From: **Sebastian Borgeaud** spb61@cam.ac.uk
Subject: Replication of BraTS paper using ConvNets
Date: 22 March 2017 at 08:28
To: id5692@alunos.uminho.pt
Cc: Duo Wang wd263@cam.ac.uk, Mateja Jamnik mj201@cam.ac.uk

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Dear Mr. Pereira,

As part of my Bachelor thesis on brain tumour segmentations I am trying to replicate the method you published in "Brain Tumor Segmentation Using Convolutional Neural Networks in MRI Image". For my thesis I have decided to not use the Nyul normalization and instead only use the N4ITK for time and scope reasons. I then trained an identical convolutional neural network to the one published using Keras.

Unfortunately, I am only able to replicate the dice score for the Complete region in the Challenge dataset, obtaining dice scores of (0.80, 0.69, 0.50) compared to (0.8, 0.78, 0.73).

As my network architecture is the same as the one reported in your paper and the training is done identically (SGD with Nesterov momentum over 20 epochs with a linear decrease in learning rate from 3e-5 to 3e-7). I believe that the difference must come from one of:

1. Data source
2. Pre-processing
3. How the patches are extracted

1) For the training data I used the BraTS 2015 version of the 2013 data, as all scans have the same dimensions. However, for the segmentation I had to use the Challenge dataset from the 2013BraTS challenge, as I couldn't find the data in the 2015 dataset. Did you have to do the same?

2) For the pre-processing, I first winsorize the top and bottom1% of each scan and then perform the N4ITK normalisation on the T1 and T1c scans. Each scan is then linearly transformed to the range [0,1] and finally normalised to mean 0 and variance 1.

3) For the patch extraction I randomly select 90,000 patches for each class. In the paper you mention that the frequency of the different classes isn't exactly the same, with about 40% from class 0? I have tried to do that but it didn't improve the results.

I would really appreciate it if you could take a moment to verify what I am doing different/wrong.

Many thanks,

Sebastian Borgeaud

(Undergraduate student in Computer Science at the University of Cambridge)