

Neural Network Theory and Applications

Homework Assignment #2

March, 31, 2022

Due at April, 30, 2022

1 Problem Introduction

Individual differences in EEG signals lead to the poor generalization ability of EEG-based affective models. Transfer learning, as we introduced in the class, can eliminate the subject differences and achieve appreciable improvement in recognition performance. In this assignment, you are asked to build and evaluate a cross-subject affective model using **Domain-Adversarial Neural Networks (DANN)** with the SEED dataset.

For more information about DANN model and transfer learning, please refer to:

- a) <https://cloud.bcmi.sjtu.edu.cn/sharing/jUllbbFD3>
- b) <https://cloud.bcmi.sjtu.edu.cn/sharing/wSgYFHwGv>
- c) <https://cloud.bcmi.sjtu.edu.cn/sharing/eqZC1H8sb>

2 Dataset Introduction

The data sets provided in this assignment are from the SEED dataset, which are collected from 5 subjects, and the emotion labels are 1 for positive, 0 for neutral, and -1 for negative.

The data is stored in python pickle format, to load the data into memory you can use the code (python3) below:

```
import pickle
with open('data.pkl', 'rb') as f:
    data = pickle.load(f)
```

Once you load the data into memory, you can use *data.keys()* to get the subject information (i.e. sub_0, sub_1, ..., sub_5). And you can use *data['sub_0'].keys()* to find out data arrays and labels.

- a. The data link: <https://cloud.bcmi.sjtu.edu.cn/sharing/tetRRKRfb>
- b. The code link: <https://cloud.bcmi.sjtu.edu.cn/sharing/REdK13bld>

3 Problems

(1) Emotion recognition with DANN and compare with baseline method

You are required to apply leave-one-subject-out cross validation to **classify different emotions** with DANN model and **compare the results** of DANN with a baseline model (you can choose the baseline model on your own).

Under Leave-one-subject-out cross validation configuration, for each subject, an affective model should be trained with one subject as target domain, and other subjects as source domain. In the end, there should be five DANN models for each of the subject, and you should report both the individual recognition accuracy and the mean recognition accuracy.

Here are some suggestions of parameter settings. The feature extractor has 2 layers, both with node number of 128. The label predictor and domain discriminator have 3 layers with node numbers of 64, 64, and C, respectively. C indicates the number of emotion classes to be classified.

(2) Emotion recognition using a different transfer learning model (Optional)

To have a deeper understanding of transfer learning, you can complete this **optional task** in which you are asked to solve the previous problem with a different transfer learning method. Similar to previous problem, you are also required to apply **leave-one-subject-out cross validation** to evaluate the method you used. For each subject, an affective model should be trained with one subject as the test set, and other subjects as training sets.