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Machine Learning with Python-From Linear Models to Deep Learning

Course Progress Dates Discussion Resources

Course / Unit 3. Neural networks (2.5 weeks) / Project 3: Digit recognition (Pa

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10. Overlapping, multi-digit MNIST

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

In this problem, we are going to go beyond the basic MNIST. We will train a few neural r problem of hand-written digit recognition using a multi-digit version of MNIST.

You will be working in the files `part2-twodigit/mlp.py`, `part2-twodigit/conv.py` `twodigit/train_utils.py` in this problem

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In your project folder, look at the **part2-twodigit** subfolder. There you can find the files Your main task here is to complete the code inside the method `main` in these files.

Do the following steps:

- Look at `main` method in each file. Identify the training and test data and labels. How the train and test data? What is the size of each image?
- Look at the definition of the MLP class in **mlp.py**. Try to make sense of what those lir What is `y_train[0]` and `y_train[1]`?
- Look at `train_utils.py`, particularly the `run_epoch` function.

Now given the intuition you have built with the above steps, complete the following tas

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Fully connected network

0 points possible (ungraded)

Ungraded due to grader issues.

Complete the code **main** in **mlp.py** to build a fully-connected model with a single hidde For this, you need to make use of `Linear` layers in PyTorch; we provide you with an in `Flatten`, which maps a higher dimensional tensor into an N x d one, where N is the nu your batch and d is the length of the flattend dimension (if your tensor is N x h x w, the $d = (h \cdot w)$). Hint: Note that your model must have two outputs (corresponding to the to be compatible with the data.

Incorrect

Test results

ERROR

Submit You have used 2 of 50 attempts

Convolutional model

0.0/5.0 points (graded)

Complete the code `main` in **conv.py** to build a convolutional model. For this, you need layers and **MaxPool2d** layers (and perhaps Dropout) in PyTorch. Make sure that the las network is a fully connected (Linear) layer.

Available Functions: You have access to the `torch.nn` module as `nn`, to the `torch` and to the `Flatten` layer as `Flatten`; No need to import anything.

```
class CNN(nn.Module):

    def __init__(self, input_dimension):
        rows, cols = input_dimension
        super(CNN, self).__init__()
        flaten = 128 * ((((rows-2)//2-2)//2-2)//2) * ((((cols-2)//2-2)//2-
        self.n1 = nn.Sequential(
            nn.Conv2d(1, 32, (3,3)),
            nn.LeakyReLU(0.01),
            nn.MaxPool2d((2,2)),
            nn.Conv2d(32, 64, (3, 3)),
            nn.LeakyReLU(0.01),
            nn.MaxPool2d((2,2)),
            nn.Conv2d(64, 128, (3, 3)),
            nn.LeakyReLU(0.01),
```

Press ESC then TAB or click outside of the code editor to exit

Incorrect

Test results

validation and test set.

Please enter your **test accuracy** .

Submit You have used 0 of 5 attempts

Conclusion and What's Next

As you have seen in this project, neural networks can pretty successfully solve the MN
2012, following the impressive performance of AlexNet on the ImageNet dataset, deep
been the standard in computer vision. As datasets went growing in size and complexity
power became cheaper and more efficient, the trend has been to build deeper and big

The last part of the project has given you a hint as to why neural networks can be very
changing the output layer, you were able to train the network to predict overlapping MN
building blocks can be reused to build more complex architecture and solve more diffic
deep learning framework like Pytorch makes this process even more accessible.

If you have access to a GPU, you can try implementing an object classification system
have not covered in this course, and maybe expanding it to an object detection or an in
system.

If you do not have access to a GPU, you can try renting resources from an online provic
(<1$/hour) or Google Colab (free).

Below is an optional recitation in draft form, newly created by TA Sam Tenka, to demon
train, and use a binary image classifier from scratch. In the videos, he will build multiple
mulitple architectures.

