Chapter 7

De-Noising of Binary Image Using Accelerated Local Median-Filtering Approach

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ABSTRACT
In the last few decades huge amounts and diversified work has been witnessed in the domain of de-
noising of binary images through the evolution of the classical techniques. These principally include
analytical techniques and approaches. Although the scheme was working well, the principal drawback
of these classical and analytical techniques are that the information regarding the noise characteristics
is essential beforehand. In addition to that, time complexity of analytical works amounts to beyond
practical applicability. Consequently, most of the recent works are based on heuristic-based techniques
conceding to approximate solutions rather than the best ones. In this chapter, the authors propose a
solution using an iterative neural network that applies iterative spatial filtering technology with critically
varied size of the computation window. With critical variation of the window size, the authors are able
to show noted acceleration in the filtering approach (i.e., obtaining better quality filtration with lesser
number of iterations).

INTRODUCTION
In real life often images are found within a noisy perspective, whether it is a camera shot image or printed
image of old books, newspapers or posters or even micro or distant vision instruments like microscope
or binoculars. In every case the human brain is able to filter the noise and extract out the object under
probe with spectacular efficiency may be with certain limitations. When the scale of the input rises
abruptly, human error tends to creep into the performance. Consequently, the authors resort to compu-
tational technologies in order to handle such problems. The computer obviously performs the execution
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faster than that of the human brain but unfortunately when people expect accuracy of the level of that of the human brain, they land up in an undesired output and hence our despair. Therefore the authors feel the need for intelligent computer vision for the accomplishment of such objective. Recent years have already witnessed growth in usage of digital images in dramatic proportions and as a result they play an important role in many image processing applications such as content-based retrieval.

Needless to mention that several classical techniques have evolved over the years aimed towards addressing the above. For instance there are some graph theoretic approaches presented in (Bhattacharyya S.et. al., 2014) that employs energy function optimization technology to solve image extraction problem. While (Bhattacharyya S.et. al., 2011) presents a graph cuts based active contours (GCBAC) approach to object segmentation, (Perlovsky L.I. et al. 1997) presents ratio contour as a novel graph-based method for extracting salient closed boundaries of interesting objects from noisy images. Although these methodologies seem to give satisfactory performances in some cases, but they clearly show their inefficiency in solving the image extraction problems in the case of complicated image conditions such as in cluttered image or noisy images etc. On the other hand human visual capabilities go far ahead in its efficiency of executing the same task.

RELATED WORK

Among various extraction approaches the ones that perform better are the ones that behave in accord with human visual perceptions. Itti et al. (Bhattacharyya S.et. al., 2014) presented an approach in which Multi-scale image features are combined into a single topographical saliency map and thereafter a dynamical neural network selects the attended locations in order of decreasing saliency. Ma and Zhang (Ma Y. and Zhang H.,2003) proposed a feasible and fast approach to attention area detection in images based on contrast analysis. The main contributions are generation of a new saliency map through a method based on local contrast analysis followed by simulation of human perception as a fuzzy growing method to extract attended areas or objects from the saliency map; and finally a practicable framework has been presented for image attention analysis.

Achanta et al. (Achanta R.et. al., 2009) introduced a method for salient region detection that outputs full resolution saliency maps with well-defined boundaries of salient objects. Their method exploits features of color and luminance, which is simple to implement, and is computationally efficient. Hou and Zhang (Hou X.and Zhang L., 2007) presented a model that is independent of features, categories, or other forms of prior knowledge of the objects. By analyzing the log-spectrum of an input image, they have extracted the spectral residual of an image in spectral domain, and proposed a fast method to construct the corresponding saliency map in spatial domain. However, nearly all existing saliency-based approaches suffer from the integrity problem, viz., the extracted result is either a small part of the object (referred to as sketch-like) or a large region that contains some redundant part of the background (referred to as envelope-like). Yu et al. (Yu H. et. al., 2010) have proposed a novel object extraction approach by integrating two kinds of “complementary” saliency maps (i.e., sketch-like and envelope-like maps). In the said approach, the extraction process is decomposed into two sub-processes, one used to extract a high-precision result based on the sketch-like map, and the other used to extract a high-recall result based on the envelope-like map. They have also proved experimentally that their approach outperforms six state-of-art saliency-based methods remarkably in automatic object extraction, and is even comparable to