Localization of Brazilian vehicle plates in images using statistical analysis

B.B. LEITE[1,3],MARCELO P. ALBUQUERQUE[1], A. GESUALDI MELLO[1], I. A. ESQUEF[2], M.P. ALBUQUERQUE[1]

[1]CBPF – Centro Brasileiro de Pesquisas Físicas - Rua Dr. Xavier Sigaud, 150, 22290-180, Rio de Janeiro, RJ, Brasil
[2]UENF – Universidade Estadual do Norte Fluminense - Av. Alberto Lamego, 2000, Horto, Campos, RJ, Brasil
israel@uenf.br
[3]DRV – Desenvolvimento e Representação Ltda, Rua 2 S/Número, 21945-970, Rio de Janeiro, RJ, Brasil
{borba,marcelo,aline,mpa}@cbpf.br

Abstract. This work aims the localization of Brazilian vehicle plates using image processing techniques and statistical analysis. We present how to find the plate based on its luminance variance. Preliminary results show efficiencies above 94%.

1 Introduction

In this paper we discuss how to find the plate position from the entire vehicle image. An image plate database was built in order to simulate real conditions encountered in daily life operations. The images of this database were normalized to have 2mm/pixel of resolution in the plate (*i.e.* height $\approx$ 25 pixels/character) as discussed in [1]. We also used the frequency analysis presented in [2].

2 Statistical Analysis

The proposed technique was based on the wide luminance variation property of the plate image. With this property we compute the luminance variance of each image line. In order to get its evolution, an alternative measure based on sliding window technique was applied [3].

3 Algorithm

Initially, we filter each image line using a digital bandpass Butterworth filter with the cutoff frequencies of $[0.07 < \omega_n < 0.1]$, where ω_n is $[0.0 < \omega_n < 0.5]$, with 0.5 corresponding to half the sample rate. Then we calculate the standard deviation of each line with a sliding window of size Δx creating a standard deviation image I_σ. After that, we sum I_σ lines getting the projection over y axis. In order to locate the y position we apply another sliding window of size Δy aiming to find the high standard deviation index i_y. At last, the x position of the plate i_x is obtained by:

$$i_x = \max[I_\sigma(j, i_y)] \;\; \forall \; j = 1 \ldots N_x. \qquad (1)$$

4 Results

Two hundred images were used to test the system performance. In order to compare efficiency values, different configurations of Δx and Δy sliding windows were used. We varied Δx from 150 to 250 pixels with step $\delta_x = 25$ pixels, and Δy from 10 to 30 pixels with step $\delta_y = 1$ pixel. Maximum efficiency was achieved at 94.5% with $\Delta x = 200$ pixels and $\Delta y = 25$ pixels. The best result occured for a sliding window with the same size of the plate in x axis and the same height of the character in y axis. Figure 1 presents an example of the system.

Figure 1: Vehicle plate recognition example.

5 Conclusion

An implementation of the Brazilian vehicle plate localization using image processing techniques was proposed. Combining line frequency analysis, sliding window technique and using plate luminance variation property, we developed a useful method to find the position of the plate in the whole image vehicle.

References

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