The Note about Histograms

TangNing

Abstract—Histograms have been widely used in computer vision and image processing, the main uses of histogram include image enhancement, object recognition, and image retriavel. Histogram has been basically adopted as a fundamental tool for image enhancement. But in the past few decade, histogram-based feature despritors have been receiving increasing attention due to the appearance of Histogram of Oriented Gradient (HOG). This note is divided into three parts as follows. The first part primarily summarsizes some distinct histogram-related techniques and the relation among these various techniques. The second part explains the definiton of multiresolution histogram, this part will focus in comprehending the meaning of multiresolution. And finally, the multi-dimensional histogram is discussed in the third part.

1 Histogram-related Techniques

1.1 Histogram-based Image Enhancement

One of the simplest approaches to image enhancement is based on histogram, which is usually called histogram modification or histogram transformation. The traditional methods of histogram transformation can be classified as either global [2, 12, 15] or local [3]. Histogram stretch [1], histogram equalization [9], and histogram specification (histogram matching) [6, 11, 16, 17] are the common methods for histogram modification. Besides, there is a least popular manner named histogram hyperbolization [13], which could also manipulate the picture brightness levels to achieve the goal of image enhancement.
Histogram specification refers to a class of image transforms which aims to obtain images the histograms of which have a desired shape, and in Particular, obtaining a uniform histogram image corresponds to the well-known image enhancement technique called histogram equalization. Adaptive Histogram Equalization (local histogram equalization, or termed block-overlapped histogram

equalization) is an extension of histogram equalization where the image is divided into several smaller regions and these regions are locally equalizaed to obtain more local image details. To reduce the high computation complexity of this method, sub-block nonoverlapped histogram equalization can be used. However, this nonoverlapped histogram usually produces blocking effects in output image after enhancement. Therefore, partially overlapped sub-block histogram equalization has been proposed [8]. Contrast limited adaptive histogram equalization, another extension to ordinary adaptive histogram equalization, could limit its contrast and avoid amplified noise excessively in the image [18]. This feature could also be applied to globel histogram equalization, giving rise to contrast limited histogram equalization. These histogram-based techniques for image enhancement could even be stretched over two-dimensional histogram or more [4].

1.2 Histogram-based Descriptors

Histogram-based descriptors have been extensively used in computer vision.

1.2.1 Histogram-based Search

Histogram-based search is to tackle the problem of searching a template in a test image using the histogam-based representations. The well-known integral histogram is presented to easily and fastly compute histograms of all possible target regions in a given data, yet the computational cost and the requirement of memory for which are proportional to the number of histogram bins [14]. Another mean termed distributive histogram is based on fast median filtering, which outperforms the previous approach [10]. But the computational cost and memory requirement of the distributive histogram are still proportion to the number of histogram bins. Thus, other algorithms are presented such as a square-root sampling approach [5] and an extension termed min-space integral histogram of integral histogram [7].

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