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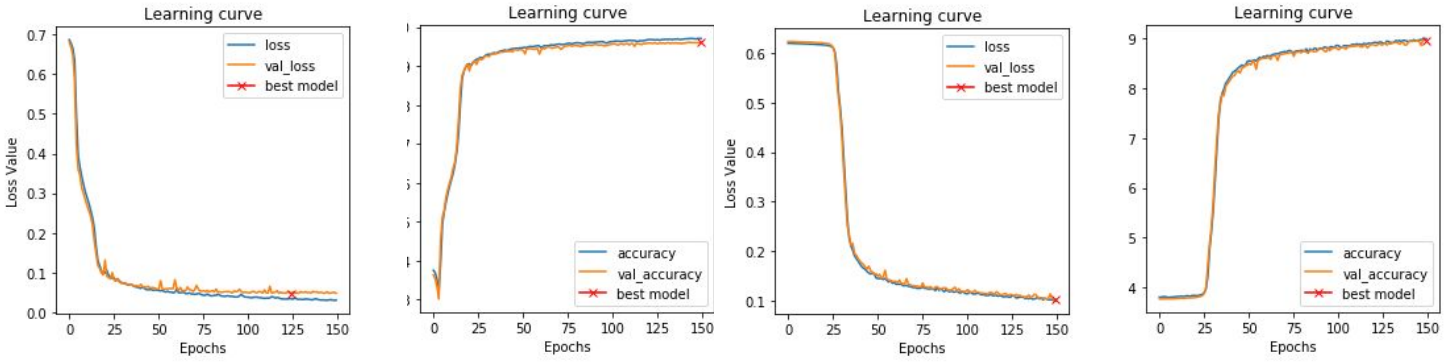
LAB4 - Report

Task 0 results are in the code repository.

Task 1a) and 1b) : Lung segmentation in chest X-ray images



(a) **(b)** **(c)** **(d)**

Fig1. Validation and accuracy curves for binary-cross entropy (a-b) and dice loss function (c-d) with 2D Unet segmentation model.

When the loss function is modified, we can observe that at until 25 epochs the loss value stays high and then drops for the dice loss function. The dice coefficient gets the same value approximately at the end with the two loss functions. However, when dealing with more challenging segmentation tasks, we think that the dice loss function could be more useful. In imbalance problems, it could be better to choose the dice loss function because of the shape of the gradient used.

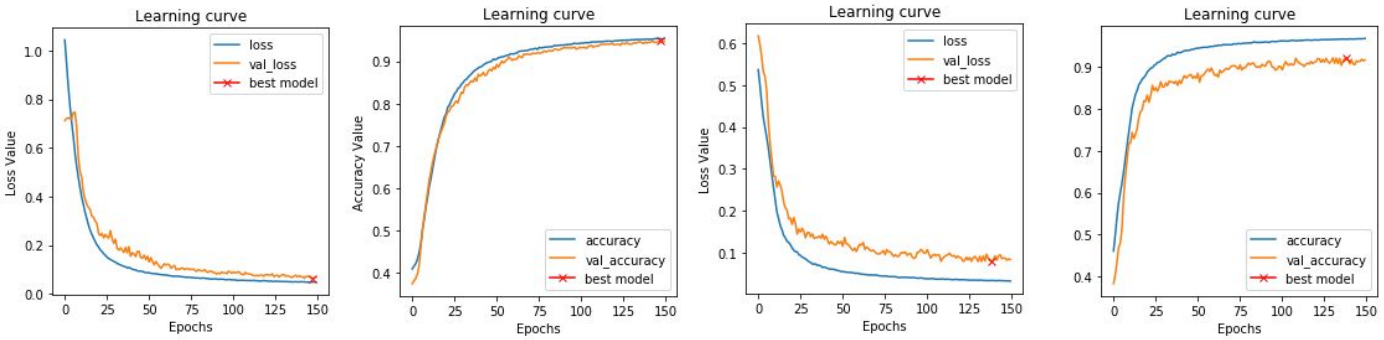
Task 1c :

Adding dropout layers does not affect model performance for bce, but adds noise to both curves. For the dice loss function, more epochs will be needed to obtain the highest accuracy. It removes the slight overfitting.

Task 1d :

By increasing the model capacity (base=32 + dropout layers), the bce curve results are approximately the same. With the dice loss function, the performance seems to be better as the loss value decreases earlier than before, and there are less “flat zones” on the curve.

Task 1e :

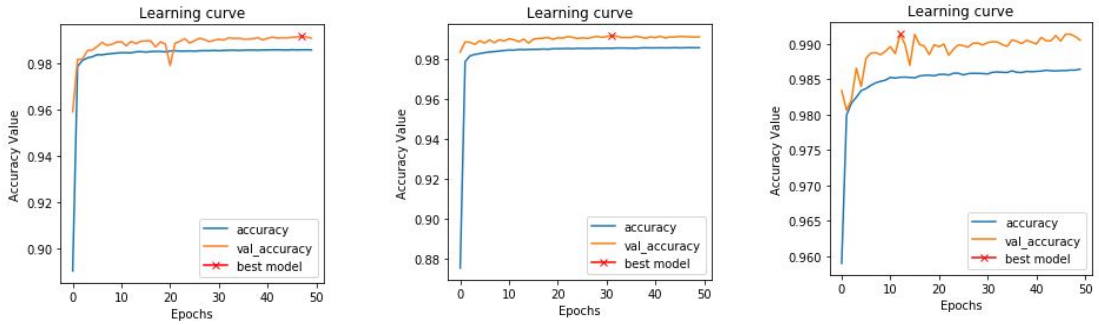


(a) **(b)** **(c)** **(d)**

Fig2. Learning and accuracy curves with BCE (a-b) and with dice-loss function (c-d). Model used = 2D Unet. Augmented images, with dropout layers

When putting new data in the model thanks to the data augmentation, we can see that for the same base (16), the curves seem to be closer in both bce and dice loss function cases. Thus, image augmentation could improve the generalization power. By getting more data into the model, it can train better and get closer to the real segmentation.

Task 2b :



(a) **(b)** **(c)**

Fig3. Learning and accuracy curves with dice coefficient loss and different metrics (a) dice coefficient, (b) precision and (c) recall.

Precision and recall metrics allow us to verify the utility of the data in the system. Among all the segmented data, when the precision is high (98% in our case), it means that the selected data for the segmentation are in the right class. Additionally, when the recall is high, it means that there are less false negatives in each class. In our case, both values are high because the data are easily classified, but in general, when one value is high, it can be at the cost of the other.

Task 3 :

Check the code, it is the same pipeline than the previous task but with categorical loss function to perform multi-class segmentation.

Problem : it takes four hours to run the code**.**