Pattern Keys Investigation for Content-Based Image Retrieval System

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Abstract – **An approach to search images from a databases by structural features got from the three stages clustering algorithm is considered. Image key forming investigation for visual pattern processing is presented.**

Keywords – **clustering, content-based image retrieval, structural properties, visual pattern.**

I. INTRODUCTION

The existent universal content-based image retrieval (CBIR) systems attribute to one of three categories depending on approach of extracting features: a histogram, coloured location, and region-based. A successful categorization of images will greatly enhance the performance of CBIR systems by filtering out images from irrelevant classes during matching.

II. CBIR PROBLEM

In general, the content-based image retrieval problem is to create a image set that are relevant to the user's image-request, arranged in order of decreasing relevance, and the need to choose the optimum between the minimization and maximization of relevance images [1, 2].

We describe a mathematical model of the image search and introduce some basic concepts:

1. The set P of all images in a database, consisting of n images classes:

$$P=\{P_1,P_2,...,P_n\}=\{\{p_{11},p_{12},...,p_{1k}\},...,\{p_{n1},p_{n2},...,p_{nm}\}\} \quad (1)$$

2. I set with corresponding images indices:

$$I=\{I_1,I_2,...,I_n\}=\{\{i_{11},i_{12},...,i_{1k}\},...,\{i_{n1},i_{n2},...,i_{nm}\}\} \quad (2)$$

Each index represents a set with image keys number g, where each key is a set of r image features:

$$i=\{i^1,...,i^g\}=\{\{k_1^1,k_2^1,...,k_{r_1}^1\},...,\{k_1^g,k_2^g,...,k_{r_g}^g\}\} \quad (3)$$

3. Input user's image-query p_u, belongs to a P_w class:

An optimization problem is to find images set P_{res} by the user's image query p_u:

$$P_{res}(p_u)=\{\{p_{11}(i_{11}),...,p_{1q}(i_{1q})\},...,\{p_{v1}(i_{v1}),...,p_{vs}(i_{vs})\}\} \quad (4)$$

that satisfies the following conditions:

$$d(i_u(p_u),i(p))\to\min,\ f(P_{res},P_w)\to\max,\ \ p\in P, i\in I, \quad (5)$$

$$v\to\min,\ \overline{q,s}\to\max,\ \ t\to\min, \quad (6)$$

where: d − a distance function between the key features of an image query p_u and image p in the database; f − a similarity function (relevance) of classes P_1, ..., P_v result set on the P_{res}-class image query P_w; v − number of resulting classes image; q, s − the number of images in each result class; t − the receipt time of the result set; $p(i)$ (or $P(I)$) − in general, means of obtaining p (or image group P) from the database by an index i (group index I); $i(p)$ (or $I(P)$) − generally means getting index i (or building new if absence in the repository indexes) (group index I) for the image p (image group P).

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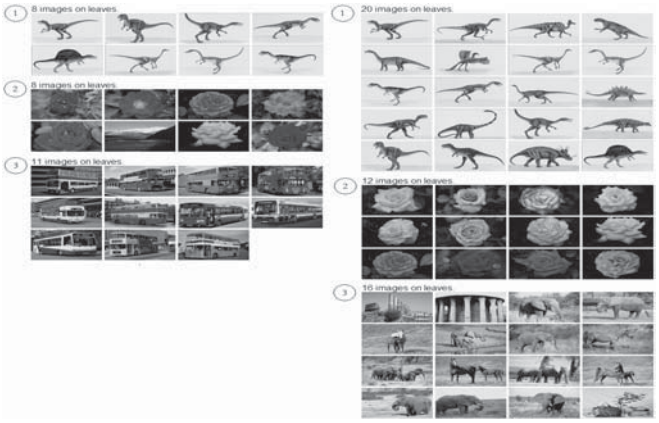
III. PATTERN KEYS INVESTIGATION

For image indexing investigation a set A with 3×8=24 pattern features and set B with 3×8+2=26 pattern features were took:

$$A=A\{BI_D(C, XY), BI_D(CR, XY), BI_D(IA, XY)\} \quad (7)$$

$$B=B\{CR, IA, C_D(XY), CR_D(XY), IA_D(XY)\} \quad (8)$$

Fig.1 illustrates classification result for 3 semantic groups: dinosaurs, flowers, busses and animals (lions + elephants).



(a) (b)

Fig.1. Clustering results for pattern feature sets A (a) and B (b).

IV. CONCLUSION

An approach to solving content-based image retrieval problem using 4-D structural features obtained as a clustering result, allowing comparison with other approaches to improve the search images quality is developed.

New three-stages clustering algorithm based on the classical hierarchical agglomerative algorithm, which unlike the known methods, is adaptive to the characteristic images features when looking at database is designed and developed.

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