PATTERN RECOGNITION LECTURE 2 PARADIGMS OF PR

LECTURE NOTES
03-01-2020

# Different Paradigms (Models) for Pattern Recognition

- Statistical Pattern Recognition
- Syntactic Pattern Recognition/Structural Pattern Recognition
- Template Matching
- Neural Networks

1. Statistical Pattern Recognition

- Statistical PR is more popular and has received the majority of attention in literature.
- The main reason for this is that most practical problems in this area deals with noisy data and uncertainty.
- Statistics and probability are good tools to deal with such problems.
- In statistical PR, we focus on the statistical properties of the pattern (generally expressed in probability densities) and this will be used in most of the real time applications.
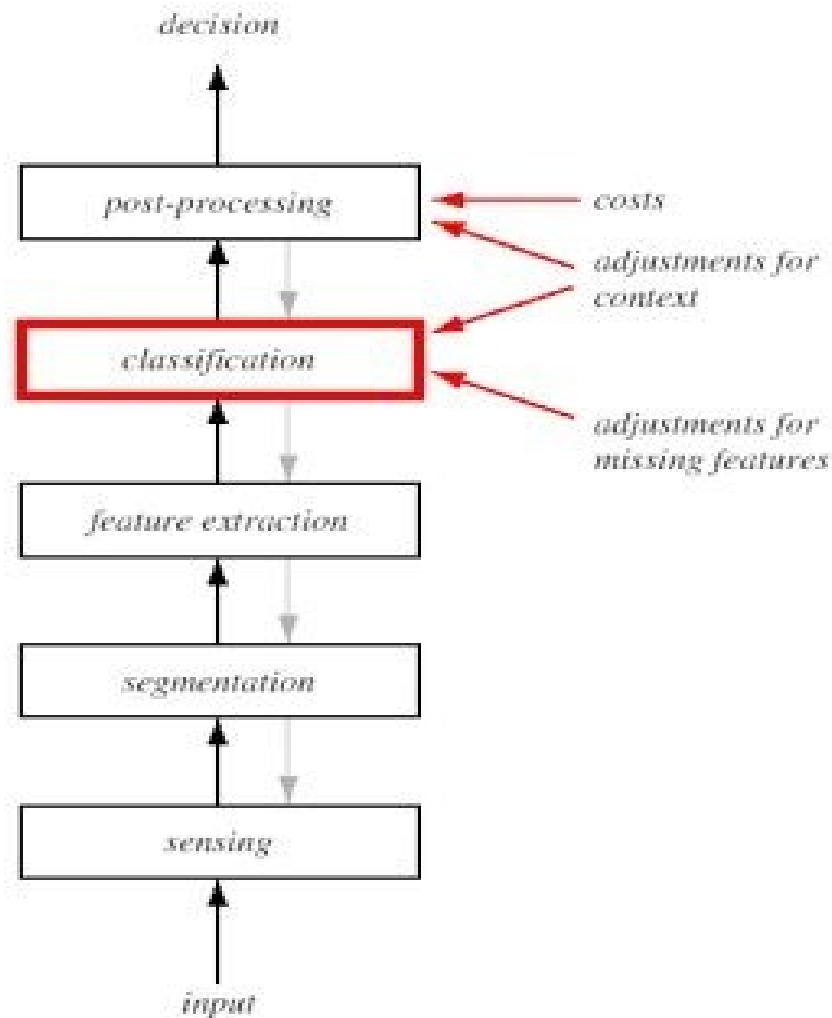- Here, we use vector spaces to represent patterns and classes.

