Artwork Image Retrieval using Weighted Colour and Texture Similarity

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Abstract

We present a preliminarily study to investigate the effectiveness of colour and texture integration into the "query by content" problem for artwork. These combined features are particularly relevant for artistic paintings where both relate directly to the palette and brush style of the artist and the period/style of the work.

1 Introduction

Image retrieval has long been interpreted as *"query by keyword"* or basic "*qu*ery by content" based on specific object or class recognition. Here we investigate the "*query by content*" upon art paintings where we seek works with similar atheistic properties (colour choice, style, etc). This raises the issue of finding appropriate techniques to retrieve such works independent of subject – we seek works of similar artistic style, not of the similar scenes or objects. Prior work in this area appears limited to the consideration of colour [1, 2] or current compression encoding technologies [3].

Here we consider the construction of a colour and texture vector description for each image upon which a weighted K Nearest Neighbour (KNN) is then used to investigate the relative colour/texture importance in artwork retrieval.

2 Colour Descriptor

Colour features are based on multiple image colour spaces: RGB, HSV, Lab [1,2]. From these three (three channel) spaces we obtain nine histograms – one for each channel of each colour space channel of the image. These resulting normalised distributions are then each compared using six distances (Euclid., Manhattan, Correlation, Chi-square, Intersection, Bhattacharyya) between any two images. In total this results in a 54 point vector (3 spaces * 3 channels/distributions * 6 distances) describing the colour distribution distance between any two images.

3 Texture Descriptor

The texture descriptor is extracted by combining two established texture discriminators.

3.1 Grey Level Co-occurrence Matrix (GLCM)

GLCM is established as one of the most prominent texture retrieval methods in terms of retaining the "busyness" and orientation of the textural components [4]. Here, we sub-sample this descriptor to calculate only the two most dominant co-occurrence matrices directions for a given image based on simple chi-square analysis. The standard energy, entropy, contrast, homogeneity and correlation in these two directions are then calculated [4].

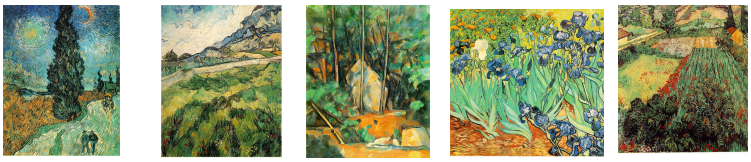
3.2 Laws Texture Energy Approach

For increased precision we also utilised Laws' textural approach with nine different 3x3 filters. A histogram is then constructed from the energy estimation of the resultant filtered images (Gaussian smoothed). These histograms are then compared (Manhattan) to those of a texture reference image.

In total a combined 20 point texture descriptor vector is constructed from both approaches (10 GLCM + dominant direction indicator, 9 Laws distances).

4 Results

Based on a user query image and relative colour to texture weightings we can see the following results ranked by distance in descriptor space (Figs. 1-3)



Query *Van Gogh* | **1st result** *Van Gogh* | **2nd result** *Cezanne* | **3rd result** *Van Gogh* | **4th result** *Van Gogh*

Figure 1: A ratio of 100% colour - 0% texture

Query *Ardon* | **1st result** *Matisse* | **2nd result** *Shahn* | **3rd result** *Clemente* | **4th result** *David*

Figure 2: A ratio of 50% colour - 50% texture

Query Posada | **1st result** Sohlberg | **2nd result** Roussea | **3rd result** Hals | **4th result** Hausmann

Figure 3: A ratio of 0% colour - 100% texture

A change in the relative colour/texture weighting provides a similar change in retrieved works within the bounds of "artistic similarity" (notably some correlation in period, style, artist is maintained). This contrasts with colour based studies [1,2] to support the importance of texture in this domain [3]. Overall we show how texture can play a significant role in artwork retrieval in addition to purely colour based methods.

Future work: primary shape similarity, art specific textures.

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