zad1_wip

April 19, 2020

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
import mkl

np.random.seed(1234)
mkl.set_num_threads(4)

%matplotlib inline
%config InlineBackend.figure_format = 'retina'
plt.rcParams["figure.figsize"] = [16, 9]
```

0.1 Funkcje pomocnicze

In [2]:
```
# Add a column of ones at the end of a matrix
def append_ones(matrix, axis=1):
    # matrix.shape[0] -> number of rows
    # axis=1 -> horizontally
    ones = np.ones((matrix.shape[0], 1), dtype=matrix.dtype)
    return np.concatenate((matrix, ones), axis=axis)
```

In [3]:
```
%%timeit #the code will be run multiple times

a = np.zeros((100))
b = np.zeros((100))

c = np.empty((100))

for i in range(100):
    c[i] = a[i]+b[i]
```

```
46.8 ţs ś 3.1 ţs per loop (mean ś std. dev. of 7 runs, 10000 loops each)
```

In [4]:
```
%%timeit

a = np.zeros((100))
b = np.zeros((100))
```

```
        c = np.empty((100))
        c = a+b

5.17 ţs ś 246 ns per loop (mean ś std. dev. of 7 runs, 100000 loops each)
```

0.2 Propagacja sygnau, funkcja aktywacji i "kafelki"

```
In [5]: # Propagacja sygnay przez warstw w pelni poczon
        def feed_forward(W, dataset, activation_fun):
            #A@B lub np.dot lub np.matmul -> to jest mnozenie macierzy
            # biases
            return activation_fun(dataset @ W)

In [6]: # Sigmoidalna funkcja aktywacji
        def sigmoid(matrix):
            return 1.0 / (1.0 + np.exp(-matrix))

In [7]: def tiles(examples):
            rows_count = examples.shape[0]
            cols_count = examples.shape[1]
            tile_height = examples.shape[2]
            tile_width = examples.shape[3]

            space_between_tiles = 2
            img_matrix = np.empty(shape=(rows_count * (tile_height + space_between_tiles) - spac
                                         cols_count * (tile_width + space_between_tiles) - space
                                  dtype=np.float32)
            img_matrix.fill(np.nan)

            for r in range(rows_count):
                for c in range(cols_count):
                    x_0 = r * (tile_height + space_between_tiles)
                    y_0 = c * (tile_width + space_between_tiles)
                    img_matrix[x_0:x_0 + tile_height, y_0:y_0 + tile_width] = examples[r, c]

            return img_matrix
```

0.3 Histogram aktywacji i filtry w pierwszej warstwie sieci

```
In [8]: class Rbm:
            def __init__(self, visible_size, hidden_size, learning_rate):
                self.visible_size = visible_size
                self.hidden_size = hidden_size
                self.learning_rate = learning_rate
                self.W = np.random.normal(scale=0.01, size=(visible_size+1, hidden_size+1)).asty
                self.W[:, -1] = 0.0
                self.W[-1, :] = 0.0
```

In [9]:
```
import mnist
import pickle
import seaborn as sns

with open("./lab1_rbm.pickle.dat", "rb") as f:
    rbm = pickle.load(f)

DATASET_SIZE = 512
DIGIT_SIZE = 28
mnist_dataset = mnist.test_images().astype(np.float32)
np.random.shuffle(mnist_dataset)
mnist_dataset = np.reshape(mnist_dataset[:DATASET_SIZE] / 255.0, newshape=(DATASET_SIZE,

mnist_dataset = append_ones(mnist_dataset)
```

In [10]:
```
rbm.W.shape
```

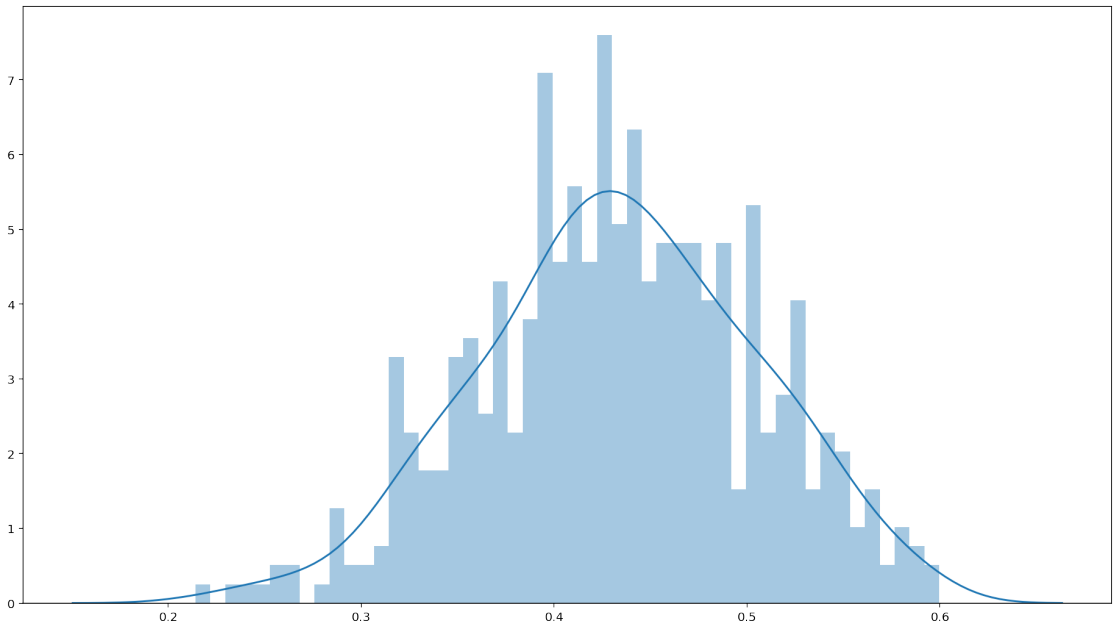
Out[10]:
```
(785, 513)
```

In [11]:
```
mnist_dataset.shape
```

Out[11]:
```
(512, 785)
```

In [12]:
```
# Histogram wartoci aktywacji neuronów
activations = feed_forward(rbm.W, mnist_dataset, sigmoid)
mean_activations = np.mean(activations, 1)
sns.distplot(mean_activations, bins=50)
```

Out[12]:
```
<matplotlib.axes._subplots.AxesSubplot at 0x7fafd4fc1940>
```



In [13]:
```
# Filtry w pierwszej warstwie sieci
filters = np.reshape(np.transpose(rbm.W)[:-1, :-1], newshape=(16, -1, 28, 28))
filters = np.clip(filters, -1.0, 1.0)

img = tiles(filters)
plt.matshow(img, cmap='gray', interpolation='none')
plt.axis('off')
plt.show()
```