These videos are optional and aim to supplement the lectures, homeworks and projects
segmented yet but released while project 3 is still fresh in your mind. We hope you will
nonetheless.

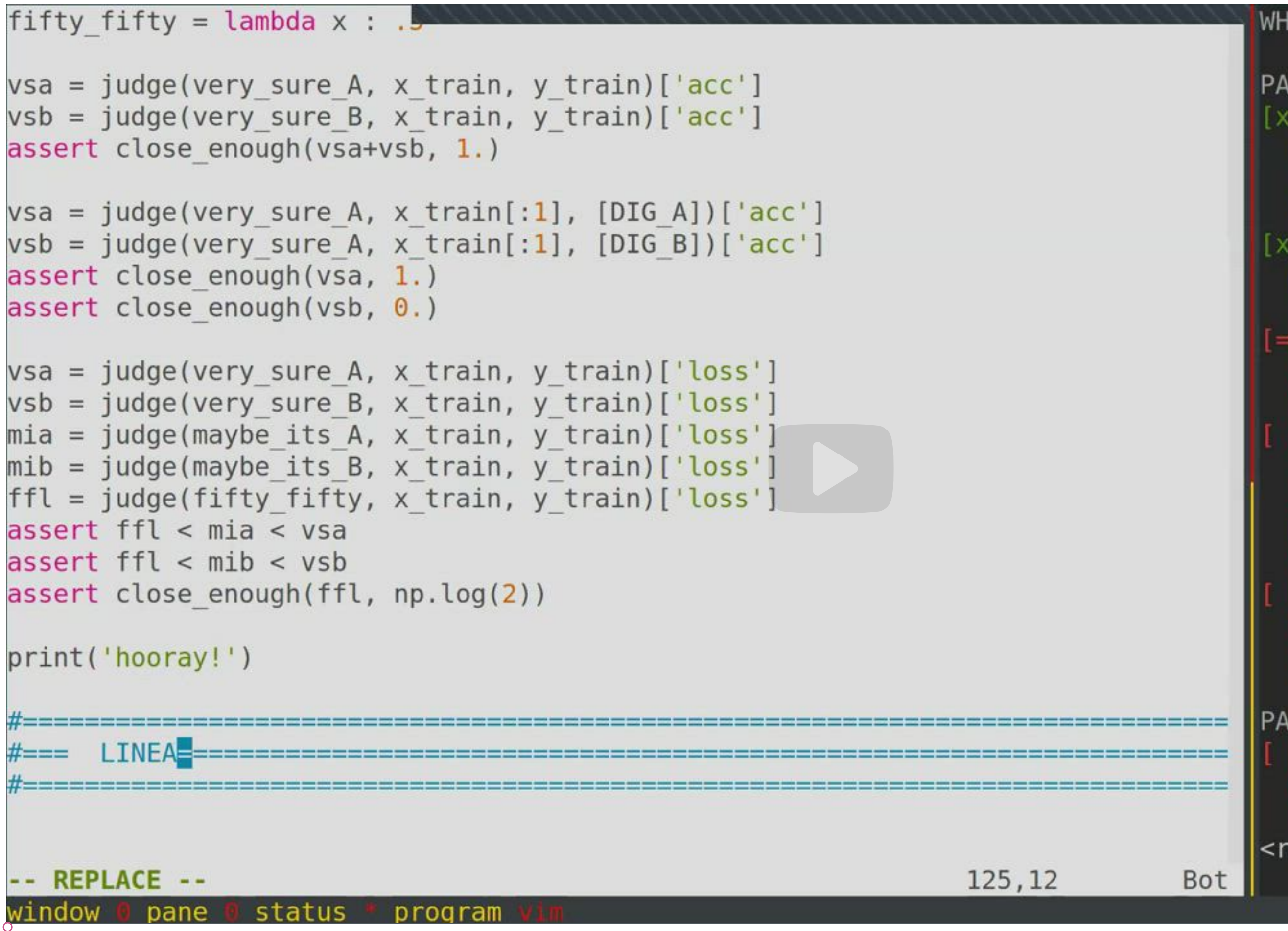
Introduction and Setup (Helper Functions)

