Pedestrian Detection using Stereovision and Graph Kernels

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Introduction

Problem :

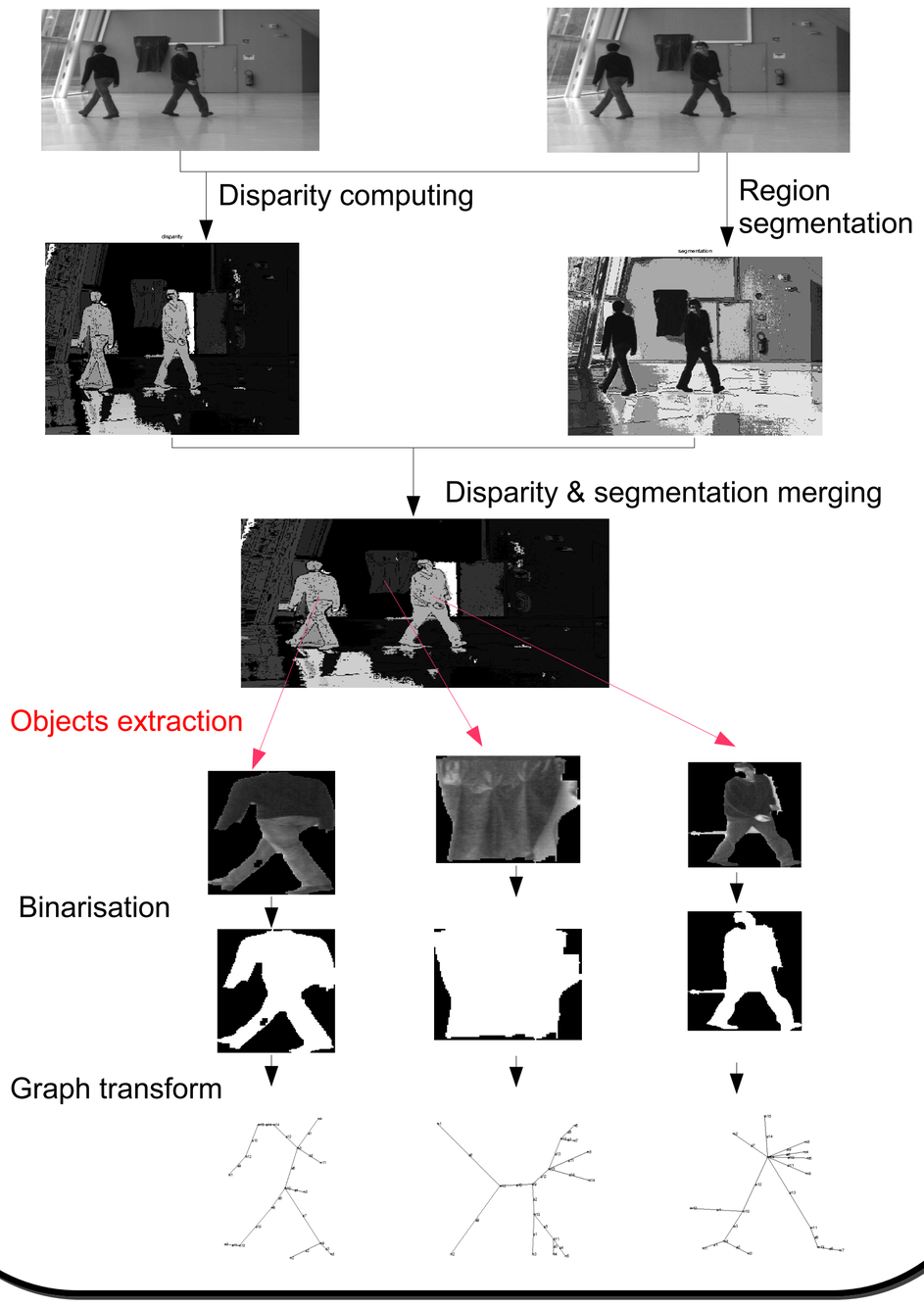
- **pedestrian detection**,
- artificial vision and machine learning technique ([3], [6], [1], [5], [4]),
- adresses the problem of pose variability,
- separates the pedestrian from the background with **stereovision**,
- represents a shape with a **graph** obtained from the skeleton,
- classifier : **SVM** with a graph kernel.

