UNIVERSIDADE TECNOLÓGICA FEDERAL DO PARANÁ

Programa de Pós-Graduação em
Engenharia Elétrica e Informática Industrial

Deep Learning (2021/3)

Assignment: Transfer Learning

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Objective: To understand the use of the transfer learning method by using models for image classification.

Dataset: The dataset to be used in this task is the UTFPR-BOP (Birds of Prey), found here. This dataset has images of birds of prey found in several regions of Brazil. Images are classified into 6 families and 41 species. In this assignment only the family level of classification will be used. A reference paper reporting the use of this dataset can be found in this link. Download the dataset and join the images of the species together into families. It would be adviseable to reduce and standardize the size of images for saving memory during training (see the paper). Create the train and test datasets by the proportion of 70/30 within each class.

Part 1:

1. Use as base model (BM#1) your own trained CNN developed for the previous assignment. Use the best performing model you have build.
2. To use Transfer Learning, the last fully-connected layer of your model shall be excluded, while mantaining all the remaining network. Then, include a new fully-connected layer in your model with the number of output neurons suitable for the new classification problem stated below.
3. For re-training the model, all weigths of BM#1 must be frozen. Actually, only the recently included layer will be trained. This means that the the training process will use the first part of the CNN as a fixed feature extractor, and the last layer as classifier. All the training parameters shall be empirically adjusted.
4. Use the F1-score to evaluate the quality of the classification, and report it for each class (family) and the macro-averaged F1 for the whole test dataset. Plot the confusion matrix (with the number of instances classified in each locus). Repeat the training with different control parameters to achieve the best possible F1. If the performance achieved will not be satisfactory, try yo unfreeze the last layer(s) of the base model and re-train the network.

Part 2:

1. Instead of using the BM#1, now use the pretrained MobileNetV2 model (BM#2), found here. Use the same dataset, training procedure and parameters (as close as possible) as before. The objective here is to evaluate BM#2 as a feature extractor, so as to compare later with BM#1.
2. Again, use the F1-score to evaluate the quality of the classification, and the confusion matrix, as before.

Analysis: Compare the classification results of the published paper, BM#1 and BM#2, regarding the F1-score and the confusion matrices. Explain the differences in performance, and draw general conclusions regarding the models (feature extractor and classifier) and the ovrall transfer learning process.