

Programming with neural networks: Exercise sheet 10

SS 2020

University of Würzburg - Chair for Computer Science VI

Prof. Dr. F. Doll, A. Hekalo, M. Krug

Exercise sheet: 10

Edited on July 16

Task 1: Classification

Consider the following network for classifying capital letters in images of size 256x256 (grayscale), whereby the conv-layers have valid padding and the activation function ReLU is. You can use several different letters appear in a picture. However, each type of letter can only be used once appear in a picture.

The numbers above the layers indicate the number of feature maps and the Filter size or the number of nodes.

- (a) Enter the pseudo-code and the output dimension of all layers for the implementation of the network.
- (b) Enter a suitable loss function (with the corresponding formula for a training example) for the training.
- (c) Which forms of regularization could be incorporated and which operational Are data augmentation useful here? Why why not?
- (d) How must the network and the loss function be adjusted so that one can only classified exactly one letter per picture?

Task 2: sequence classification

In the following, the network from exercise 1 is intended to identify the sequence of letters be expanded. For this we assume, in simplified form, that only the letters from

Page 3

A to J can occur. Sequences of 0 to 5 letters should be recognized can be.

- (a) Let the following output of the network y_t be given using the CTC greedy decoder.

k . Decode the sequence

Page 1 of 3

Programming with neural networks: Exercise sheet 10

SS 2020

University of Würzburg - Chair for Computer Science VI

Prof. Dr. F. Doll, A. Hekalo, M. Krug

y_t	0	1	2	3	4th
-	0.9	0.1	0.2	0.3	0.15
A.	0	0.8	0.1	0	0
B.	0	0	0.7	0.4	0
C.	0	0	0	0	0
D.	0	0	0	0	0.1
E.	0	0	0	0.3	0.15
F.	0	0	0	0	0.1
G	0.1	0.1	0	0	0.15
H	0	0	0	0	0.15
I.	0	0	0	0	0.2
J	0	0	0	0	0

- (b) The ground truth for the output is actually AI. Calculate the forward and backward variables α and β . Use it to calculate the total probability possibility of AI.

Task 3: Image segmentation and object recognition

- (a) How do image segmentation and object recognition differ, ie how is classified, what are the expenses etc.?
- (b) Given the well-known FCN U-Net (Figure ??) with the variation that have the conv-layer padding = same. The Up-Convolutions are supposed to be the have the same filter size as the normal Convolutions. Enter the pseudo docode (without dimensions) for this architecture. The activation function can be understood here as an attribute of the conv-layer. The output should be 10 different, exclusive classes may be possible.

Figure 1: U-Net

- (c) List the (main) approaches to classification in object recognition and name an example architecture for each.

page 2 of 3

Programming with neural networks: Exercise sheet 10

SS 2020

University of Würzburg - Chair for Computer Science VI

Prof. Dr. F. Doll, A. Hekalo, M. Krug

- (d) What types of segmentation are there? What makes them stand out?

Task 4: Medical application

Consider the following application in medicine: You want to diagnose Doctors provided support by looking at the (entire) lung volume from X-ray scans or, as a first step, determine the patient's lung area.

Describe which type of neural network you could use and which Kind of data that medical professionals would need to provide for training.