Statistical PR (cont)
Schematic Diagram :
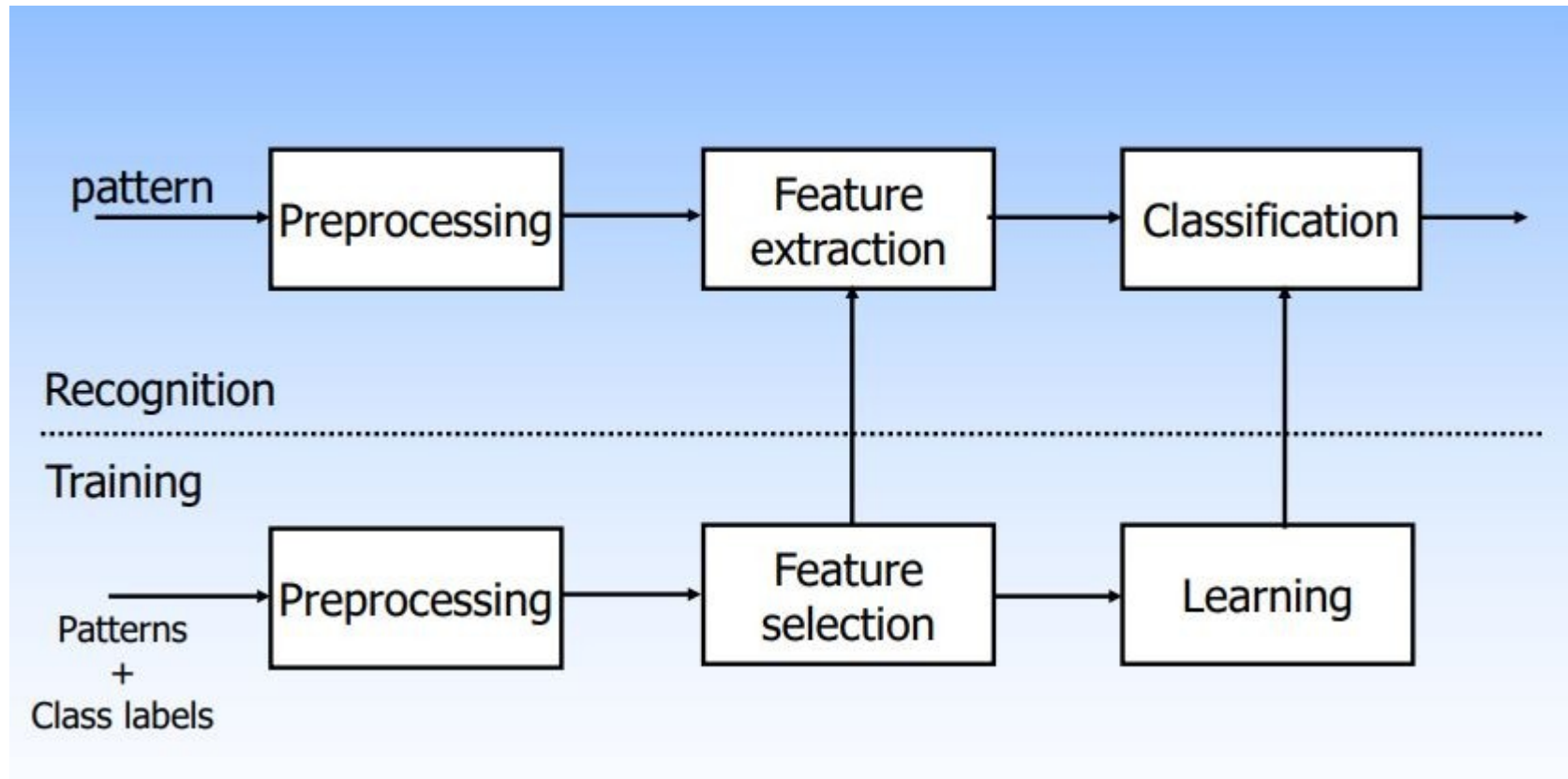
Statistical PR (cont)
Schematic Diagram

Statistical PR (cont)

- **Sensor** converts images/sounds/physical inputs into signal data.

- **Segmentation** isolates sensed object from the background.

- **Feature extraction** measures object properties that are useful for classification.

- **Classification** assigns sensed object to a category.

- **Post processing** take into account other considerations, such as effects of context and the cost of errors to decide on the appropriate action.

Statistical PR (cont)

- The abstractions typically deal with probability density or distributions of points in multi dimensional spaces/ vector space.

- Because of the vector space representation, it is meaningful to talk of sub-spaces /projections and similarity between points in terms of distance measures.

Statistical PR (cont)- Examples

- The **Baye's Classifier** characterises optimality in terms of minimum error rate classification.

- The use of **HMM (Hidden Markov Model)** is popular in fields like speech recognition.

- A **Decision Tree** is a transparent data structure which can deal with classification of patterns employing both numerical and categorical features.

- **Nearest Neighbour Rule**: It is the most popular and simple classifier. A new pattern is classified based on the class label of its nearest neighbour. In such a classification, we do not have a training phase.

