



Effective solution for digital image edge detection based on artificial neural network

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Abstract— In this paper, an artificial neural network system is used to identify the edges of digital images. In the proposed method, for each pair of image in the database (original image and real edge), a table containing edge and non-edge records is extracted. Then using the k -mean clustering algorithm, the average number of non-edge records should be reduced. By reducing the volume of records, the information in the tables is combined together and the training table for the neural network is created. To test the neural network by grabbing a gray image, it is divided block wise and each block is delivered to the neural network as an input, the neural network gives the output value as an edge or non-edge pixel. To analyze the results, different various metrics have been used to evaluate the result of the proposed method compared to other methods. The results of the implementation show that the proposed algorithm performs better than comparable methods.

Keywords- edge detection, artificial neural network, k -mean clustering algorithm, and image blocking.

I. INTRODUCTION

In image processing using mathematical operations, features such as edges, curves and corners can be extracted from images, so analyzing the image space for machine is possible using these features. An edge can be defined as a set of contiguous pixel positions where an abrupt change of intensity (gray or color) values occur. Edges are the most common features of an image [1]. Edge detection is of fundamental important in image processing. From the mathematical point of view, the properties of an optimal edge can be determined by some factors. In practice, the system of the human brain perception plays an important role in deciding whether or not a pixel is edge. Moving this understanding into machine is a challenging issue. Images are given to the machine as data. In each of the edge detection

applications, it is first necessary that the input images are processed and edge detected to determine the edges of the image for expressing differences. As a result the existence of a powerful algorithm is essential to identify the boundaries of the image. In recent years, the issue of edge detection has always been a concern for researchers and a lot of work has been done in this regard [2]. Usually, each of these methods reveals only a part of the edges, and thus some of the real edges are not recognized by the algorithm. It is also possible that some points are classified incorrectly as edges. Since most edge detection algorithms extract edges as pixels apart, the edges around the objects in the image are disconnected, and some of them that extract the edges continuously generate additional edges [3]. Early edge detection algorithms such as Sobel [4], Canny [5], and Prewitt [6] are basically gradient-based. These algorithms can approximate the edge, but their ability to identify the edges of the images is not strong. Today, Canny and Sobel methods are one of the most widely used for edge detection [7] [8] [9]. In recent years, with the increasing accuracy of algorithms in image processing field, Meta-heuristic methods such as ant colony algorithm, genetic algorithm and the machine learning field for edge extraction are used [10] [11] [12].

Given that the meta-heuristic methods for edge detection have proven to be effective in detecting the edges, the disadvantage of these methods is that the edge map obtained is thick in most cases, the edge points are not carefully positioned, which limits their use in industrial applications or other applications. Generally, how many different edges can be revealed and how to identify a particular edge are still challenging issues. Artificial Neural Networks work well in many image processing applications such as programming, pattern recognition, and texture Segmentation. Artificial