▶ 0:00 / 0:00

Video

Download video file

Linear Models



```
fifty_fifty = lambda x : .5

vsa = judge(very_sure_A, x_train, y_train)['acc']
vsb = judge(very_sure_B, x_train, y_train)['acc']
assert close_enough(vsa+vsb, 1.)

vsa = judge(very_sure_A, x_train[:1], [DIG_A])['acc']
vsb = judge(very_sure_A, x_train[:1], [DIG_B])['acc']
assert close_enough(vsa, 1.)
assert close_enough(vsb, 0.)

vsa = judge(very_sure_A, x_train, y_train)['loss']
vsb = judge(very_sure_B, x_train, y_train)['loss']
mia = judge(maybe_its_A, x_train, y_train)['loss']
mib = judge(maybe_its_B, x_train, y_train)['loss']
ffl = judge(fifty_fifty, x_train, y_train)['loss']
assert ffl < mia < vsa
assert ffl < mib < vsb
assert close_enough(ffl, np.log(2))

print('hooray!')

#==========================================================================
#===  LINEA===============================================================
#==========================================================================

-- REPLACE --                                          125,12          Bot
window 0 pane 0 status * program vim
```

▶ 0:00 / 0:00

Video

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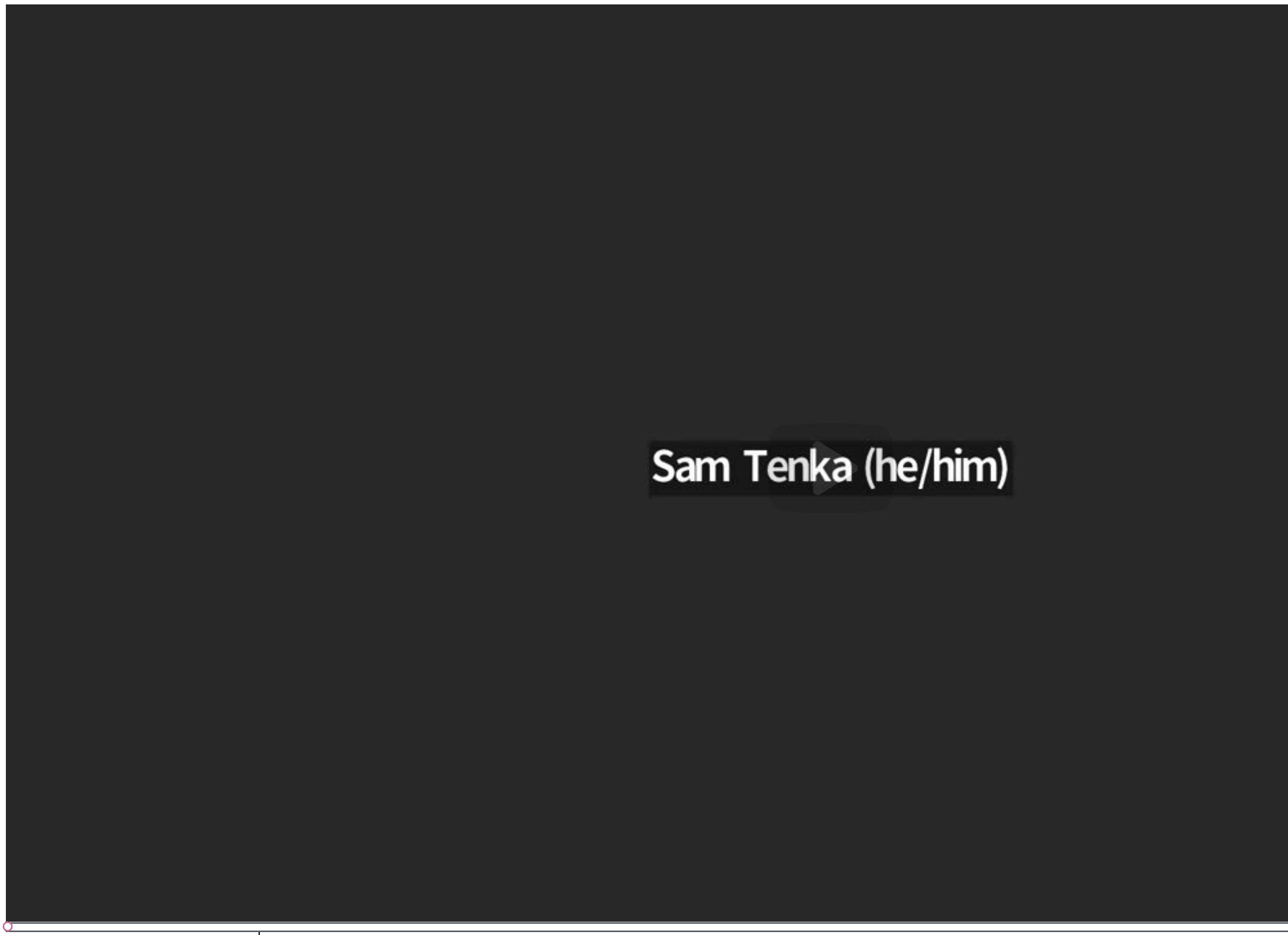
Vanilla Models

