Artificial Neural Networks and Deep Learning - 19/06/2020 Exam (27 Points)

During the whole exam you should have only one screen active connected to the Zoom meeting that you can access from the POLIMI portal. No external monitors or virtual screens are allowed.

You should only have a browser open and no other application besides a text editor open next to the browser to keep a safety copy of your answers. The browser should have only the exam tabs open. The exam is saved into the browser cookies so if you close it and reopen it nothing should happen, but we cannot guarantee.

Do not maximize the window of your browser.

You do not need to work on paper so keep you eyes on the browser and do not look around you. You cannot go out of sight. Your microphone should be on all the time.

You will have a fixed amount of time, after which the Form is automatically closed and there will no possibility to submit your answers any more. You will be noticed 15' in advance by the teacher not to miss the delivery time. Exams which are not submitted withing the given time will be considered as RITIRATO.

In case you do not see the IMAGES try to reload the page.

Section 1

QUESTION 1: MACHINE LEARNING / DEEP LEARNING

Consider the modern dichotomy between Machine Learning and Deep Learning and answer the following questions.

1

Which conceptual difference does make Deep Learning differ significantly from being just another paradigm of Machine Learning similarly to supervised learning, unsupervised learning, reinforcement learning, etc.?
(1 Point)

Enter your answer

2

Make an example of an application where Classical SUPERVISED learning is used and than present its Deep counterpart. -> (I want it a real, short. fully specified, application example, including the algorithms and the models ... there should not be another answer like your in the class).
(2 Points)

Enter your answer

3

Make an example of an application where Classical UNSUPERVISED learning is used and than present its Deep counterpart. -> (I want it a real, short. fully specified, application example, including the algorithms and the models ... there should not be another answer like your in the class).
(2 Points)

Enter your answer

Section 2

QUESTION 2: NEURAL NETWORKS TRAINING

Neural networks are powerful non linear approximators used to learn non linear relationships between an input vector and an output vector. The more the neurons, i.e., the more the parameters, the lower the errors they can attain. However overfitting is behind the corner ...

4

What is the relationship we learn in a neural autoencoder? Why we do it?
(1 Point)

Enter your answer

5

How could we size the embedding of a neural autoencoder?
(1 Point)

Enter your answer

6

When would you prefer weight decay with respect to early stopping? How can you tune the gamma parameter of weight decay?
(2 Points)

Enter your answer

7

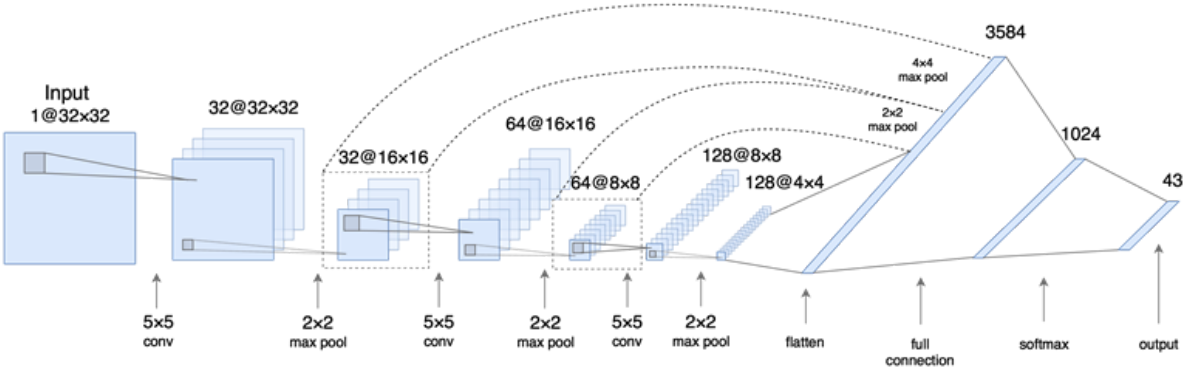
Discuss the good and the bad of sigmoid, hyperbolic tangent, and ReLu. When you should use each of them? Why? Provide their derivatives.
(3 Points)

Enter your answer

Section 3

QUESTION 3: CONVOLUTIONAL NEURAL NETWORKS

With reference to the deep neural network in the IMAGE answer the following questions.



8

Enumerate the building blocks of the networks as if you were going to implement it in Keras and for each of them tell the number of parameters providing a short description on how you compute them, e.g., 3x5x5=45 and not just 45. (Yes you can use the calculator, but we are more interested in the formula than on the numbers !)
(4 Points)

Enter your answer

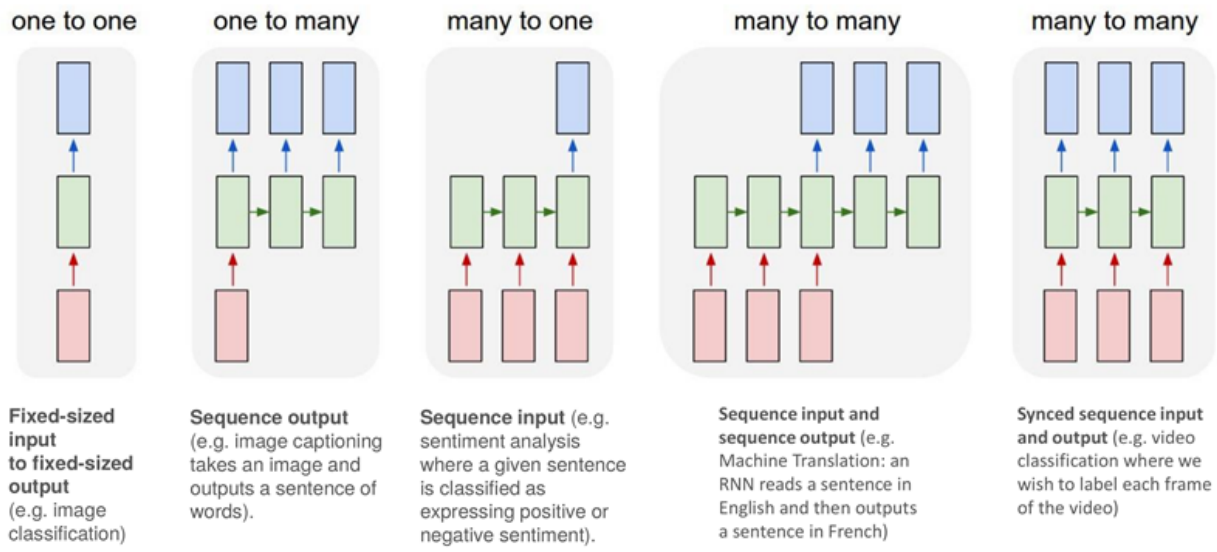
9

Describe the network in the IMAGE in terms of the characteristic elements composing it, the rationale behind the architecture, the task it might be supposed to do, the loss function you would use to train it. Justify all your statements.
(3 Points)

Enter your answer

Section 4

QUESTION 5



10

For each of the models in the IMAGE above provide its description and make an example of it.
(3 Points)

Enter your answer

11

Why do we need an attention mechanism? Aren't Long Short-Term Memories enough?
(1 Point)

Enter your answer

12

Why do we need recurrence mechanism? Isn't attention mechanism enough?
(1 Point)

Enter your answer

13

What does the sentence «You shall know a word the company it keeps» by John R. Firth (1957) mean? Why do we mentioned it in the course and which model uses it? Describe the model
(3 Points)