

Pattern Recognition

Traditional Methods

ETC3123 Artificial Intelligence for Engineering Applications

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Pattern Recognition Process

Feature Extraction

Pattern Recognition

Challenges and Limitations with Traditional Pattern
Recognition Techniques

Pattern Recognition Process





► Often require human input, may or may not be based on domain knowledge

► Example techniques

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|--|--------------------------|
| ■ Principal Component Analysis (PCA) | dimensionality reduction |
| ■ Histogram of Oriented Gradients (HOG) | image |
| ■ Scale-Invariant Feature Transform (SIFT) | image |
| ■ Term Frequency-Inverse Document Frequency (TF-IDF) | text |
| ■ Mel-Frequency Cepstral Coefficients (MFCCs) | audio |
| ■ Wavelet Transforms | signal, image |



- ▶ Includes regression, classification, and clustering; Often require the assumption of a mathematical model
- ▶ Example techniques
 - Support Vector Machines (SVM) classification
 - k-Nearest Neighbours (k-NN) regression, classification
 - Decision Trees regression, classification
 - Naive Bayes classification
 - k-Means Clustering clustering
 - Density-Based Spatial Clustering of Applications with Noise (DBSCAN) clustering

Challenges and Limitations with Traditional Pattern Recognition Techniques

- ▶ Manual feature extraction
relies heavily on domain-specific, handcrafted features, which may not always capture the essential patterns in complex datasets
- ▶ Limited performance in complex tasks
often hit a performance ceiling especially in unstructured or high-dimensional data such as image or speech processing and recognition
- ▶ Scalability
do not scale well for large datasets

A blue-tinted photograph of a Sunway University building. In the foreground, a large, curved banner is suspended, featuring the Sunway University logo and the text "SUNWAY UNIVERSITY". The banner is supported by several vertical poles. In the background, a multi-story building with a modern architectural style is visible, featuring large windows and a glass facade. The scene is set outdoors, with a paved area in the foreground and some greenery on the right side.

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Thank you