pytorch_cl_vae_MNIST_exmaple

September 20, 2018

```
In [1]: from sklearn.datasets import fetch_mldata
        from sklearn import preprocessing
        from scipy.stats import norm
        import numpy as np
        import numpy.random as random
        from src.pytorch_cl_vae.model import ClVaeModel
        import matplotlib.pyplot as plt
        import torch
        %matplotlib inline
```

0.1 1 - Load the model

```
In [2]: fname = '../data/models/cl_vae_mnist_09_20_2018_03_55_PM.pt'
        model = ClVaeModel.load_from_ckpt(fname)
```

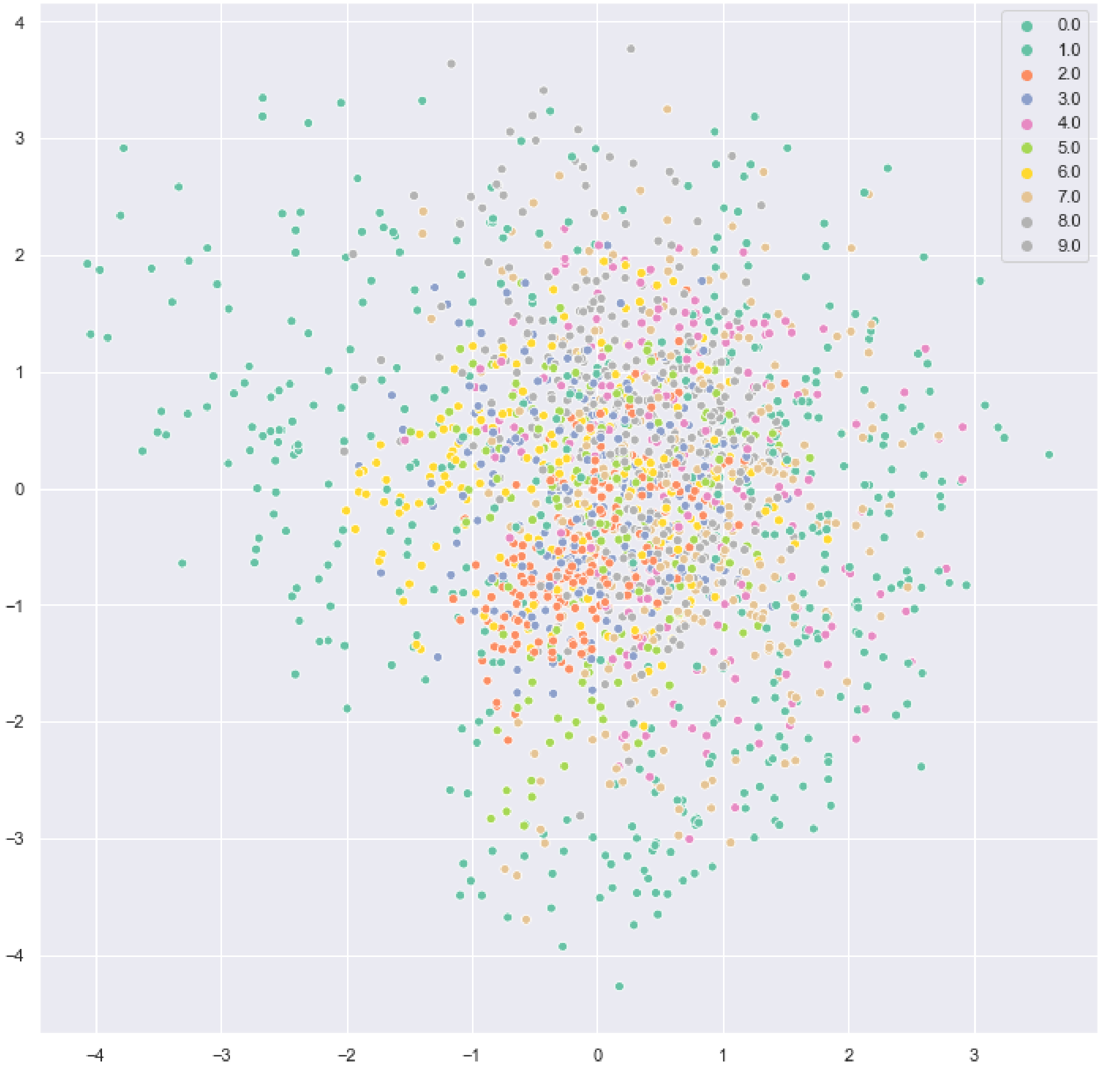
0.2 2 - Load MNIST

```
In [3]: datadir = '../data'
        mnist = fetch_mldata('MNIST original', data_home=datadir)
