Homework 3 - Rice Classification

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Introduction

For this assignment, I chose to use the Rice Classification Dataset to classify the different types of rice. With a large amount of rice varieties available globally, distinguishing between them based on their images can be difficult. The types of rice were Arborio, Basmati, Ipsala, Jasmine, and Karacadag, each having their own folder of images. The dataset included 75,000 images and the types were identified by their features. These features include shape, texture and color. In this project, the objective was to create a Convolutional Neural Network that could efficiently and accurately classify the different kinds of rice images into their proper category. This report will provide a detailed understanding of the analysis and method proccesses along with a results section and a reflection.

Analysis

The dataset I used separated images of rice grains into various folders with each representing a unique type of rice. Each folder contained 15,000 images of the rice grain. I had to load in the dataset which took a very long time and also split the folders I had into training, testing and validations sets. All the images were resized to a 250x250 pixel dimension ensuring consistency for the neural network input.

Type	Arborio	Basmati	Ipsala	Jasmine	Karacadag
count	15,000	15,000	15,000	15,000	15,000

Methods

My plan was to build this convolutional neural network from scratched without depending on pre-trained models. I first separated the data 70% into the training set, 15% into validation set, and 15% testing set. My model's architecture consisted of 5 convolutional layers, 3 max

pooling layers, dropout for regularization, and also dense layers. The convolutional layers are there to help extract the important features for classifying within the images. The max pooling layers decrease the spatial dimensions of our convolutional neural network's output. It basically captures the most crucial information within our images. I chose dropout mainly because it is computationally inexpensive compared to other regularization methods and the dataset I was working with was already a very large size. Some benefits of using dropout in my model is that it helps prevent overfitting and makes it so the model does not over rely on certain patterns or connections within the network. At the end of my model, I used the softmax activation function and had a number to represent the amount of different rice categories. I also used Adam as the optimizer algorithm for my model

Results

For image classification, having a model that produces a high accuracy and low loss is very important in order for it to function properly. The goal of this convolutional neural network was to identify the different types of rice grains based on their visual features. I created a model using 7 epochs of training and evaluated its performance through the produced accuracy scores and loss, or sparse categorical crossentropy.

The training metrics showed that the model achieved a loss of 0.0276. Having a very low value like this suggests that when the model predicts a rice grain it is very closely aligned with the training set labels. It also produced an extremely high accuracy at 99.11%. This means our model was very successful in identifying the rice grain types and has learned and utilized the patterns within our data very well.

The validation set produced a loss value of 0.0624. It is a little more than the loss value of the training set, but it is still very low. The models prediction on this set are very accurate. It also had a high accuracy of 98.48% displaying its great ability to generalize well to data it has not seen before.

The testing set reported a similar loss to the validation set with the value coming in at 0.0657. The similarity between 3 loss values we have produced shows that the convolutional neural network model has a performed consistently across various datasets. This set also had an accuracy of 98.39% which further engrains our model's capability in classifying rice grains.

Overall, the convolutional neural network model built for rice grain classification has shown outstanding performance. With the accuracy exceeding 99% on the training set and 98% on testing and validation sets, it is clear that the model has gained a thorough understanding of the training data patterns and can generalize very well and be beneficial to new data. Also the model seems to be very relaible and not have much overfitting because the metrics are very similar across the training, validation and testing sets.

Reflection

Building this rice grain classifier had some challenges but resulted in a lot of learning. It gave me more experience building convolutional neural networks and furthered my understanding of them. I was able to test out differen numbers of epochs to see how they impacted my model and its performance. Surprisingly, one of the biggest challenges of this assignment was loading in the dataset. This was one of the first time while using Python, where I dealt with a dataset that contained multiple folders of data. I had to experiment with different techniques to figure out how to properly load it in and eventually used a splitfolders function I learned online. Also, before this project the only experience I had coding convolutional neural networks was the classwork we did, so it was challenging learning about some of the aspects by myself. In the future, I think I would have started earlier on the project. This would have given me more time to account for unexpected errors and would lessen stress levels. I should also go to office hours to get help on some of the challenging parts in the assignment.