Series 2a. Mean - Variance Feature - extraction
Pattern Recognition

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1 Description

1.1 A proposed feature extraction

The script **1.2.Transf.py** reduces the size feature vector from 28 x 28 values to 28 x 2 values. The original vector is split in 28 subsets i.e. $C_{n=[1...28]} \subseteq V^{28x28}$ where the colors values (0-255 gray scale) are not important anymore, but instead we take in count the position where each pixel has a value greater than a parameter called opacity. We define this transformation as: $X_i \in V^{28x28}; \mu_n \in M^{28}; \varrho_n \in G^{28}$, where x_i is each feature in the vector of 28 x 28, μ_n is the mean position of a subset of 28 pixels and the ϱ_n is the difference between the mean value and the variance in each subset of 28 pixels, therefore we have the equations (1) and (2) :

$$\mu_n = \frac{1}{N} \sum_{i=0}^{28} X_{i|v>opacity} \tag{1}$$

In the equation, X_i is the gray scale feature (0-255) for each subset pixel representation, N is number of pixels that have values whose the gray scale value is greater than *opacity* parameter, σ is the variance of each subset $C_n \subseteq V$:

$$\sigma_n = \frac{1}{N} \left[\sum_{i=0}^{28} (X_{i|v>opacity} - \mu)^2 \right]^{1/2} \tag{2}$$

Finally the transformation is the vector Y defined as: $f(X_{i \in C}) \rightarrow^T Y_n = (\mu_n, \varrho_n)$ for each subset $C \in V$. The script returns the following structure (n: is number of 28 formed groups, therefore $n = [0...27]$):

x[0]: Contains the digit handwriting data label.

x[2n+1]: Contains the mean position of the pixels inside of the group n.

x[2n+2]: Contains the difference of the mean position and the variance: $\varrho = \mu - \sigma$