%20image.

4https://medium.com/@RaghavPrabhu/understanding-of-convolutional-neural-network-cnn-deep-learning-99760835f148