

ECCE 635 Deep Learning Systems Design

Fall 2020

Assignment 3

Due Date: Sunday - November 1, 2020 (12:00 midnight)

Submission: You must submit two code files through Blackboard:

- The first code file titled Student_ID_Name_code_Assignment3_part1.ipynb.
- The second code file titled Student_ID_Name_code_Assignment3_part2.ipynb.

Part 1: Transfer Learning and Fine-Tuning (50 points)

Having introduced the building components of VGG16, we now introduce the architecture of Inception v3. The architecture of Inception is shown in Figure 1.

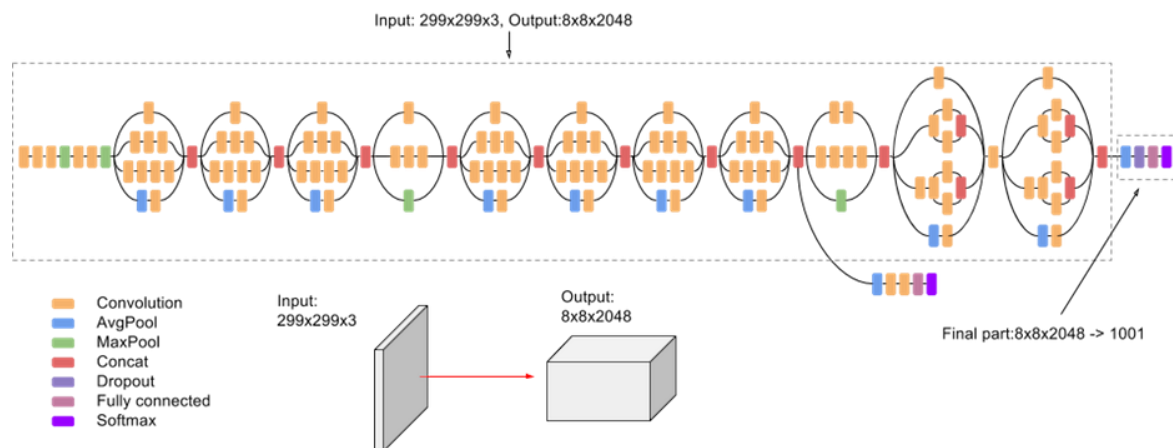


Figure 1 Inception Model

- [6 points] Explain the Inception model architecture and its architectural benefits.
- [26 points] During the class lecture, we used VGG16 Transfer learning and Fine-Tuning models to solve Cat and Dog classification problems (in the small sample); repeat the same experiment setting using the Inception model. For this analysis, you need to report the following:
 1. [10 points] Implement Transfer Learning with data augmentation using Inception v3
 2. [10 points] Implement Fine Tuning with data augmentation using Inceptions v3, named the layers you started retraining from, and the reason for choosing them.
 3. [6 points] Compare the results you get from step 1 and 2 with the class results (VGG16 models); explain your observation and state how the results relate to different models' architecture.

- [2 points] State the difference between transfer learning and fine-tuning techniques?
- [16 points] Visualizing Intermediate Activations
 1. [7 points] Compare the output of the second layer and the original image (output of the first layer) from the Inception Fine Tuning (you trained for Cat vs. Dog problem); what changes do you find?
 2. [7 points] Compare the output of the third layer and the output of the second layer from the Inception Fine Tuning (you trained for Cat vs. Dog problem); what changes do you find?
 3. [2 points] Explain your observation for step 1 and step 2.

Part 2: LSTM and GRU (50 points)

For this task, you will analyze the BBC news article datasets. Follow the following steps to download the dataset:

1. Go to the <http://mlg.ucd.ie/datasets/bbc.html>
2. Download Dataset: BBC → Download raw text files
3. Create a folder and name it: “datasets”.
4. Extract BBC news folders into “datasets” folder
5. Q2_Question_startup_code.ipynb provides you with the start-up code to read the data and divide it into training and testing set using python.

Now it is your turn:

- [7 points] Data Preprocessing.
 1. [5 points] How are you going to tokenize the text?
 2. [2 points] What do we mean by sequence padding? For your analysis, what is the maximum length of padding you used?
- [26 points] Build and train three models
 1. [8 points] Model 1: Train a model using a pertained word embedding
 2. [9 points] Model 2: Train a model using LSTM with a pertained word embedding.
 3. [9 points] Model 3: Train a model using GRU with a pertained word embedding.
- [4 points] What do we mean by word embeddings, and what are the advantages of using it?
- [3 points] List three Recurrent Neural Network-specific hyperparameters you used for training your models? What alternative values those parameters can replace with?
- [5 points] Evaluate your three models’ performance on the testing set using confusion matrix and accuracy. Note use the scikit-learn package

1. confusion matrix Example:

```
from sklearn.metrics import confusion_matrix
y_true = [2, 0, 2, 2, 0, 1]
y_pred = [0, 0, 2, 2, 0, 2]
confusion_matrix(y_true, y_pred)
```

2. Accuracy Example

```
from sklearn.metrics import accuracy_score
y_pred = [0, 2, 1, 3]
y_true = [0, 1, 2, 3]
accuracy_score(y_true, y_pred)
```

- [5 points] Compare the three models’ performance in the testing set. Explain your observation.