

Hierarchical Indexing Images Using Weighted Low Dimensional Texture Features

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Abstract

This paper introduces a new method to analyse the image texture and to index the image database. We present a new strategy to reduce the computational time to extract image features with high retrieval accuracy. We also propose a method to reduce the image feature dimension, so any robust indexing methods can be used. By weighting the extracted image features, a system may perceive the image consistent with human perception. We use two spaces to keep the key images and the candidates images for an efficient indexing of the image database.

1. Introduction

Texture is an important component in the perception, classification, identification and segmentation of images for content based image retrieval (CBIR). A variety of techniques have been used for measuring texture similarity. Liu and Picard [22] calculated measures of image texture such as the degree of periodicity, directionality and randomness. Other methods of texture analysis for retrieval include the use of Gabor filters [2, 13] and fractals.

Texture queries can be formulated by selecting examples of desired textures from a palette, or by supplying an example query image. The system then retrieves images from an image database with texture measures most similar in value to the query.

There are three problems to solve: high computational time, handling high dimension data, and comparing images consistent with human perception. The first problem is the high computational time. Since texture has been recognized as an important feature for CBIR, many texture features have been proposed to precisely describe the natural texture properties. Among different texture features, one of the best texture-based feature analysis methods is the multi-resolution Gabor wavelet feature [2]. It can achieve the highest retrieval rate on the entire Brodatz texture database

test. However, the drawback of this method is the large computation time in feature analysis. We present a new strategy to compute an image feature with a high retrieval accuracy to reduce the computation time.

The second problem is to handle the high-dimension data. An image database management system needs a multi-dimensional indexing technique since the computed image features have high dimensions. One of the more robust methods, the R*-Tree works well up to 10 dimensions [15], but the overheads for using complex index structures are considerable. One solution to manage the high-dimensional database is to reduce the dimension, so any robust indexing methods can be used. We introduce a method to reduce the image feature dimension using the reward-punishment algorithm.

The third problem is that an ideal CBIR system should compare images in its database with the query in a manner that is consistent with human perception of visual features. We propose means to make the system perceive the image similar with human perception.

In this paper, we present a new image feature extraction with a high retrieval accuracy using Quasi-Gabor filters, introduce a method to reduce the extracted image feature dimension using the reward-punishment algorithm and to weight the extracted image features to make a system perceiving the image consistent with human perception.

The layout of this paper is as follows. In Section 2, we will explain the hierarchical indexing and the dimension reduction. In Section 3, we will describe the image retrieval. In Section 4, we will detail our experiments, and finally, in Section 5, the conclusions of this paper will be presented.

