Question 1: Deep Learning Warm-up

2

One of your friends shows up with a brand new model she has invented, but which she is not able to train. You suspect this could be due to VANISHING/EXPLODING GRADIENT, what would you look at to check THIS hypothesis?

HINT: Six and only six are correct; if you mark more, these will be counted as errors, if you mark less you are loosing points ...
(3 punti)

- [ ] The activation functions used for neurons
- [ ] The output values of neurons during training
- [ ] The distribution of the weights during training
- [ ] The initialization of the weights
- [ ] The depth of the network
- [ ] The balance of classes
- [ ] The gradient descent algorithm used
- [ ] The average gradient norm during training
- [ ] The value of the learning rate
- [ ] Whether the model contains Convolutional layers
- [ ] Whether the model contains Recurrent Layers
- [ ] The loss function used

3

In Recurrent Neural Networks (RNN), what is the Vanishing Gradient due to? How this i s fixed by Long Short-Term Memories (LSTM)? Why does this fix the problem?
(3 punti)

Inserisci la risposta

Indietro

Question 2: Convolutional Neural Networks

```
import tensorflow as tf
tfk = tf.keras
tfkl = tf.keras.layers

input_shape = (128,256,3)

input_layer = tfkl.Input(shape=input_shape, name='input')

conv1 = tfkl.Conv2D(filters = 16, kernel_size = (5,5), strides=(1,1), padding='same', acti
vation='relu', name='conv1')(input_layer)
mp1 = tfkl.MaxPooling2D(name='mp1')(conv1)

conv2 = tfkl.Conv2D(filters = 32,  kernel_size = (3,3), strides=(1,1), padding='same', acti
vation='relu', name='conv2')(mp1)
mp2 = tfkl.MaxPooling2D(name='mp2')(conv2)
dropout = tfkl.Dropout(0.3)(mp2)

conv3 = tfkl.Conv2D(filters = 128,  kernel_size = (1,1), strides=(1,1), padding='same', ac
tivation='relu', name='conv3')(dropout)
batchNorm = tfkl.BatchNormalization(name='batchNorm')(conv3) #this normalizes eac
h slice of the volume independently

convt1 = tfkl.Conv2DTranspose(filters = 32, kernel_size = (3,3), strides=(2,2), padding
='same', activation='relu', name='convt1')(batchNorm)
convt2 = tfkl.Conv2DTranspose(filters = 16, kernel_size = (3,3), strides=(2,2), padding
='same', activation='relu', name='convt2')(convt1)
output_layer = tfkl.Conv2DTranspose(filters = 3, kernel_size =(1,1), strides=(1,1), paddin
g='same', activation='sigmoid', name='output')(convt2)

model = tfk.Model(inputs=input_layer, outputs=output_layer, name='model')
# Consider now the execution of the following command
model.summary()
```

 # TO ANSWER THIS QUESTION, DOWNLOAD THE TXT FILE FROM HERE
 # https://www.dropbox.com/s/w1awzyyyhg0mkxl/2022_02_09_architecture.txt?dl=0 (https://www.dropbox.com/s/w1awzyyyhg0mkxl/2022_02_09_architecture.txt?dl=0)
#
 # THEN COPY THE TEMPLATE DIRECTLY IN THE ANSWER FIELD,
 # KEEP EVERYTHING ALIGNED WITH THE TEMPLATE
#
 # Note that sizes are expressed as (batch, width, height, channels)

 # Fill in the missing numbers in the console output below. In particular, replace
 # - [ADD SIZES] with the tuple indicating the output shape in the form [WIDTH, HEIGHT, CHANNELS]

. Remember that the first size is None because is the minibatch size used during trainin
g.

Inserisci la risposta

 # - [ADD PARAMS FORMULA] add the formula for computing the parameters (e.g. 8 x 2 x 4)
 # - [ADD PARAMS] add the resulting number of parameters (e.g. = 64).

(5 punti)

5

What is the receptive field of a pixel at the center of the output of batchNorm layer?

(1 punto)

- 6 x 8
- 9 x 9
- 10 x 10
- 4 x 4
- 8 x 8
- 12 x 12
- 5 x 5

6

Consider the network is now compiled as follows,

model.compile(optimizer=tfk.optimizers.Adam(), loss='categorical')

and that you have a large training set of images from a surveillance camera, with whate ver annotation needed.

Select all the tasks for which a neural network expert (like you are expected to be) woul d train and use this network for:
(1 punto)

- [ ] determining how many persons appears in the image
- [ ] determining the image regions covered by cars, by persons and anything else
- [ ] determining whether it is winter or summer, whether it is raining or not
- [ ] determining which pixels contain a human, a car and what is the temperature in there
- [ ] determining where cars are parked in the image
- [ ] determining where there are empty parking slots
- [ ] tracking persons, cars and buses moving in the scene
- [ ] determining the locations of: each person, each dog, each car in the scene.
- [ ] determining all the pixels covered by road, sky or others

7

Consider the Inception Net module. Which of the following statements are true?

(1 punto)

- [ ] it uses multiple convolutional filters of different sizes in parallel
- [ ] it was the first to introduce skip connections
- [ ] it has been the first module used for semantic segmentation
- [ ] it was the first learnable upsampling filter
- [ ] it leverages 1x1 convolutions to reduce the computational burden

8

What are GANs? *Briefly* describe their training process.
(2 punti)

Inserisci la risposta

Indietro

Attention models

9

What are Neural Turing Machines? How does attention work in this kind of models?

(2 punti)

Inserisci la risposta

10

What is the Transformer? How does attention work in this model?
(2 punti)

Inserisci la risposta

Indietro