        mnist.data = mnist.data / 255
        num_samples, input_dim = mnist.data.shape
        num_classes = len(np.unique(mnist.target))
        lb = preprocessing.LabelBinarizer()
        lb.fit(mnist.target)
        print('MNIST db has been successfully loaded, stored in the: "{}"'.format(datadir + '/
```

```
MNIST db has been successfully loaded, stored in the: "../data/mldata"
```

```
In [4]: num_examples = 2000
        idxs = random.randint(0, num_samples-1, num_examples)
        x = mnist.data[idxs]
        y = mnist.target[idxs]
        y_probs = lb.transform(y)
        x_batch = torch.from_numpy(x).float()
        ws_batch = [torch.from_numpy(y_probs).float()]

        z, _, _ = model.encode(x_batch, ws_batch)
```

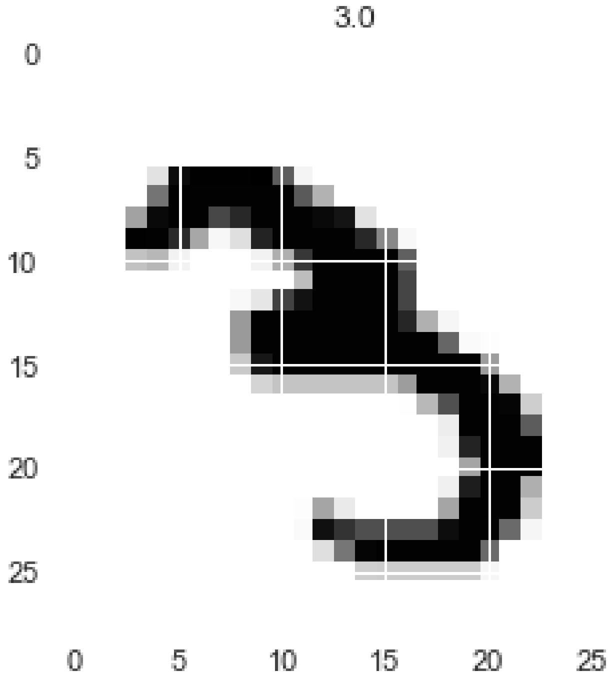
```
import src.pytorch_cl_vae.utils as utils
plt.figure(figsize=(12,12))
utils.plot_latent(z.detach().numpy(), y)
```

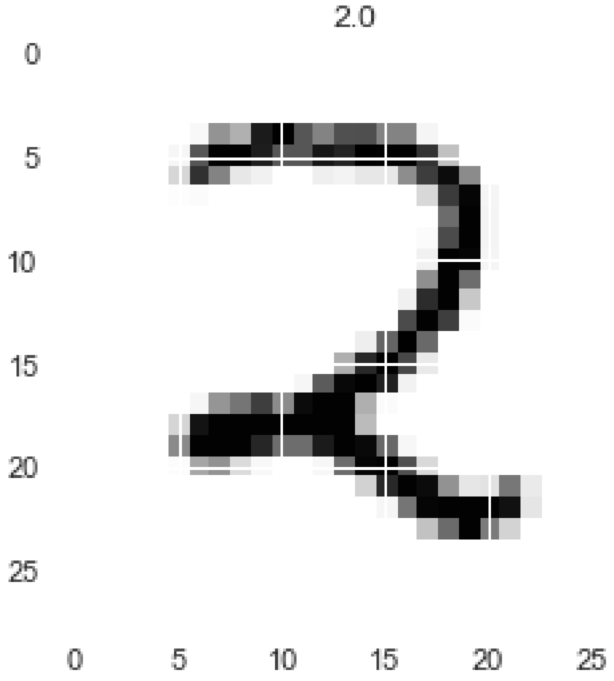


0.3 3 - Get some examples to work with

```
In [5]: num_examples = 2
        idxs = random.randint(0, num_samples-1, num_examples)
        x = mnist.data[idxs]
        y = mnist.target[idxs]
        y_probs = lb.transform(y)
        for i in range(x.shape[0]):
            plt.figure()
```

```
    img = x[i].reshape([int(np.sqrt(x.shape[-1]))]*2)
    plt.title(y[i])
    plt.imshow(img, cmap='Greys')

plt.show()
```

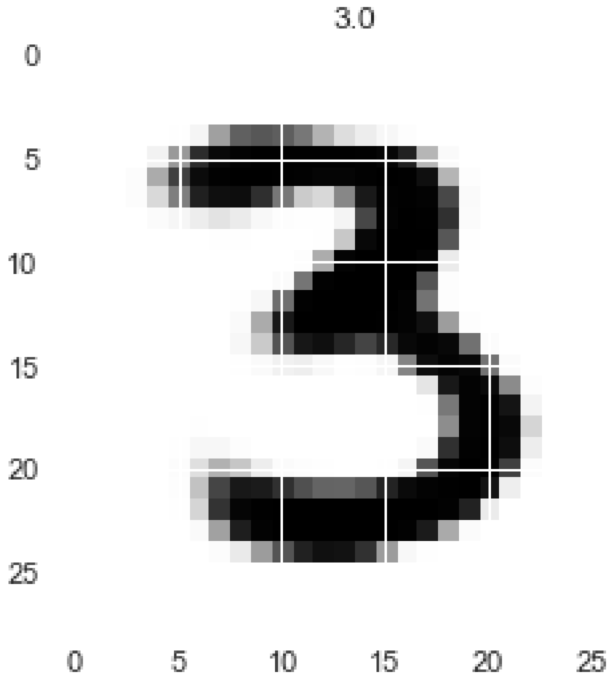




0.4 4 - Reconstruction check

```
In [6]: # Encode
