2. Convolutional Neural Networks

Exercises due Apr 5, 2023 08:59 -03 Past due

Introduction to Convolution Neural Networks

0:00 / 0:00 1.0x

Video
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Motivation for CNN

1/2 points (graded)
Let's suppose that we wish to classify images of 1000×1000 dimensions.

We wish to pass the above input through a feed-forward neural network with a single h
1000×1000 hidden units each of which is fully connected to the full image.

If the number of connections that exist between the first hidden layer and the input ima
enter below the value of $log_{10}(x)$, i.e. the logarithm of x to the base 10:

3

✖ **Answer:** 12

Instead of a fully-connected layer, now suppose that we use a convolutional layer with
11×11 instead. Enter below the number of parameters in the first layer (ignoring the

Second Motivation for CNN

1/1 point (graded)

Suppose a feed-forward, non-convolutional neural network is learning how to classify i
classify images even if the relevant object is in a different part of the image.

- ○ true
- ◉ false ✔

Submit You have used 2 of 2 attempts

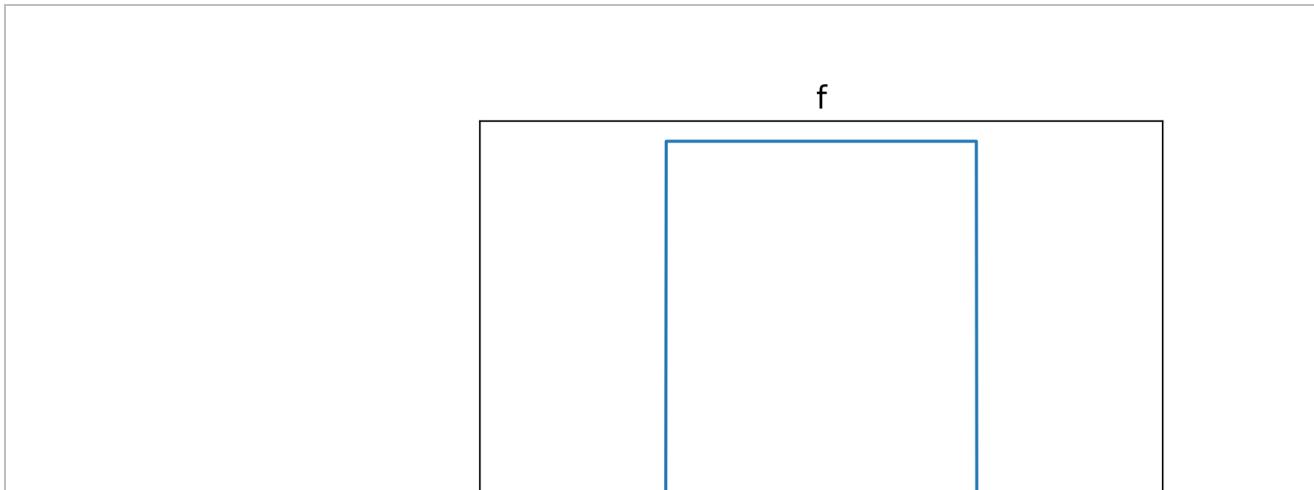
Convolution: Continuous Case

2/2 points (graded)

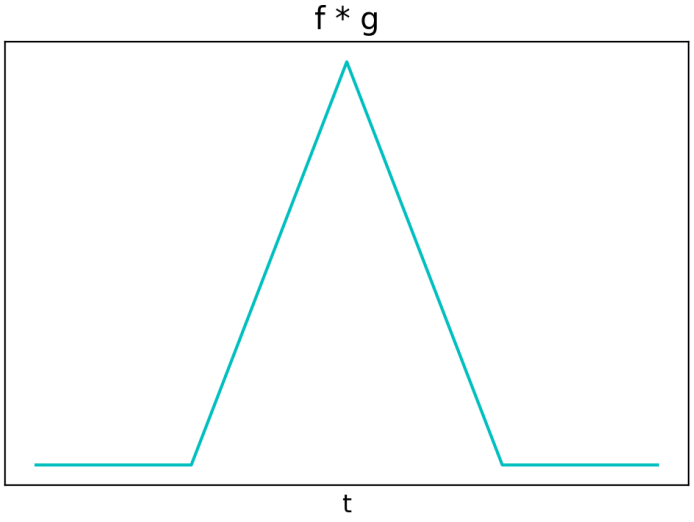
In the lecture we saw the example of using the convolution operation to create a featur
define the convolution as an operation between 2 functions and :

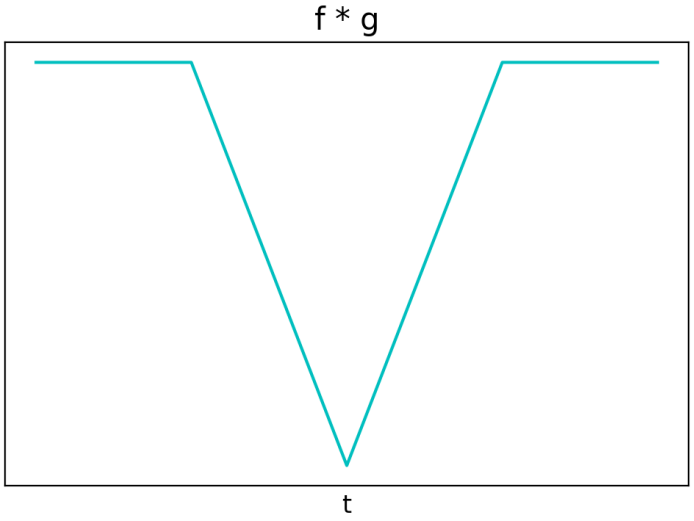
In this integral, is the dummy variable for integration and is the parameter. Intuitivel
the two function and by expressing the amount of overlap of one function as it is sh
function.

