LOGO LOCALIZATION USING THE DISCREPANCY NORM

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Abstract

In this poster, we discuss Hermann Weyl's discrepancy concept in the context of localization. A novel algorithm is introduced for logo localization in the field of Make and Model Recognition (MMR) for cars. It is shown in particular that combining a good a-priori knowledge with the monotonicity property of the introduced discrepancy norm yields an efficient and reliable logo localization.

Definitions

The discrepancy norm for images is defined as (see [2]):

$$\|f\|_D = \max_{\delta_1,\delta_2\in\{-1,1\}} \max_{m,n\in\mathbb{Z}} \Big| \sum_{\substack{i\in\mathcal{I}_{\delta_1}(m)\\ j\in\mathcal{I}_{\delta_2}(n)}} f_{i,j} \Big|$$

with $\mathcal{I}_{\delta_0}(n) = \{i : \delta_0 \cdot i \leq \delta_0 \cdot n\}$.

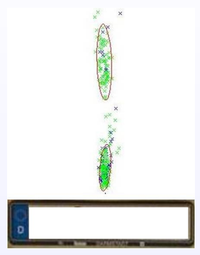
Monotonicity Property

Let t be a vector, f_t be the translated signal and $\lambda_1, \lambda_2 \in \mathbb{R}$ with $\lambda_1 \leq \lambda_2$

$$\|f - f_{\lambda_1 t}\|_D \leq \|f - f_{\lambda_2 t}\|_D$$

Prior Knowledge

Having the license plate's size and location, we have the following distribution for the logo location.



References

[1] J.-L. Bouchot, J. Himmelbauer, B. Moser, On Autocorrelation Based on Hermann Weyl's Discrepancy Norm for Time Series Analysis, in *World Congress on Computational Intelligence*, 2010

[2] B. Moser, A Similarity Measure for Image and Volumetric Data Based on Hermann Weyl's Discrepancy Concept, in *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 2009

Make and Model Recognition of Cars

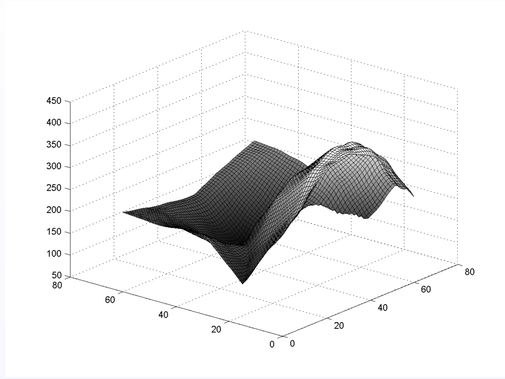
MMR can be divided into three parts: Image Capture → License Plate Localization → Recognition. Two ideas for the Recognition part have been proposed:

1. Recognize the brand and then optimize the model recognition or ...
2. Recognize the brand on one side, model on the other, and check consistency.

In the next parts we describe to logo localization.

Location Optimization

The next figure shows a 3D surface of the discrepancy dissimilarity between an image and a given sample. As one can see there is a nice wide area where we have the monotonicity property.



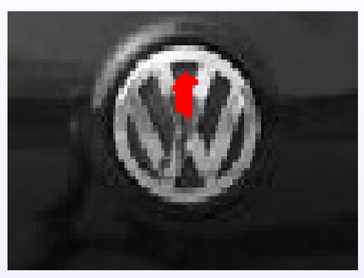
Having a good first guess and using this property will lead to a fast and reliable solution.

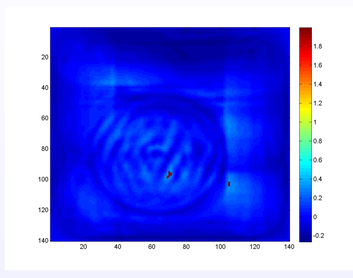
We have used a steepest descent approach for the optimization which ensures:

- Iterative method (need for a good first guess)
- Converges to local minimum (with the monotonicity property)

Results

This image shows that using a good first guess, the discrepancy based approach converges to a perfect result.





This image shows that the cross correlation gives approximative result which is bad for the recognition process.

Outlook

Even if this novel approach has shown good results some works has to be done:

- Scale space analysis
- Complexity reduction based on L^p-norms

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