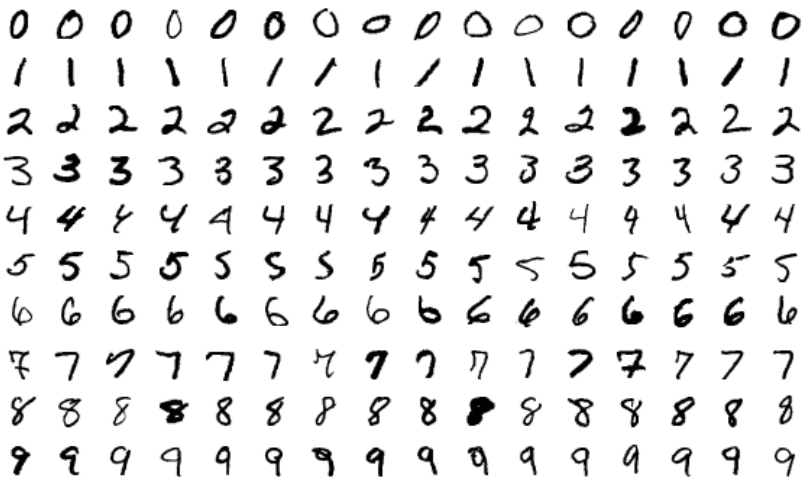
FL #7

1. Read the MNIST dataset using provided python code.



2. Extract several meaningful features from images, and apply k-means algorithms (e.g., k=10). Some examples of features are as follows.

영역1의 특징 기술자

- 면적 $a = 20$
- 중점 $(\bar{y}, \bar{x}) = \left(\frac{1}{20}\sum_{(y,x)\in R} y, \frac{1}{20}\sum_{(y,x)\in R} x\right) = (3.05, 2.7)$
- 행 분산 $v_{rr} = \frac{1}{20}\sum_{(y,x)\in R}(x - 2.7)^2 = 3.01$
- 열 분산 $v_{cc} = \frac{1}{20}\sum_{(y,x)\in R}(y - 3.05)^2 = 1.848$
- 혼합 분산 $v_{rc} = \frac{1}{20}\sum_{(y,x)\in R}(y - 3.05)(x - 2.7) = -1.135$
- 둘레 $p = 10 + 6\sqrt{2} = 18.485$
- 둥근 정도 $r = \frac{4\pi \times 20}{18.485^2} = 0.736$

3. Measure the uniformity of each cluster.