

Лабораторная работа №2. Введение в  
проектирование нейронных сетей с помощью Python  
По предмету "Киберфизические системы и  
технологии"

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```
[1]: import numpy as np
import matplotlib.pyplot as plt
import os
import random
import scipy
import torch
import cv2

torch.cuda.synchronize()
torch.cuda.empty_cache()

cuda = torch.device('cuda')
print(torch.cuda.get_device_properties(cuda))
```

```
_CudaDeviceProperties(name='NVIDIA GeForce RTX 3080 Laptop GPU', major=8,
minor=6, total_memory=8191MB, multi_processor_count=48)
```

```
[33]: mnist_train = np.genfromtxt(f"dataset/mnist_train.csv", delimiter=',',
    dtype=np.uint8)
mnist_test = np.genfromtxt(f"dataset/mnist_test.csv", delimiter=',',
    dtype=np.uint8)
```

```
[41]: print(mnist_train.shape)
print(mnist_test.shape)

images_train = np.float64(np.reshape(mnist_train[:, 1:], (mnist_train.
    shape[0], 28, 28))) / 255
numbers_train = np.zeros((mnist_train.shape[0], 1))
images_test = np.float64(np.reshape(mnist_test[:, 1:], (mnist_test.
    shape[0], 28, 28))) / 255
numbers_test = np.zeros((mnist_test.shape[0], 1))

print(images_train.shape)
print(numbers_train.shape)
print(images_test.shape)
print(numbers_test.shape)

number = 4000
plt.imshow(images_train[number, :, :], cmap=plt.cm.binary, vmin=0, vmax=1)
```

```
(60000, 785)
```

```
(10000, 785)
```

(60000, 28, 28)

(60000, 1)

(10000, 28, 28)

(10000, 1)

