DATE: 2017/1/10

Department of Electrical and Electronic Information Engineering		ID	M155206
Name	Taiki Makishi		

Supervisor	Shuichi Ichikawa Naoki Fujieda

Abstract

Title	Trade off between execution time and estimation accuracy of sub-optimal parameter estimation on Bilateral Filter with distribution distance

Bilateral filters perform edge-preserving smoothing and are widely used for noise reduction of images. The performance of noise reduction is sensitive to the choice of two parameters of bilateral filter for each input image. Both an input image (with noise) and an ideal image (without the noise) are necessary to get the optimal parameters, while it is difficult to get an ideal image in practical use. Therefore, parameter estimation based on distribution distance has been proposed as one of the estimation methods without ideal images.

The method estimates the optimal parameter pair from distribution distance between assumed noise distribution and residual noise distribution, and was proven to be effective in images registered with SIDBA (Standard Image Data Base). However, the method has two problems. The first problem is the degradation of the estimation accuracy in images with many edges. The second problem is long execution time caused by brute-force search. Our group had proposed a method using shape information of input image for the first problem and had shown the improvement of the image quality with the same images as the previous research. Thus, the purpose of this study is to shorten the execution time of parameter estimation.

Generally, even if the optimal parameter pair is not used, there are no practical problems if the image quality is sufficient. This study adopted local search to obtain a sub-optimal parameter pair. Two methods are examined to sustain the estimation accuracy. The first method is to adopt a new distribution distance function. The second method is to correct estimated parameter with regression line.

According to the evaluation, the local search drastically shortened the execution time. It became less than 1 second in low resolution images. The image quality was improved by changing distribution distance function from Hellinger distance (HD) to Symmetric Kullback-Leibler distance (SKLD). Moreover, the execution time of local search based on SKLD was shorter then HD. The image quality of the parameter pair corrected by the regression line was comparable to the optimal parameter pair. After the correction, though the image quality of SKLD became slightly lower than HD, SKLD still had an advantage of execution time.