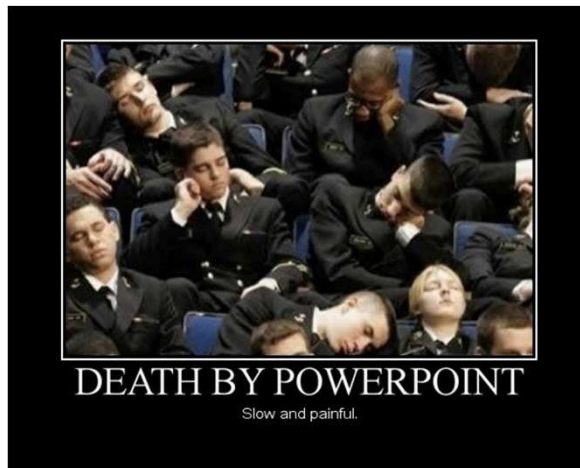


EE 583 PATTERN RECOGNITION



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Introduction

Overview, basic concepts

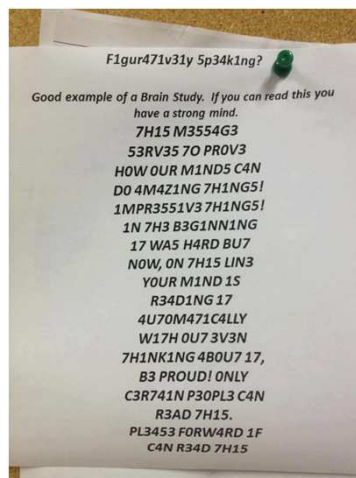
Example problems

Different Approaches

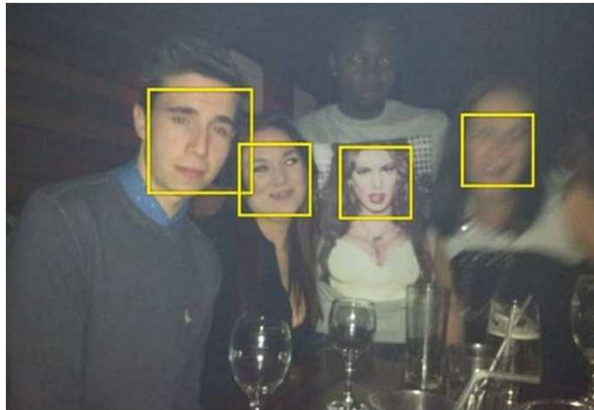
Introduction

- Pattern recognition (PR) is a tool for *machine intelligence* problem
- PR is a science for description or classification/recognition of *measurements*
- Interrelated approaches to PR
 - Statistical (StatPR)
 - Syntactical or structural (SyntPR)
 - Neural (NeurPR)

Human brain is



This course is all about ...



Pattern Recognition Applications

- Image segmentation
- Seismic analysis
- Radar signal classification
- Face detection/recognition
- Speech recognition/understanding
- Fingerprint identification
- Character recognition
- Medical diagnosis



What is PATTERN ?

- Pattern : anything you want to classify
 - e.g. Peaches, array of pixels, speech waveform vector
- Feature : any data *extractable* from measurements (low & high level)
 - e.g. color, age, name, weight (low)
 - e.g. aspect ratio, dominant color (high)



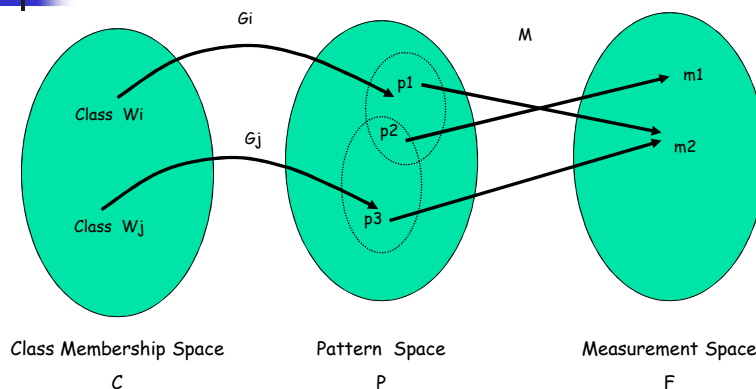
Some definitions :

- Classification : Assigning input into one of classes based on features
- Recognition : Ability to classify
- Description : Alternative to classification where a structural description of input is desired
- Pattern class : A set of patterns known to originate from the same source, sharing some common attributes
- Noise : Distortions or errors of input, errors in feature extraction, errors in training data

Classifiers, Decision Regions

- A classifier partitions feature space into class-labeled *decision regions*
- For unique class assignment, these regions must cover all feature space and disjoint
- Border of each region is called *decision boundary* (not easy to find)
- Classification strategy is simple : assign feature vector according to the class of the decision region

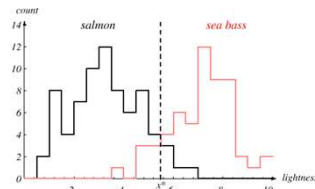
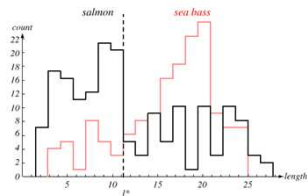
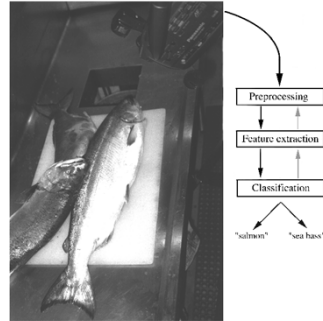
Abstract Representation



Given measurements, find and invert M and G

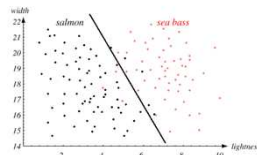
Example :

- Classify *sea bass* and *salmon*
- Choose the features
 - e.g. length, lightness, width
- Obtain a threshold from training data for classification

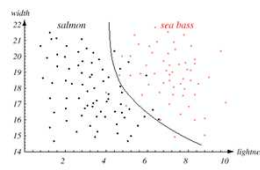
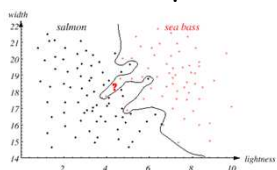


Example (cont'd) :

- Use two features together : lightness and width
- Classify by defining a boundary between the samples



- Memorize vs. Generalize
 - Complicated vs. simple models



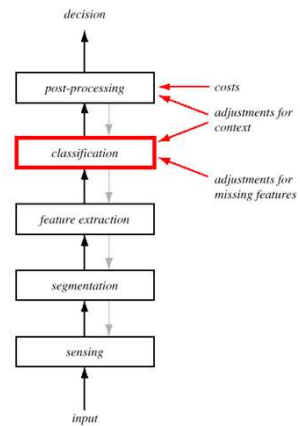


Fundamental Approaches

- Statistical : assumes underlying model is a set of probabilities, but structure is ignored
- Structural or syntactic : assumes interrelations are more important, but not easy to find these relations
- Neural : imitates humans, based on statistical PR fundamentals.

Components of PR systems

1. Sensing
2. Segmentation
3. Feature Extraction
4. Classification
5. Post-processing



PR problem Design Cycle

1. Data collection
 - Find typical examples
2. Feature choice
 - Prior knowledge & invariance
3. Model choice
 - Model selection is not easy
4. Training
 - `learning by example`
5. Evaluation

