Difference of Gamma Correction Based Text Binarization Documents & Natural Scenes

Abstract

This paper presents a novel image binarization approach which does not require any parameter to tune by the user; and can deal with degradations occur such as shadows, non-uniform illumination, low-contrast, large signal-dependent noise, smear and strain. A pre-processing procedure based on morphology is first applied to suppress the light/dark structures at the background. Next the difference of gamma functions is computed and approximated with Generalized Extreme Value Distribution to realize the proper threshold.

Introduction

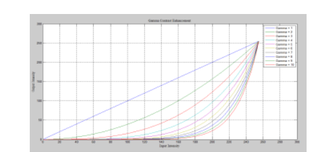
The problem of text segmentation in still images is still an open problem due to the large variability of appearance of texts (font style, size), complex background, occlusions, object shadows, highlights from shiny object parts, and differences of color brightness of objects. In this field of study. A lot of image binarization techniques have been developed by many authors to solve those issues; however there is no commonly accepted algorithm which can be applied on any given dataset.

Even if many approaches have been specifically developed for image binarization most of these approaches fail when the image is complex. The aim of this work is to develop a general threshold technique and to demonstrate the need for such a new technique in the field of document and natural scene image analysis.

Objectives

- Reduce the noise in binarized images while keeping textual information as much as possible
- Lesser complex processes than other well-known approaches.

Difference of Gamma Corrections Aproximation with Generalized Extreme Value Distribution



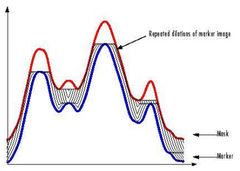
Influence of the parameter gamma on the contrast of the output image.

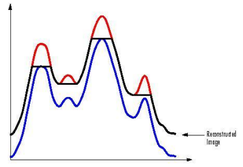
Up and down images respectively gamma correction γ=2 and γ=4

Difference image of different gamma scales (γ=2,γ=4)

METHODOLOGY

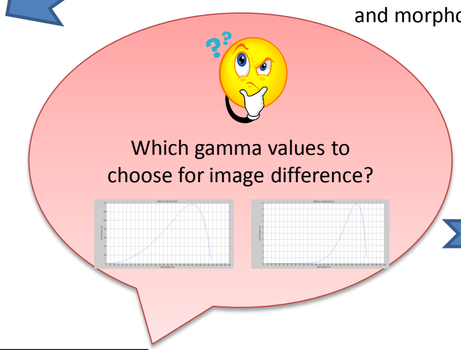
Geodesic Dilation to Enhance Image





Every small fluctuations in an image cause regional maximum or minimum but we are only interested with significant maximum and minimum values caused by background texture.

Up to down respectively original images and morphological reconstructed images



We propose to use the Generalized Extreme Value Distribution (GEVD) model to find the best approximation of difference of gamma corrections for our problem.

For k is not equal 0

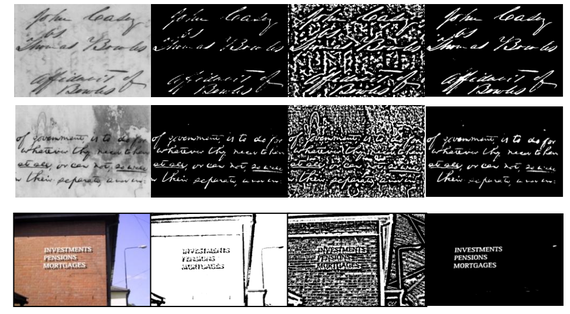
$$f(x) = \left\{\frac{1}{\sigma}\exp^{\left(-(1+kz)^{-1/k}\right)}.(1+kz)^{-1-(1/k)}\right.$$

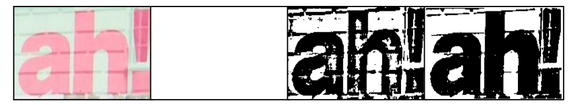
For k is equal 0

$$f(x) = \left\{\frac{1}{\sigma}\exp^{(-z-\exp(-z))}\right.$$

We propose here to use the Cumulative Distributions Function (CDF) of the GEVD to define the significance levels which best describe the distributions studied. Next we use these significance levels as threshold for binarization.

Experimental Results





From left to right respectively Input, Sauvola , Niblack, proposed methodology outputs

Binarized Images