Patter Recognition

Pattern Learning Methods

- **Pattern Learning Methods**
  - ❖Supervised Learning: labelled training samples
  - ❖Unsupervised Learning: unlabeled training samples
  - ❖Semi-supervised Learning: labelled with few samples and then adapt more unlabeled samples

Topics

- Template Matching
- Random Forest
- *K*-Nearest Neighbour
- K- means Clustering
- Principal Component Analysis (PCA)
- Support Vector Machine

Template Matching

- Correlation coefficient

$$\alpha_t = M_t / P_t \quad (0<\alpha_t \leq 1)$$

- Manhattan distance

$$\delta_t = \{\sum_{1}^{x \times y} | I - G_t |\}$$

- Where M_t is the total number of matched pixels and P_t is the total number of pixels. $I(x,y)$ input image and $G_t(x,y)$ is t^{th} template image.

Template Matching

- Image and Template are the same sizes (same resolution)
- Object size (in an image) is greater/smaller according to camera and object distance, in that case,
  - Multi-resolution templates or template pyramids are used
  - Or the original image is resized multiple times.

Template Matching (Example)

Sample Templates
(60x60)

Test image
(60x60)

Face Detection Using Multi-resolution Templates

Step 1: Prepare Template images with different resolutions

Step 2: For each frame template image sliding starts from the (0,0) position of the image and progresses it by a given step size from left to right and top to bottom.

Step 3: Measure Minimum distance or Correlation Coefficient

Step 4: This process is done until template reaches the end of the input image

Step5: Based on specific threshold detect face area and draw a boundary.

Face Detection Using Multi-resolution Templates

- This method uses the template images of (50X50), (60X60), (70X70), (80X80), (90X90), and (100x100) dimensions for face detection.