Activity and Context Recognition

Term work:
Ubiquitous Human-Computer Interaction

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Outline

- Activities
- Contexts
- Recognition
  - Sensors
  - Classifier
  - Naïve Bayes Classifier
  - Hidden Markov Models
  - Neural Networks
- Future Work

Activities

- Somebody or something can do an activity
- Happens in context

Context

- Information that characterize a situation of an entity
- An entity is a person, place, physical or computational object
- A context can be defined as a Subcontext

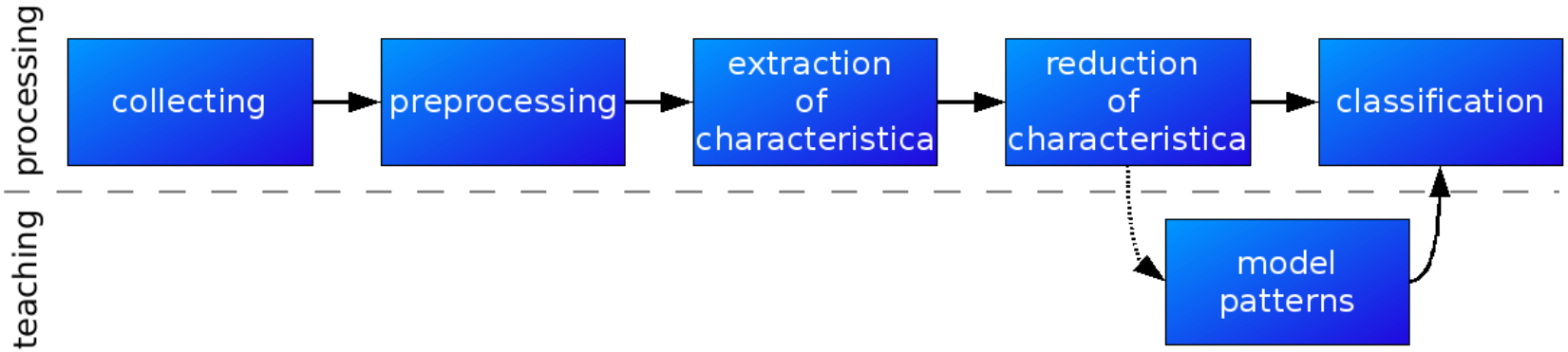
Recognition

Assigning a perception to a concept

- Capture generic context information
- Activity surrounding information

- Contextual information for specific activities
- Contextual dependencies

Recognition process



1. Sensor data
2. Noise minimized and normalized
3. Transformed
4. Simplified
5. Classified by model patterns

Sensors

Recognition begins by choosing the right sensors and positions

- Context cannot be captured directly
- Interpretation of sensor data
- Setting is important
- Noise reduction

Classifier

Supervised

- Lead by a Supervisor
- Presorted data

versus

Unsupervised Classifier

- Cluster
- Compress

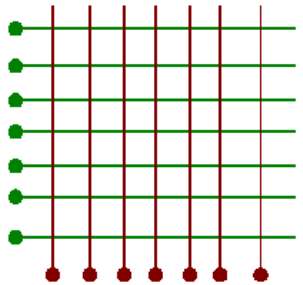
Classifier

Online versus Offline learning

- Modifies target function
- Changes behavior

- Static target function
- Behavior is set in learning stage

Naïve Bayes Classifier

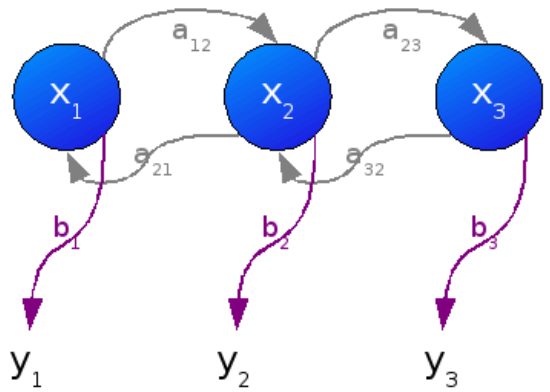


$$p(C \mid F_1, \ldots, F_n) = \frac{p(C)}{Z} \prod_{i=1}^{n} p(F_i \mid C)$$

- Classical way
- A probability model
- based on Bayes' theorem:
  $p(C \mid F_1, \ldots, F_n) = \frac{p(C) \cdot p(F_1, \ldots, F_n \mid C)}{p(F_1, \ldots, F_n)}$
- Supervised learning
- Maximum likelihood estimation

