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An Oriented-Contour Point Based Voting Algorithm for Vehicle Type Classification

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Objectives & Applications

Automatic license plate recognition system & vehicle type recognition

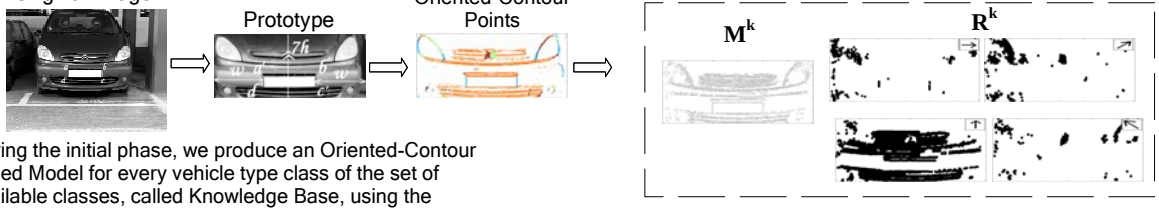
Renault Laguna

Application : Assistance for a vehicle access control system used in restricted areas or parking lots.
Objective : vehicle type (make and model) identification from greyscale frontal images.
Method :
- Model : oriented-contour point based model.
  + provide additional information to the simple contour points
  + rigid pattern defined by the manufacturer
- Classification : voting algorithms fusion.
  + robust to partial occlusions.

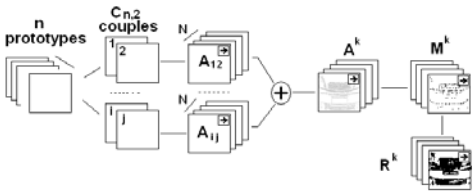
Real examples

Model creation

Original Image → Prototype → Oriented-Contour Points → Class Model



During the initial phase, we produce an Oriented-Contour based Model for every vehicle type class of the set of available classes, called Knowledge Base, using the Training Base samples.

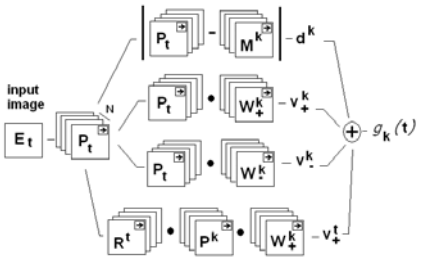


The array **M** contains the Oriented-Contour Points that are rather stable through the n samples of the class *k* in the Training Base.
We weight the points of regions arrays **R**, giving highest values to those points with the ability to best discriminate the class *k* respect the others classes. We obtain the weighted arrays **W**.

Training Base samples

Vehicle Classification

Classification score for class k



Four matching scores are combined in a scoring function $g_k(t)$ matching the sample test *t* to the class *k* :
- v_+^k : positive votes,
- v_-^k : negative votes,
- v_+^t : votes to test,
- d^k : distance error measure.

$$g_k(t) = d^k + v_+^k + v_-^k + v_+^t$$

When a new test instance **t** is presented in input, the scoring function is computed for every available class in the Knowledge Base. The label *k* returned via the discriminant function *G(t)* is associated with the most 'similar' model class (*winner-take-all* rule) :

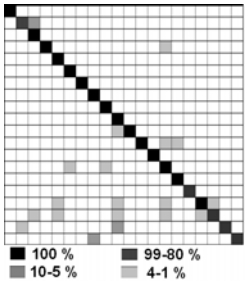
$$G(t) = k = ArgMax \{ g_1(t),\ldots,g_K(t) \}$$

Test Base samples

Results & Conclusions

Confusion Matrix

We select a finite set of **K** = 20 classes called Confusion Matrix. The set is composed of **480** samples from de Test Base. The Oriented-Contour Voting Algorithm correctly identifies in average **92.39 %** samples from the Confusion Matrix.



Tollgate simulation

The test simulates the presence of the tollgate at 4 positions hiding 15 % of the pattern.

Position	Mean success
1	93.10 %
2	92.24 %
3	90.92 %
4	88.46 %

Conclusions

We have presented a voting algorithm for a multiclass vehicle type recognition based on Oriented-Contour Points.
Results shows that the method to be robust to partial occlusions.
Future works will be oriented to improve the points selection and the creation of a confidence measure indicating how truly it judges the system response.