nmf-comparison

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1 Fundamentals of Machine Learning - Exercise 9

Dominique Cheray & Manuel Krämer

```
In [1]: import math
        import matplotlib.pyplot as plt
        import numpy as np
        import pandas as pd
        from sklearn.datasets import load_digits
        from sklearn import decomposition
```

1.1 1 Setup

```
In [2]: digits = load_digits()
        X = digits["data"] / 255
        Y = digits["target"]
```

1.2 2 Non-negative matrix factorization vs. SVD comparison

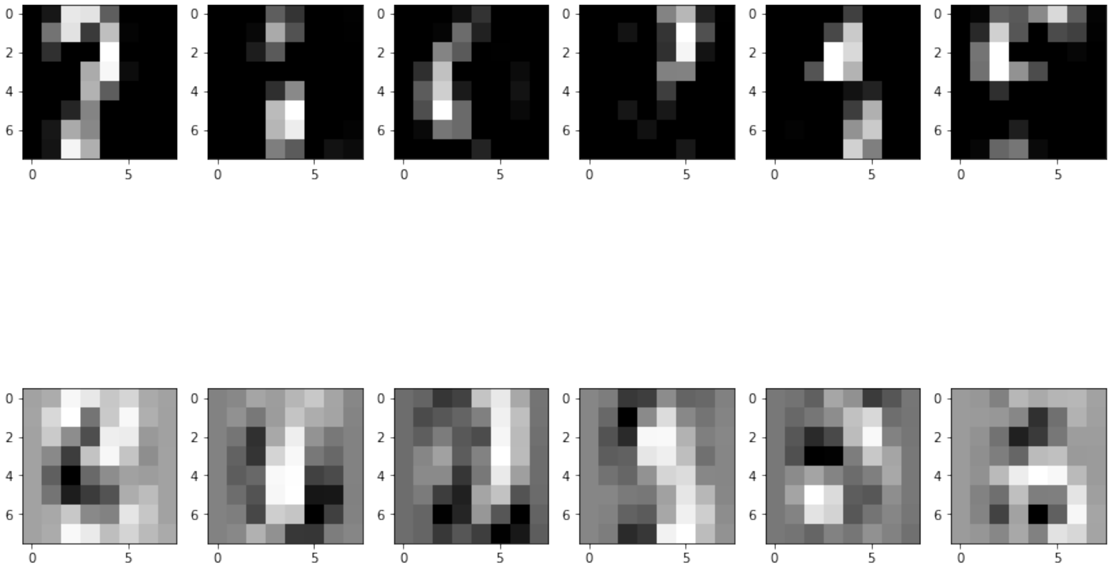
```
In [3]: nmf = decomposition.NMF(n_components=10)
        W1 = nmf.fit_transform(X)
        H1 = nmf.components_

        means = np.mean(X, axis=0)
        X_centered = X - means

        U, S, V = np.linalg.svd(X_centered, full_matrices=True)
        V = V + means

        fig, axes = plt.subplots(2, 6, figsize=(15, 10))
        axes = axes.ravel()
        fig.suptitle('Top: components of NMF, Bottom: components of SVD')
        for i in range(6):
            axes[i].imshow(H1[i,:].reshape(8, 8), cmap=plt.cm.Greys_r)
        for i in range(6, 12):
            axes[i].imshow(V[i-6, :].reshape(8, 8), cmap=plt.cm.Greys_r)
        plt.show()
```

Top: components of NMF, Bottom: components of SVD



For the NMF components most of the values are 0 which makes senes, since for all numbers the biggest part of the image is just black background. One can also see prototypical parts of the numbers out of whom the different numbers can be formed. For the SVD the values of the components vary way more and rather form protoypical numbers and not prototypical parts of numbers.