Hidden Markov Model

- Hidden states
- Hidden transitions
- Visible emission
- Blackbox model
- Two probability processes

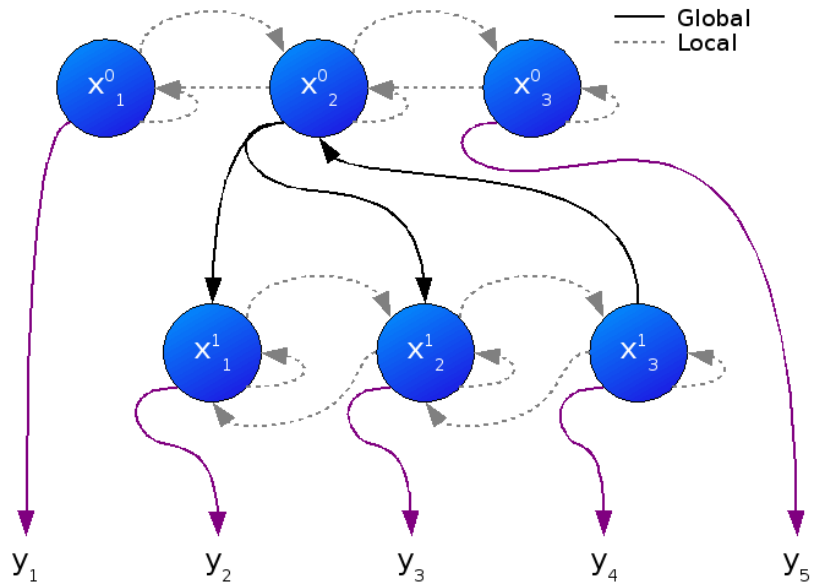


Forward Backward Algorithm

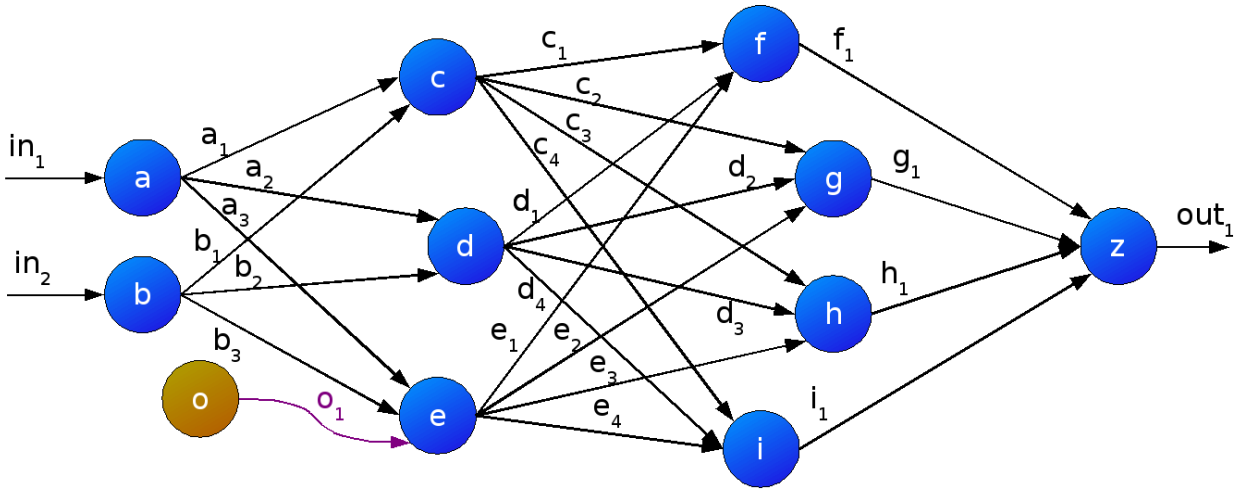
- Needs only emission probabilities
- Maximum likelihood estimation
- Supervised learning

Hierarchical hidden semi Markov Model

- Special form
- Hierarchical
- Compatible
- Complexer to teach
- More efficient solving



Neural Network



Calculation with wits

- Without formal mathematical calculations
- Nodes build a network

Multilayer-Perception

- Without feedback loops
- Layers
- Backpropagation learning
- Supervised

Future Work

- Direct comparison of classification algorithms
- Showing disadvantages

Thank you!

Questions?