        x_batch = torch.from_numpy(x).float()
        ws_batch = [torch.from_numpy(y_probs).float()]

        z, z_mean, z_log_var = model.encode(x_batch, ws_batch)
        print("{}\n{}\n{}".format(z, z_mean, z_log_var.exp().sqrt()))
        x_decoded = model.decode(z, ws_batch)

        x_decoded = x_decoded.detach().numpy()

        for i in range(x_decoded.shape[0]):
            plt.figure()
            img = x_decoded[i].reshape([int(np.sqrt(x_decoded.shape[-1]))]*2)
            plt.title(y[i])
            plt.imshow(img, cmap='Greys')

        plt.show()
```

```
tensor([[-0.5023,  1.7967],
        [ 0.2045,  0.0372]])
tensor([[-0.5787,  1.8468],
        [ 0.3023,  0.0588]])
tensor([[0.0682, 0.1523],
        [0.0909, 0.1054]])
```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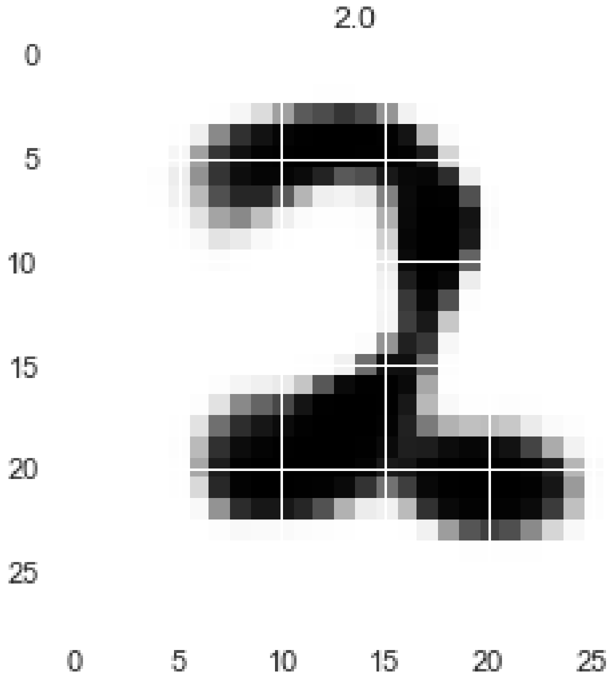
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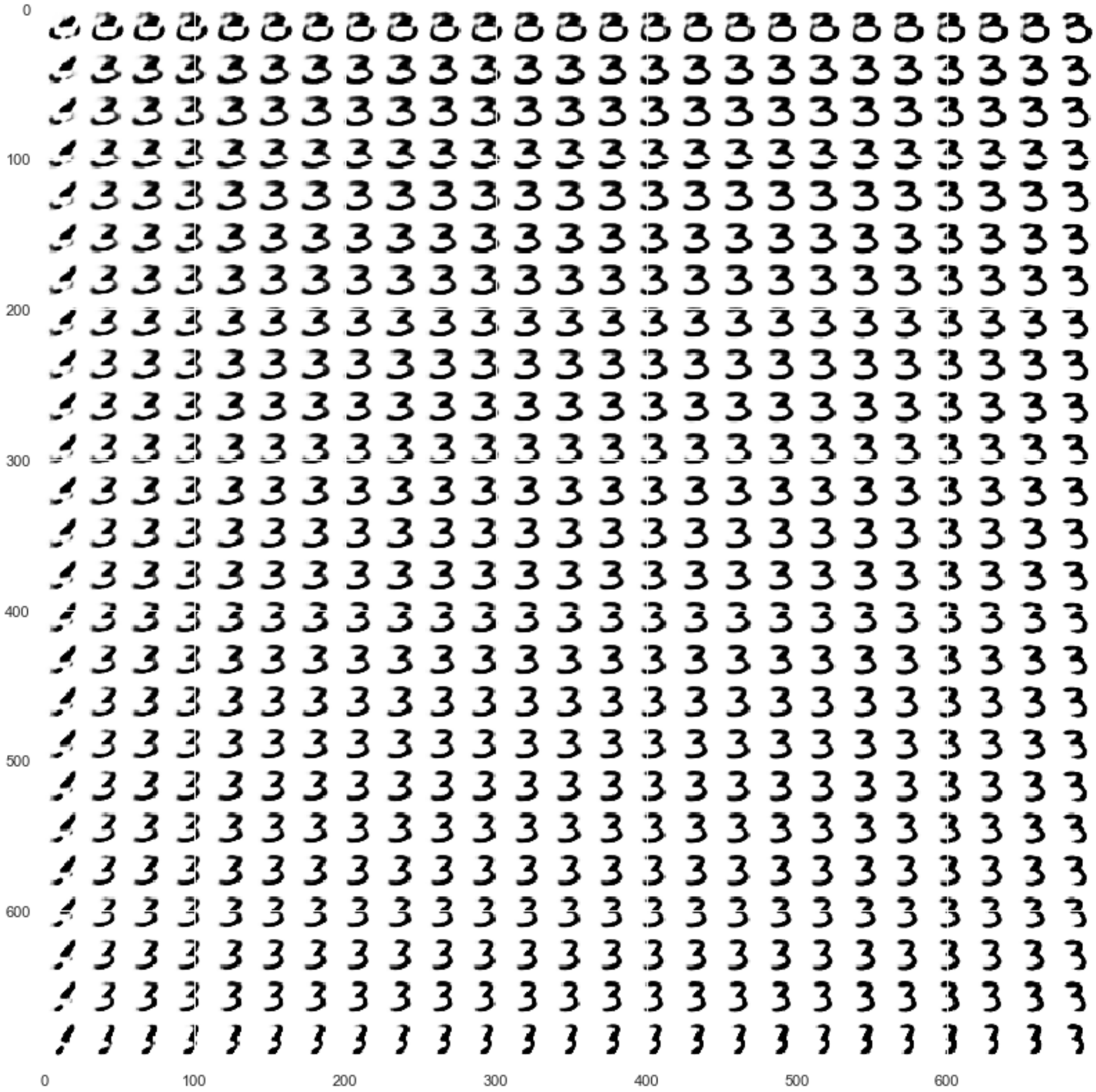
0.5 5 - Generate with fixed ws

```
In [7]: n = 25
        w_fixed = ws_batch[0].detach().numpy()
        print(w_fixed.shape)
        w_fixed = np.tile(y_probs[0][:], (n**2, 1))

        print(w_fixed.shape)
        z_random = random.normal(size=(z[0].shape))
        z1 = norm.ppf(np.linspace(0.00001, 0.99999, n))
        zx, zy = np.meshgrid(z1, z1)
        z_random = np.stack((zx, zy), axis=-1).reshape((-1, 2))
        print(z_random.shape)

        z_random = torch.from_numpy(z_random).float()
