Experiment: Applying SVM to classify shifted images of digit 8 (positive class) and shifted images of digit 6 (negative class)

Shifted images: the center 16\*16 pixels of the original digit image (28\*28 pixels) would be extracted, and then placed on the random position of a zero matrix of 28\*28. The examples of shifted digit 8 and shifted digit 6 are shown in Figs. 1 and 2 correspondingly.

Linear SVM is applied to classify the shifted digit 8 and shifted digit 6.

- 200 training data 200 (100 for each class) is used to estimate the SVM classifier.

- 200 validation data 200 (100 for each class) is used to select the optimal model.

- 1000 test data: 1000 (500 for each class) is used to evaluate the prediction performance.

The prediction results on original images and shifted images are shown in Table 1. SVM shows a very good prediction performance on classifying the original images (digit 8 vs. digit 6). However, the prediction performance declines significantly on shifted images (shifted digit 8 vs. shifted digit 6). The results suggest that randomly shifting the digit images increase the difficulty of prediction task significantly.

Table 1. Prediction results on shifted/original images

|  |  |  |  |
| --- | --- | --- | --- |
| Original images | | | |
| Training SS | Training SP | Test SS | Test SP |
| 1 | 0.99 | 0.98 | 0.97 |
| Shifted images | | | |
| Training SS | Training SP | Test SS | Test SP |
| 0.89 | 0.92 | 0.63 | 0.69 |

一張含有 監視器, 時鐘 的圖片

自動產生的描述一張含有 監視器, 物件, 坐, 螢幕 的圖片

自動產生的描述

一張含有 物件, 監視器, 坐, 時鐘 的圖片

自動產生的描述一張含有 物件, 監視器, 相片, 電視 的圖片

自動產生的描述

Fig. 1. Four examples of shifted digit 8

一張含有 物件, 監視器, 坐, 時鐘 的圖片

自動產生的描述一張含有 監視器 的圖片

自動產生的描述

一張含有 監視器, 時鐘 的圖片

自動產生的描述一張含有 物件, 監視器, 坐, 時鐘 的圖片

自動產生的描述

Fig. 2. Four examples of shifted digit 6