COMP 766: Assignment 2
Available: November 9th, 2019
Due Date: November 29th, 2019

Notes: If it makes it easier, feel free to submit a paper copy of your answers (at least for Questions 1,2, 4 and 5) on the due date which is the last day of class.

This assignment refers to a lot of different papers. All of them are provided on MyCourses, together with this assignment document, for your reference.

Question 1:

In the module networks algorithm we discussed in Lecture 6, we saw that an iterative algorithm akin to Expectation Maximization is used to learn the networks. Please describe the building blocks of this algorithm, and describe which of these building blocks is learned at which step of the iterative algorithm. I would like to see a breakdown of these components as we did it in class, with the mathematical formulas and an explanation in English of what their meaning/role is.

Question 2:

We discussed in class the paper by Papyan et al., "Convolutional Neural Networks Analyzed via Convolutional Sparse Coding". Based on this paper, please write down the mathematical argument that the forward pass in a CNNs is a special case of convolutional sparse coding. I would like to see the equations that lead to this conclusion, together with the necessary explanations in English.

Question 3:

When discussing semantic image segmentation, we looked in class at the U-net by Ronneberger et al, as well as at the deconvolutional network by Noh et al. Both models can be downloaded pre-trained on the author's websites:
`https://github.com/HyeonwooNoh/DeconvNet`
`https://lmb.informatik.uni-freiburg.de/people/ronneber/u-net/`

Please download these pre-trained models and run the test images provided on MyCourses through each model. Please report the segmentation results and discuss them. What works and what doesn't? If you are asked to select the number of label classes, try with different numbers of classes.

Question 4:

Towards the end of Lecture 9, we briefly reviewed the paper by Beig et al, "Preinodular and Intranodular Radiomic Features on Lung CT Images Distinguis Adenocarcinomas from Granulomas". This paper compares a "traditional" radiomics analysis with a CNN-based analysis. Looking at the traditional radiomics part of the paper, please rate it in term of the Radiomics Quality Score that we saw back in Lecture 5 (slide 37 to 39). I have also provided you with the paper by Lambin et al that defines the quality score.

Question 5:

We also saw the paper by Lakhani et al. on classification of tuberculosis based on chest X-ray. They report extremely high accuracy values, i.e. AUC of up to 0.99. One possibility is that they have come up with an amazingly good classification model that genuinely works with 99% accuracy, which is fantastic! But unfortunately, to me this seems "too good to be true". What factors may come into play here that may be artificially inflating this accuracy value? Can you identify at least one, which in your opinion could be the main reason for an unrealistically inflated accuracy value?