Making a CNN



0:00 / 0:00

Video

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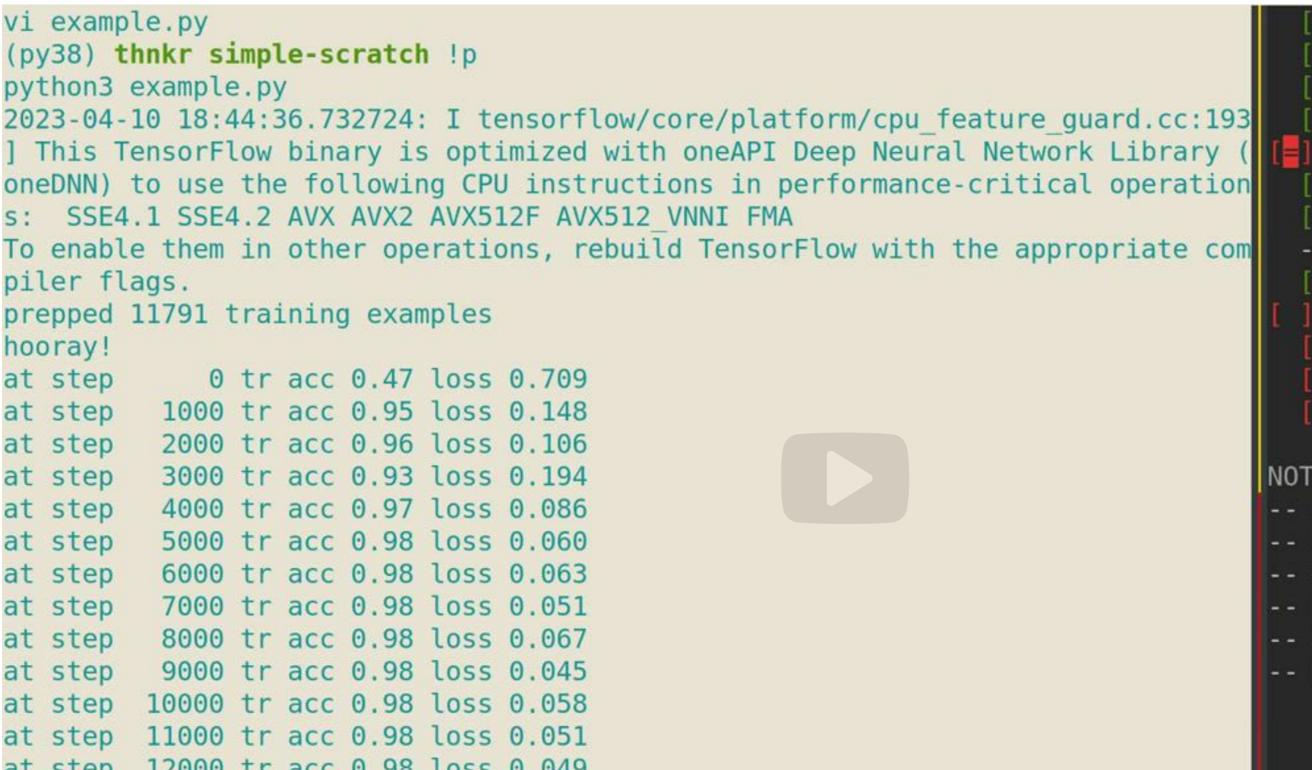
Conclusion



```
vi example.py
(py38) thnkr simple-scratch !p
python3 example.py
2023-04-10 18:44:36.732724: I tensorflow/core/platform/cpu_feature_guard.cc:193
] This TensorFlow binary is optimized with oneAPI Deep Neural Network Library (
oneDNN) to use the following CPU instructions in performance-critical operation
s:  SSE4.1 SSE4.2 AVX AVX2 AVX512F AVX512_VNNI FMA
To enable them in other operations, rebuild TensorFlow with the appropriate com
piler flags.
prepped 11791 training examples
hooray!
at step     0 tr acc 0.47 loss 0.709
at step  1000 tr acc 0.95 loss 0.148
at step  2000 tr acc 0.96 loss 0.106
at step  3000 tr acc 0.93 loss 0.194
at step  4000 tr acc 0.97 loss 0.086
at step  5000 tr acc 0.98 loss 0.060
at step  6000 tr acc 0.98 loss 0.063
at step  7000 tr acc 0.98 loss 0.051
at step  8000 tr acc 0.98 loss 0.067
at step  9000 tr acc 0.98 loss 0.045
at step 10000 tr acc 0.98 loss 0.058
at step 11000 tr acc 0.98 loss 0.051
at step 12000 tr acc 0.98 loss 0.049
```

