

Practical 1 - Brain Age Estimation

Team number: 21

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Task 1:

(a) Task 1a : Feature Identification and Calculation

We first calculated a single voxel volume and found out that it is 8. Then, we counted the voxel corresponding to each tissue volume. We used `load_segmentation` function to load the brain mask in order to calculate volume corresponding to the brain.

(b) Task 1b : Age regression and cross-validation

We used two different regression models, the first one is the basic linear regression model and the second one is the Bayesian ridge regression model. We then used cross validation to evaluate the two models, and finally get the same result as we get a mean absolute error of 8.42 for both models.

Task 2:

(a) Task 2a : Implement a Dataloader

We used the brain mask dataset to identify sections corresponding brain volume. Then we normalized by subtracting mean and dividing by standard deviation.

(b) Task 2b: Implement the model.

We implemented a model using 2 different academic papers. We used paper by Heidelberg university as our baseline architecture [1]. Later, we used the batch normalization approach by the paper from Nature journal which seems to have reached promising results. We changed the baseline architecture to better fit our input size; therefore we added an additional MaxPooling layer towards the end to have a lower linear layer input size. We also added a Dropout Layer for Regularization. We faced the problem that the network dies and always outputs the same age for each sample; therefore we added Batch Normalization after each activation function.

(c) Task 2c: Training.

lr: 0.001

betas = (0.9, 0.999)

steps: 850

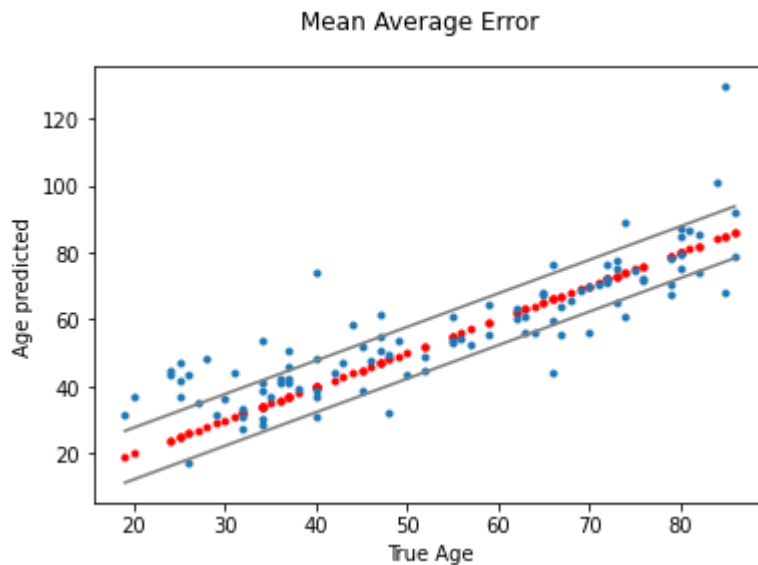
weight_decay=0.1

batch_size = 4

num_workers = 1

MAE val after all epochs:

```
Finished step 850 of 850. Train loss: 131.8287655067444 - val loss: 84.5950 - val MAE: 6.8355
```



```
Test loss: 112.5052
```

```
Test MAE: 7.7262
```

3. BONUS: What is the carbon footprint of your model?

```
Time: 0:09:18
```

```
Energy: 0.016584 kWh
```

```
CO2eq: 4.879142 g
```

```
This is equivalent to:
```

```
0.040524 km travelled by car
```

Architecture:

Source paper:

[1]

https://hci.iwr.uni-heidelberg.de/sites/default/files/publications/files/1721812507/kleesiek_16_deep.pdf

[2] <https://www.nature.com/articles/s41467-019-13163-9>