```
[ [0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      ]
 [0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      ]
 [0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      ]
 [0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      ]
 [0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.      0.      0.14117647 0.57254902 0.99607843 1.
   0.98431373 0.37254902 0.02352941 0.      0.      0.
   0.      0.      0.      0.      ]
 [0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.
   0.01176471 0.38039216 0.91764706 0.99607843 0.99607843 0.90980392
   0.99607843 0.99607843 0.1372549 0.      0.      0.
   0.      0.      0.      0.      ]
 [0.      0.      0.      0.      0.      0.
   0.      0.      0.      0.      0.      0.34901961
   0.54901961 0.99607843 0.99607843 0.68235294 0.2627451 0.12941176
   0.78431373 0.99607843 0.74509804 0.      0.      0.
   0.      0.      0.      0.      ]
 [0.      0.      0.      0.      0.      0.]
```

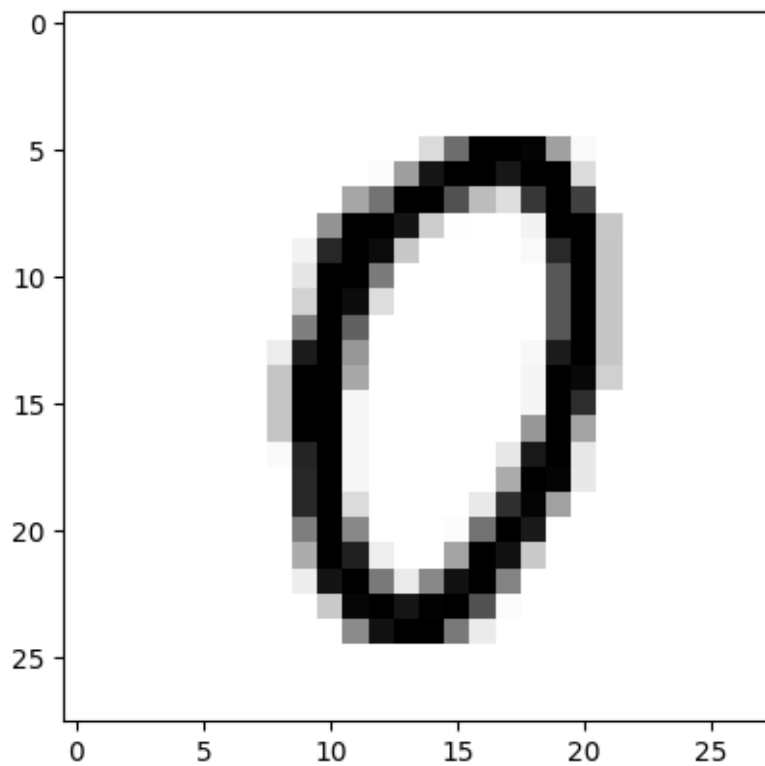
0.	0.	0.	0.	0.42352941	0.99215686
0.99607843	0.92156863	0.2	0.00392157	0.	0.
0.04705882	0.99607843	0.99215686	0.21960784	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.04705882	0.84705882	0.99607843
0.95686275	0.21568627	0.	0.	0.	0.
0.02352941	0.83529412	0.99607843	0.22352941	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.09803922	0.99607843	0.99607843
0.51764706	0.	0.	0.	0.	0.
0.	0.65882353	0.99607843	0.22352941	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.17647059	0.99607843	0.95294118
0.13333333	0.	0.	0.	0.	0.
0.	0.65882353	0.99607843	0.22352941	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.50196078	0.99607843	0.61568627
0.	0.	0.	0.	0.	0.
0.	0.65882353	0.99607843	0.22352941	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.
0.	0.	0.0745098	0.89411765	0.99607843	0.41176471
0.	0.	0.	0.	0.	0.
0.02745098	0.89411765	0.99607843	0.22352941	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.
0.	0.	0.22745098	0.99607843	0.99607843	0.34117647
0.	0.	0.	0.	0.	0.
0.03921569	0.99607843	0.96470588	0.18431373	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.
0.	0.	0.22745098	0.99607843	0.99607843	0.03529412
0.	0.	0.	0.	0.	0.
0.03921569	0.99607843	0.82352941	0.	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.
0.	0.	0.22745098	0.99607843	0.99607843	0.03529412
0.	0.	0.	0.	0.	0.
0.41176471	0.99607843	0.35686275	0.	0.	0.
0.	0.	0.	0.]		
[0.	0.	0.	0.	0.	0.

0.	0.	0.01960784	0.85882353	0.99607843	0.03529412
0.	0.	0.	0.	0.	0.09411765
0.90196078	0.99607843	0.09411765	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.84705882	0.99607843	0.03529412
0.	0.	0.	0.	0.	0.32941176
0.99607843	0.98431373	0.09019608	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.84705882	0.99607843	0.14117647
0.	0.	0.	0.	0.08627451	0.81568627
0.98431373	0.36862745	0.	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.50588235	0.99607843	0.47058824
0.	0.	0.	0.01176471	0.54901961	0.99607843
0.89803922	0.	0.	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.3254902	0.99607843	0.87058824
0.06666667	0.	0.	0.35686275	0.99607843	0.9254902
0.20784314	0.	0.	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.07058824	0.92156863	0.99607843
0.5254902	0.08235294	0.46666667	0.92941176	0.99607843	0.48627451
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.20784314	0.97647059
0.99607843	0.91764706	0.98823529	0.99607843	0.6745098	0.01176471
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.45490196
0.92941176	0.99607843	0.99607843	0.52156863	0.07843137	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	]	
[0.	0.	0.	0.	0.	0.

```

0.      0.      0.      0.      0.      0.
0.      0.      0.      0.      0.      0.
0.      0.      0.      0.      0.      0.
0.      0.      0.      0.      ]
[0.      0.      0.      0.      0.      0.
0.      0.      0.      0.      0.      0.
0.      0.      0.      0.      0.      0.
0.      0.      0.      0.      0.      0.
0.      0.      0.      0.      ]]
```

[41]: <matplotlib.image.AxesImage at 0x1bf1efa4190>



[27]:

[ ]: mnist\_train[:, 0]