ECE:2995 Intro to AI & Machine Learning in Engr
Project 2 Report
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Team 12
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Title/Authors

Title: Utilizing Transfer Learning for Image Classification of Sports
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Introduction

In this project, our team focused on **classifying** images into the sports categories Football, Basketball, Hockey, Volleyball, and Baseball respectively. We did this by following the transfer learning tutorial (which we go into more detail later) and used a dataset posted on Kaggle.

Methods: Approach

For our project, we used a modified version of the skorch transfer learning tutorial (found here) and this pytorch example (found here). While we did not use the pytorch example, it was a good resource for seeing a more in depth look at transfer learning. Some of the things we changed in the skorch tutorial to fit our data:

- Deleted the Preparations section, as our data was already downloaded and in their respective folders
- Changed the data directory to just data instead of datasets/hymenoptera_data
- Changed the module__output_features from 2 to 5
- Added a class variable to NeuralNetClassifier that outlined the sports we were predicting
- Changed device from cuda to cpu (since we were running it locally)

Methods: Data

The dataset we used is based off of an existing dataset on Kaggle. The original dataset was a collection of sports images covering 100 different sports. Images were already formatted in a 224x224x3 jpg format and the data was pre-separated into train, test and valid directories. The original dataset had 13493 train images, 500 test images, and 500 validate images.

For our own data, we tried to collect images off of Google that were more recent than the dataset to ensure we were not repeating images. The images from the dataset were taken at least a year ago, so we attempted to grab photos that were taken in the last year. We mostly grabbed photos from professional leagues (NBA, MLB, etc.) or from Iowa College Games.

Link to the dataset is here

Methods: Training/validation

We took the Kaggle dataset and shrunk it down by picking only 5 of the 100 sports to fit our model on. This left us with the sports Baseball, Basketball, Football, Hockey, and Volleyball. One of the initial problems we ran into with shrinking the dataset was that the total number of validation were too small, where we were only had 25 images total, which is not ideal. To fix this, we moved all the test images into the validation folder, along with some of the training images. The final train/validation split for the sports are as follows:

- Basketball: 108 Training Images, 71 Validation Images
- Baseball: 105 Training Images, 79 Validation Images
- Football: 104 Training Images, 97 Validation Images
- Hockey: 108 Training Images, 74 Validation Images
- Volleyball: 108 Training Images, 44 Validation Images

After we made this split, we fit the model against the test set and ran it against the validation set using the net.fit method. After we got a baseline, we messed with some of the parameters of the NeuralNetClassifier such as max_epochs, batch_size, and learning rate (lr). Our best model produced a 95.07% accuracy on the validation set with the following parameters: Epoch: 12, lr: 0.0001, batch size: 4.

Methods: Testing

For our testing set, we took 5 images from each sport, since we thought having 10 images total did not fully represent the 5 sports we were trying to classify, overall our model correctly predicted 23/25 images which is an accuracy of 92%. Below is a breakdown of our images and what the model predicted:

baseball1.jpg
Predicted: Baseball
Actual: Baseball

baseball2.jpg
Predicted: Baseball
Actual: Baseball

baseball3.jpg
Predicted: Baseball
Actual: Baseball

baseball4.jpg
Predicted: Football
Actual: Baseball

baseball5.jpg
Predicted: Basketball
Actual: Baseball

basketball1.jpg
Predicted: Basketball
Actual: Basketball

basketball2.jpg
Predicted: Basketball
Actual: Basketball

basketball3.jpg
Predicted: Basketball
Actual: Basketball

basketball4.jpg
Predicted: Basketball
Actual: Basketball

basketball5.jpg
Predicted: Basketball
Actual: Basketball

football1.jpg
Predicted: Football
Actual: Football

football2.jpg
Predicted: Football
Actual: Football

football3.jpg
Predicted: Football
Actual: Football

football4.jpg
Predicted: Football
Actual: Football

football5.jpg
Predicted: Football
Actual: Football

hockey1.jpg
Predicted: Hockey
Actual: Hockey

hockey2.jpg
Predicted: Hockey
Actual: Hockey

hockey3.jpg
Predicted: Hockey
Actual: Hockey

hockey4.jpg
Predicted: Hockey
Actual: Hockey

hockey5.jpg
Predicted: Hockey
Actual: Hockey

volleyball1.jpg
Predicted: Volleyball
Actual: Volleyball

volleyball2.jpg
Predicted: Volleyball
Actual: Volleyball

volleyball3.jpg
Predicted: Volleyball
Actual: Volleyball

volleyball4.jpg
Predicted: Volleyball
Actual: Volleyball

volleyball5.jpg
Predicted: Volleyball
Actual: Volleyball

Discussion/conclusion

Our project demonstrated a good example of transfer learning for classifying images into five sports categories, achieving a validation accuracy of 95.07% and a testing accuracy of 92%. This project was actually easier for us than project one due to the model being pre-trained as well as us picking a more detailed dataset.

As for the experience of completing the project, we think it was laid out well and was a good way for us to get hands-on experience with going through the process of adapting an existing model to our needs. I think this project gives us the tools in the future to develop more complex solutions to ML problems by using these pre-trained models. We wouldn't really change anything about the project.

Disclosure

N/A