        w_fixed = [torch.from_numpy(w_fixed).float()]

        x_decoded = model.decode(z_random, w_fixed)

        x_decoded = x_decoded.detach().numpy()

        final_img = np.zeros((n*int(np.sqrt(x_decoded.shape[-1])), n*int(np.sqrt(x_decoded.sha

        img_size = int(np.sqrt(x_decoded.shape[-1]))
        plt.figure(figsize=(14,14))
        for i in range(x_decoded.shape[0]):
        #
            img = x_decoded[i].reshape([int(np.sqrt(x_decoded.shape[-1]))]*2)
            final_img[(i % n) * img_size : (i % n + 1) * img_size, (i // n) * img_size : (i //
        #     plt.title(w_fixed[0][i].max(0)[1].detach().numpy())
        plt.imshow(final_img, cmap='Greys')

        plt.show()
```

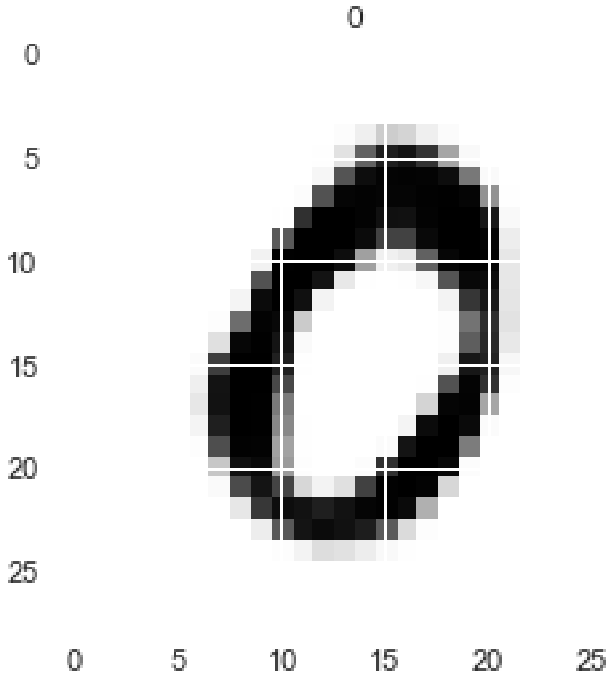
```
(2, 10)
(625, 10)
(625, 2)
```

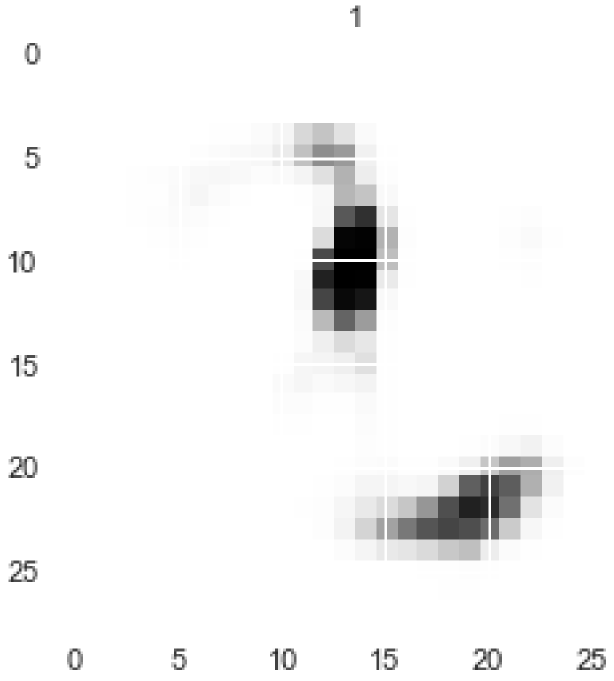


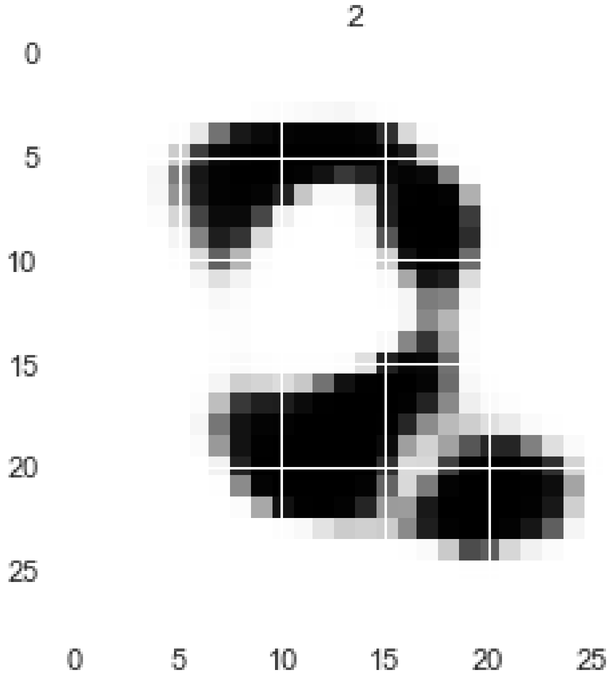
0.6 6 - Generate with fixed z

```
In [8]: ws_random = np.identity(ws_batch[0].shape[-1])
        z_fixed = np.tile(z[0], (ws_random.shape[0], 1))

        ws_random = [torch.from_numpy(ws_random).float()]
        z_fixed = torch.from_numpy(z_fixed).float()
        x_decoded = model.decode(z_fixed, ws_random)
        x_decoded = x_decoded.detach().numpy()

        for i in range(x_decoded.shape[0]):
            plt.figure()
            img = x_decoded[i].reshape([int(np.sqrt(x_decoded.shape[-1]))]*2)
```

```
    plt.title(i)
    plt.imshow(img, cmap='Greys')

plt.show()