Main advantages of this method :

- shape information contained in the graph
- scale invariability

Method description

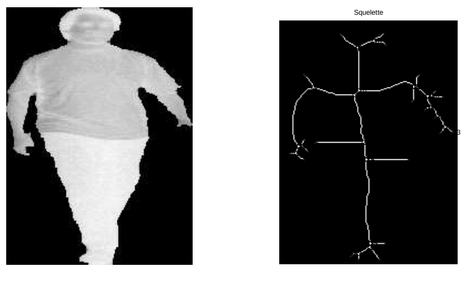
This figure shows the steps of objects extraction from the background and the resulting skeleton and associated graph.



Graph Designing

The method used to transform a black and white image in a graph is as follows.

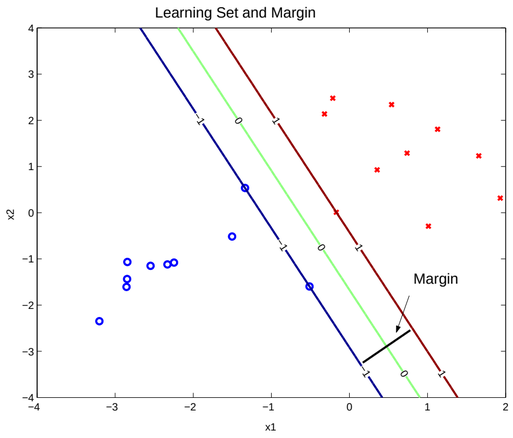
1. find the skeleton,thanks to a morphological method.
2. transform this skeleton into a graph made of vertices and edges. A vertice could be defined as a particular pixel, either the end of a skeleton line, or an intersection between many lines of the skeleton.
3. link the vertices together by searching the path between the vertices along the skeleton.



Kernel method

We used the SVM classifier and a graph kernel for our problem :

- binary classifier : pedestrian or non-pedestrian,



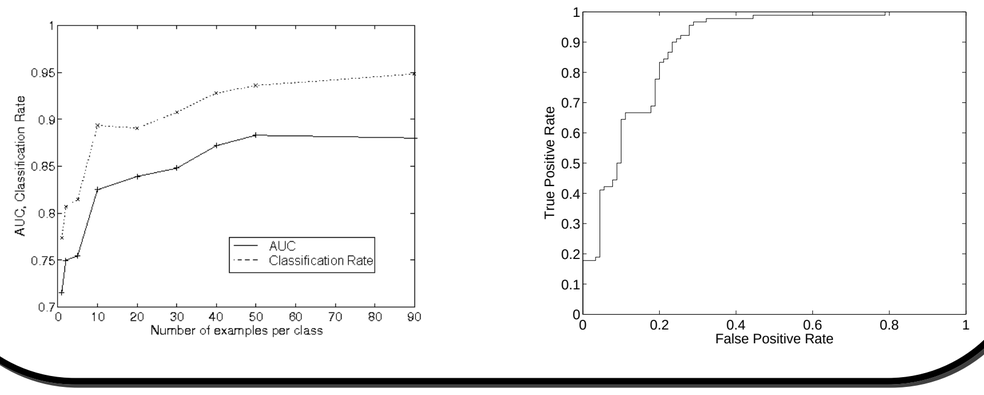
- kernel made with the inner products between graphs, obtained with the method of Kashima [2]. It compares two label sequences generated by two synchronized random walks on the two graphs.

Results

Here are some preliminary results that we obtained using our algorithm.

- video acquisition : indoor, good light, up to 3 pedestrians per image,
- set of 100 pedestrians and 1600 non-pedestrians,
- number of training set elements : 1 to 75 per class,
- SVM : cross validation,
- choose the best parameters for the classifier.

The figures below present the classification rate along the number of examples per class in the training set (left) and an example of ROC curve for 10 elements per class (right).



Conclusions and perspectives

- preliminary results are encouraging,
- high classification rate with few patterns for the learning,
- scale invariability,
- improvements :
  - classifier performance,
  - add other labels to the graph to challenge the problem of rotation,
  - real world situation,
  - multi-class classifier to detect other object : cars, bicycles.

For more information or contact, see

http://asi.insa-rouen.fr/~fsuard/

References

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