- If the model consists of some set of crisp logical rules, then we employ the method of syntactic pattern recognition, where the rules or grammar describe our decision.

- Example : To classify an English sentence as grammatical or not, crisp rules are appropriate rather than statistical descriptions such as word frequencies or correlations.

Syntactic PR (cont): Schematic Diagram

3. Template Matching

Template
Prototype

Input scene
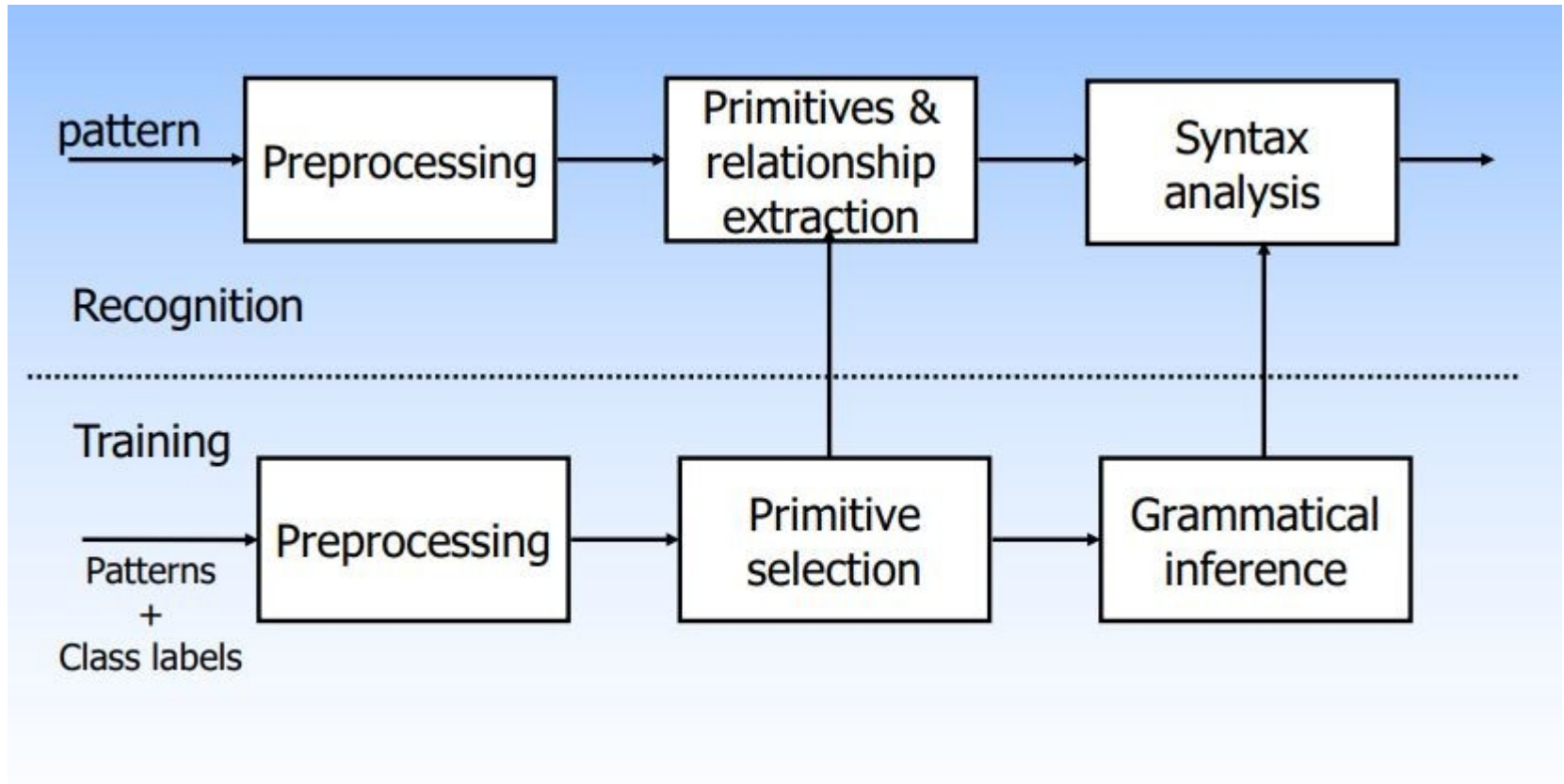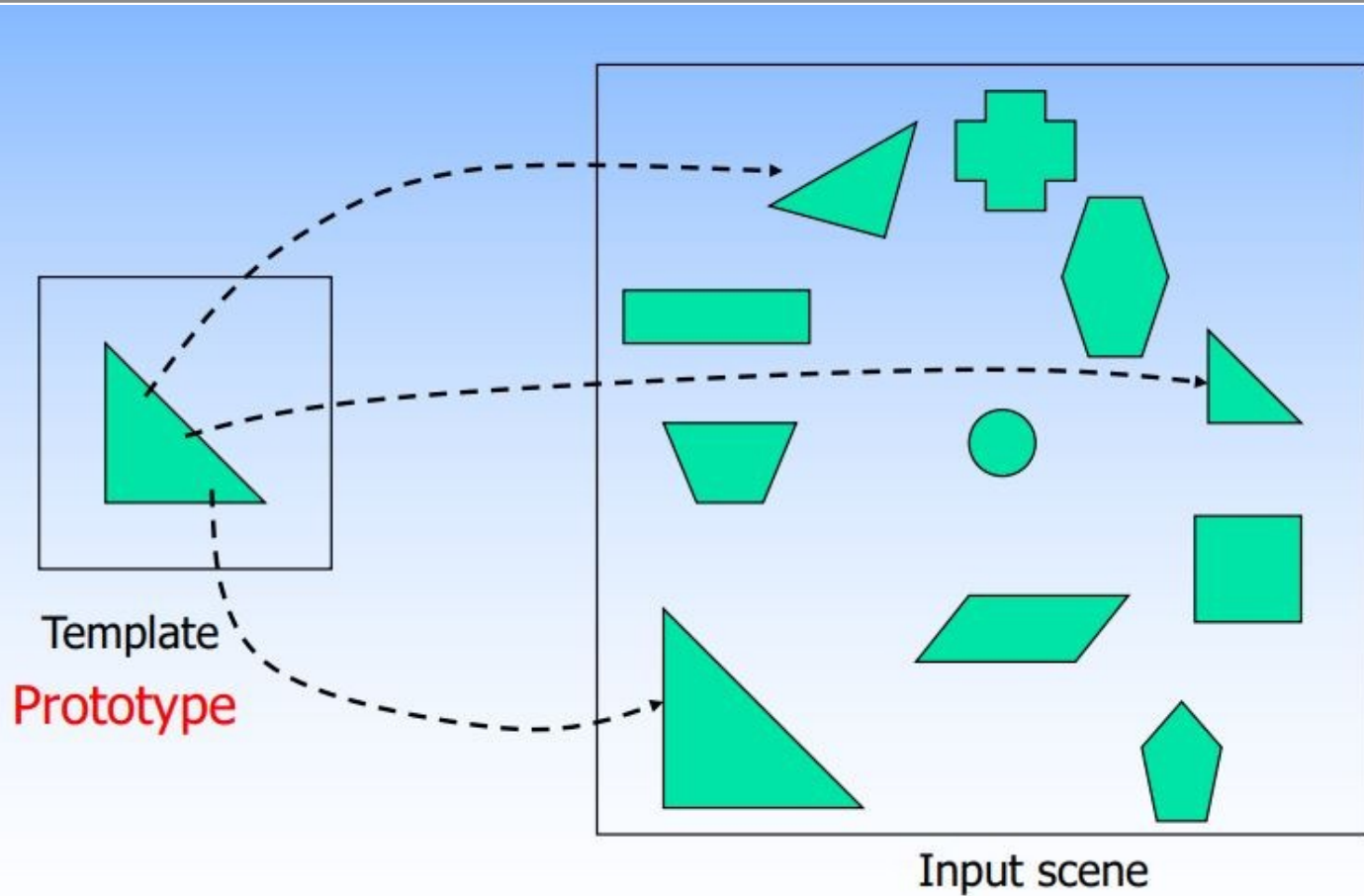
4. Neural Networks

- **Neural networks** are a set of algorithms, modeled loosely after the human brain, that are designed to recognize patterns.

- A **neural network** is a series of algorithms that try to recognize underlying relationships in a set of data through a process that mimics the way the human brain operates.