Congratulations! You passed!
TO PASS 80% or higher

Keep Learning

GRADE
100%

Week 3 Quiz: Segmentation on medical images

TOTAL POINTS 9

1. Which of the following is a segmentation task? 1 / 1 point

- Determining whether a brain tumor is present in an MRI
- Determining whether there is a mass in a chest X-ray
- None of the above
- Determining which areas of the brain have tumor from an MRI

Correct
Classification tasks have binary or categorical labels for each image, while segmentation tasks ask you to determine a label for every pixel (or voxel).

2. What is the MAIN disadvantage of processing each MRI slice independently using a 2D segmentation model (as mentioned in the lecture)? 1 / 1 point

Correct
The main disadvantage is the loss of information between slices. For example, if a tumor is present in a given slice, then we would expect higher probability of having a tumor in the same area in neighboring slices.

3. The U-net consists of... 1 / 1 point

- A contracting path followed by an expanding path
- Just a contracting path
- Just an expanding path
- An expanding path followed by a contracting path

Correct
The U-net consists of a contracting path followed by an expanding path. This can be interpreted as 'squeezing the input to create a low dimensional representation and then producing a segmentation based off of those low dimensional features.

Correct
The only transformation which preserves the integrity of the data is using rotations. If we shuffle the slices, the relationships between the slices will change and the model will not be able to learn.

5. What is the soft dice loss for the example below? 1 / 1 point

$$L(P,G) = 1 - \frac{2\sum_{i=1}^{n} p_i g_i}{\sum_{i=1}^{n} p_i^2 + \sum_{i=1}^{n} g_i^2}$$

P

0.3	0.7	0.3
0.7	0.9	0.7

G

0	1	0
1	1	1

- 0.089
- 0.544

Correct
Using the formula:

$$L(P,G) = 1 - \frac{2\sum_{i=1}^{n} p_i g_i}{\sum_{i=1}^{n} p_i^2 + \sum_{i=1}^{n} g_i^2}$$

Computing the numerator, we get 2 * (3.7) = 7.4, and the denominator is 3.13 + 5.0 = 8.13. Therefore the answer is 1 - (7.4 / 8.13) = 0.089.

6. Look at the output of model 1 and model 2: 1 / 1 point

Which one will have a lower soft dice loss?

Hint: Notice the prediction scores of P1 and P2 on the pixels where the ground truth is 1. This may help you focus on certain parts of the soft dice loss formula:

$$L(P,G) = 1 - \frac{2\sum_{i=1}^{n} p_i g_i}{\sum_{i=1}^{n} p_i^2 + \sum_{i=1}^{n} g_i^2}$$

- Model 2 has a smaller loss
- None of the above
- Model 1 has a lower loss
- They will be the same

Correct
Note that the numerator will not change between the models, since the scores for model 1 and 2 are the same

$$L(P,G) = 1 - \frac{2\sum_{i=1}^{n} p_i g_i}{\sum_{i=1}^{n} p_i^2 + \sum_{i=1}^{n} g_i^2}$$

- 0
- 1
- 4
- - infinity

Correct
The minimum value is 0. To see this, set p_i = g_i. Then the numerator will be equal to the denominator and 1 minus that will be 0.

To see that it is greater than or equal to 0, note that the top will be bounded above by both $\sum_{i=1}^{n} p_i^2$ and $\sum_{i=1}^{n} g_i^2$.

Therefore, 2 times the numerator is less than or equal to the denominator, so this fraction must be at most 1.

- Performance remains unchanged
- None of the above

Correct
We would expect performance to drop on the new external dataset since the underlying population of the new patient population is different from the population the model was trained on. Additionally, there might be idiosyncrasies about the scanners for the X-rays on the new dataset that bias the model. We would not typically expect performance to remain constant or improve, just like we don't expect the model performance on the test set to be the same as on the validation set after hyper-parameter tuning.

9. Which of the following is an example of a prospective study? 1 / 1 point

- None of the above
- A model is trained on data collected between 2001 and 2010 and then validated on data collected between 2011 and 2013
- A model is trained and tested on a dataset of X-rays collected between 2001 and 2010
- A model is deployed for 1 year in an emergency room and its performance over that time is evaluated

Correct
A prospective study is the application of a model to data that is not historical.