

Generative models for human activity recognition

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Project goal

Aim

Classification model for complex-structured objects.

Problem

Initial object has no appropriate feature description.

Applications:

- image processing;
- signal classification;
- topic modelling;
- *time series analysis*.

Related work

- ① Wang W. et al. Human activity recognition using smart phone embedded sensors // *International Joint Conference on Neural Networks*. 2014.
- ② Kwapisz, Jennifer R., Gary M. Weiss, and Samuel A. Moore. Activity recognition using cell phone accelerometers. // *ACM SigKDD Explorations Newsletter*. 12(2): 74-82. 2011.
- ③ Kuznetsov M. P., and Ivkin N. P. Time series classification algorithm using combined feature description. // *Journal of Machine Learning and Data Analysis*. 2015.

Problem Statement

- $s \in \mathcal{S}$ - complex structured object
- $y \in Y$ - class label

Task

Given: $\mathcal{D} = \{(s_i, y_i)\}_{i=1}^m$ recover

$$y = f(s) \quad \forall s \in \mathcal{S}.$$

Approach

Suppose $f = g \circ h$, where

- $h(s) : \mathcal{S} \rightarrow H \in \mathbb{R}^n$;
- $g(\mathbf{h}, \theta)$ — parametric map from H into Y (classification model).

Optimal parameters

- 1 Choice of feature map $h(s)$ by
 - prior (expert) knowledge;
 - minimizing error functional.
- 2 Classification for $\{(h(s_i), y_i)\}_{i=1}^m$

$$\theta^* = \arg \min_{\theta} S(g, \theta, \mathcal{D}).$$

E.g. g - logistic regression,
 θ - weights,
 S - classification error.

Expert functions

Autoregression model

Spectral Analysis

(?!) Splines

Data

Time series example

Results

Results

Feature union

Conclusion