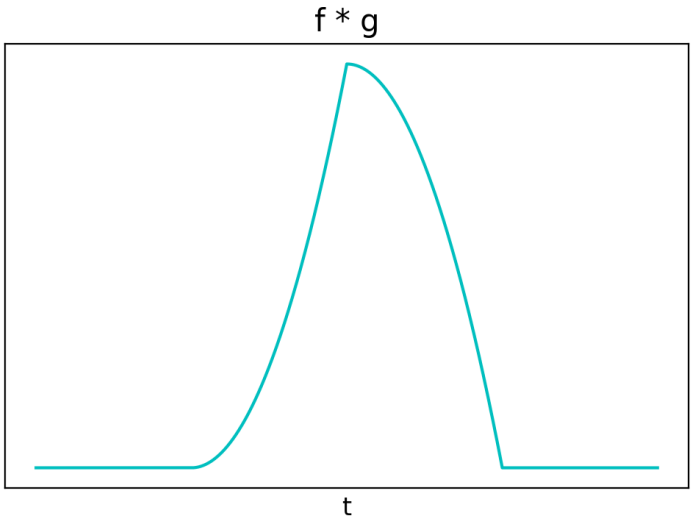
Now, suppose we are given two rectangular function and as shown in the figures be

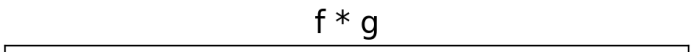


What is the shape of of ?









- The area under
- The product of the areas under and
- The sum of the areas under and

Submit You have used 2 of 3 attempts

Convolution: 1D Discrete Case

0/2 points (graded)

Similarly, for discrete functions, we can define the convolution as:

Here, we give an example of convolution on 1D discrete signal.

Let , and suppose starts from . We are computing

As and are finite signals, we just put to where and are not defined. This is usu

Now, let's compute step by step:

The other parts of are all .

Intuitively, we can get this result by first flipping g[n] and shift it over f[n] and compute each step, as shown in the figures below:

same as the input? Enter your answer as a list below (e.g. [0,0,0,0,0])

[0, 1, 3, -2, -2] ✖

Submit You have used 5 of 5 attempts

Convolution: 2D Discrete Case

1 point possible (graded)

Now, let's apply the same idea on images, which are 2D discrete signals. Suppose we h
filter as shown below. Calculate the sum of the elements in the output matrix after pa
through the convolutional filter, without zero padding.

Submit You have used 0 of 3 attempts

Pooling Practice

1/1 point (graded)

A pooling layer's purpose is to pick up on a feature regardless of where it appears in th

- (●) true
- ( ) false

✔

▶ 0:00 / 0:00

Video

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The video's message is:

the math for training updates to fancy models like CNNs or Transformers isn't fundame
math for training updates to linear models. Both are gradient descent. For each training
training loss as a function of weights. If we fix all the entries in our weights but one, the
(training loss) depending on a 1D input (value for the one entry in our weights that we c
horribly complicated function, as in the case of CNNs. But it is made of very simple par
multiplication, and relu; it is only complicated because it is a composition of very many
still a 1D to 1D function. So we can use ordinary calculus to compute that derivative. We
weight entry individually to define our gradient update. All that jazz about back propag
organized system for doing that ordinary calculus without working too hard. But there i
ingredient. If you ever get confused about what the right gradients should be, just go b
calculus and that'll tell you the right answer.

The video thus illustrates GD via two visual cartoons that could represent any of the m
discussed in class. It is a bit abstract – we don't ever write formulas, just pictures – for t
illustrating this shared thread, GD, in birdseyeview ways that you might have missed as
(important but hairy) details in the class.

We plan soon to release a sister video that does get into the weeds on how to build so
scratch. There's real code there. And we'll see further evidence there that this material
consuming, once we haveve digested the lecture concepts.

Video Note: I also goofed up with the video, so for the first couple minutes you don't se

? Why does a pooling layer pick up on features regardless of its position
As I understand from the lecture, pooling layers are meant to pick up on a feature, regardless of where it is in

☑ Is there any supplementary material we can read or watch?
I think I understand what the video is talking about and I answered the exercises below correctly. I just don't

? Few questions to clarify with regards to Convolution Discrete 1D Case Question
1) Question mention f[n] = [1,2,3] so does that mean f[0] is 1? 2) Why can we just flip g to get the calculation

1D Discrete Case - Is the correct answer incorrect? [solved]
I submitted an answer to the question but the grader claimed that the shape of the submitted vector was inc

Check out MIT's Intro to Deep Learning. (link)
Hope you find it helpful! http://introtodeeplearning.com/

? 2D Discrete Case
I am trying to put the answer as a 2×2 matrix but the grader wouldn't accept it. Isn't that the correct format:

? Patch
How do we get to the patch that we are going to apply to the image, such that the pool array can be used in

A good resource that shows how convolution of two signals work
https://www.youtube.com/watch?v=4-FS5GN_vFE&t=873s

Subtitles are out of sync
Subtitles are out of sync

Could not format HTML for problem. Contact course staff in the discussion forum for assistan
I got this message. Can you please assist?

Hint: good video to watch before starting the lecture
as for LSTM, simple and animated, will provide you with some background if you do not have any idea what C

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