```



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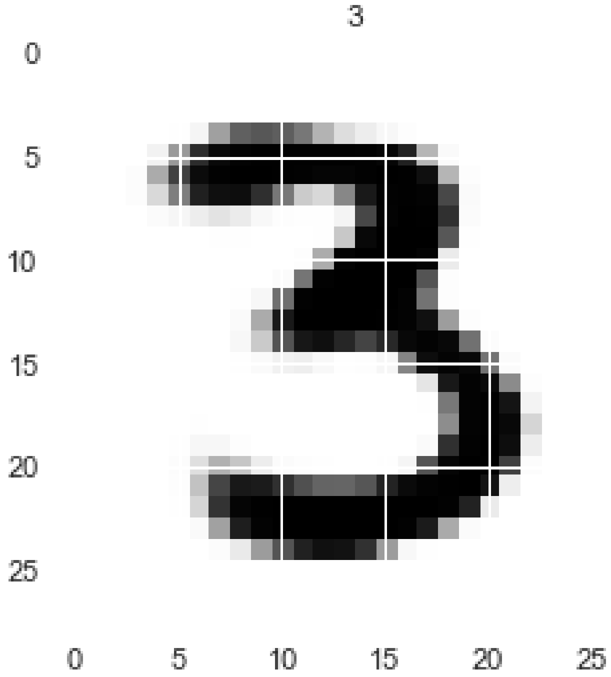
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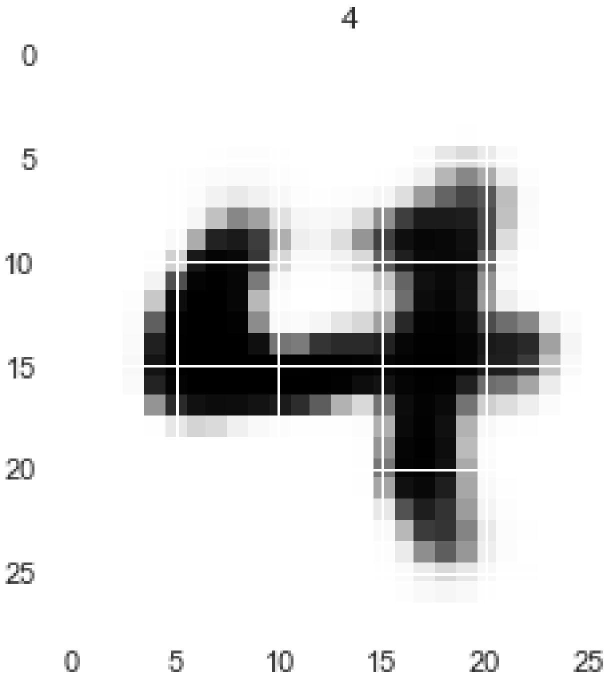
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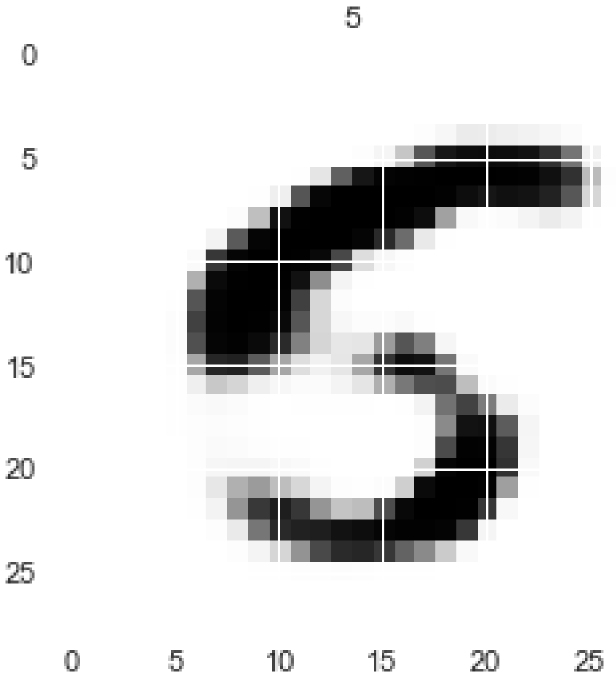
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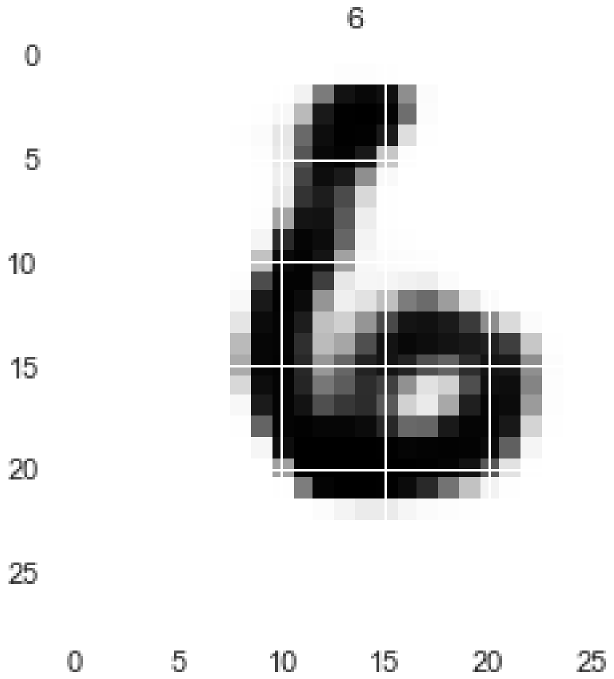
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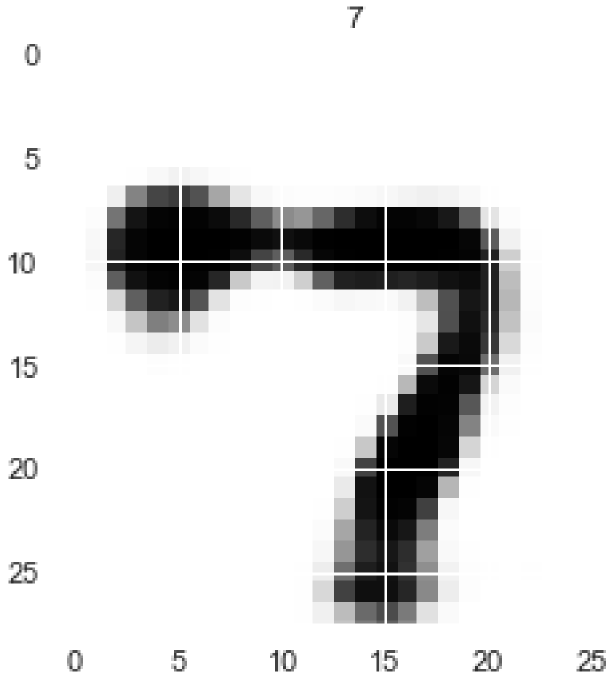
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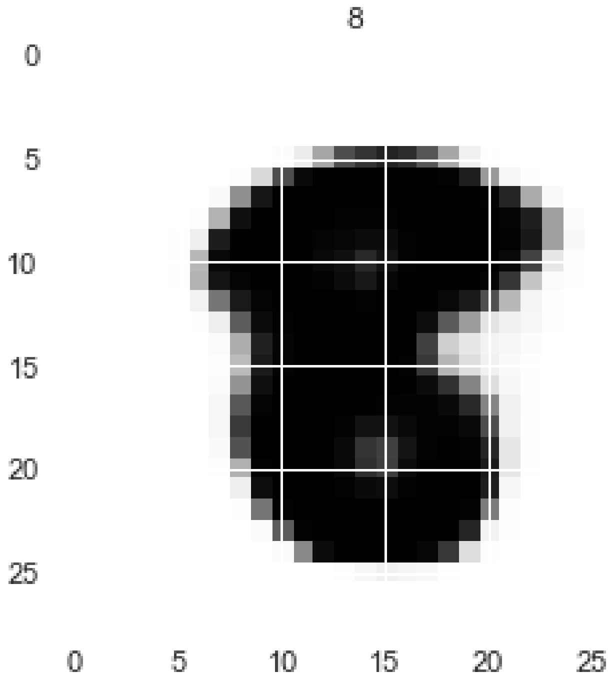
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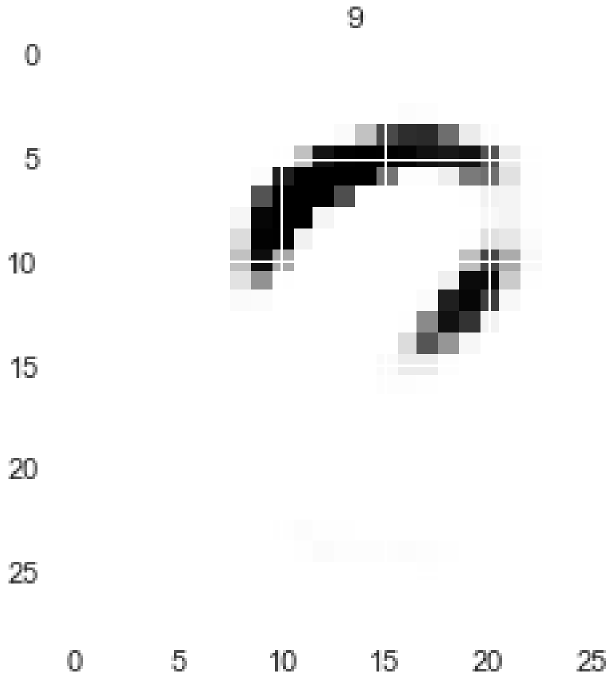
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