Previous Next

"There was a problem running the staff solution (Staff debug: L364)"

Just a quick note to inform you the issue in the grader has been solved for the Fully connected network / ML

Pinned Community TA

Real life projects

How could we learn to build projects like this from scratch (I mean, from getting the data to computing accur

? [STAFF] Conceptual question regarding the application of CNN in multi-digit MINIST

When using CNN with pooling layers we obtain a kind of "translation invariance" effect for detecting a digit. I

? Correct code for exercises

Is there any way we can see an example of code that would be considered correct for the above problems?

Facing an issue in Fully connected network problem.

There was a problem running the staff solution (Staff debug: L364) This error keeps reoccurring no matter w

error

There was a problem running the staff solution (Staff debug: L364)

convolution model, getting type error, why?

Test: has correct layers Testing has correct layers Your output: TypeError: __init__() takes 1 positional argume

[STAFF] Do we need to know PyTorch for the exams in this course and/or for the Capstone E

Hi! I believe there's no breaking of the Honor Code to ask whether we need to know PyTorch for the exams i

RunTime Error: Resource Temporarily Unavailable

What does this error mean? RuntimeError: Resource temporarily unavailable I am getting this for the first que

? argmax(): argument 'input' (position 1) must be Tensor, not tuple

Hi All. I've read through all of the hints and suggestions in this forum multiple times but I'm still totally stuck. I

No idea what to do!

The steps are useless to me! How does knowing the number of picture help? Image size helps since it's one

? Hyperparameter tuning

Does the better than 98% accuracy (validation and test) have to be achieved on both digits or just one?

? CNN Issue with Optimizer

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