High Level Semantic Retrieval in Web Based Art Painting Digital Repositories

Peter Stanchev, Phillip Ein-Dor,
Krassimira Ivanova, Iliya Mitov

Kettering University
The Academic College of Tel Aviv
Institute of Mathematics and Informatics, BAS

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Introduction

Current search engines headed by Google are in the centre of our information age.

For instance, Google answers daily more than 200 million queries against over 30 billion items.

The search power of these engines is typically limited to text and its similarity.

Since less than 1% of the Web data is in textual form, the rest being of multimedia/streaming nature.

The new search machines must combine search according to textual information or other attributes associated with the files with abilities of extracting information from the content, which is scope of action of Content-Based Image Retrieval (CBIR).

Art Painting Digital Repositories

Creators:

- academic, librarian, commercial, private art museums and galleries,
- amateur and professional art historians,
- artist sites, commercial image agencies, auction houses (usually on a temporary basis),
- etc.

Art Painting Digital Repositories

Different task in the field of digitalization of Fine Arts, such as:

- *Vasari* (1989-1992) and *Marc* (1995-1996): digital acquisition, storage and handling of colorimetric high-definition images of paintings for galleries and museums in Western Europe
- *Crisatel* (2001-2004): equipment for making spectrometric analysis of varnish layers
- *FingArtPrint* (2005-2008): creating a unique data record of the object for checking its authenticity.

Art Painting Digital Repositories

Projects and initiatives for establishing image repositories:

- *Narcisse* (1990-1992): very high digitized image bank, supervised by a multilingual text database;
- *Artiste* (2000-2002): developing of an integrated art analysis and navigation environment aimed at supporting the work of professional users in the fine arts.

Europeana

- funded by the European Commission and the member states
- born in 2005
- to make European information resources easier to use in an online environment
- multicultural and multilingual environments with technological advances and new business models
- Europeana.eu went live on 20 November 2008
- till now more than 6 millions digital items are available

✓ Images – paintings, drawings, maps, photos and pictures of museum objects

✓ Texts – books, newspapers, letters, diaries and archival papers

✓ Sounds – music and spoken word from cylinders, tapes, discs, radio broadcasts

✓ Videos – films, newsreels and TV broadcasts

MPEG 7 descriptors

Created by the Moving Picture Experts Group (MPEG) [ISO/IEC JTC1/SC29 WG11], formed by the ISO in 1988 to set standards for audio and video compression and transmission.

MPEG-7 standard ISO/IEC 15938, named "Multimedia Content Description Interface" [ISO/IEC 15938-3], which provides standardized core technologies allowing the description of audiovisual data content in multimedia environments.

- Scalable Color (SC) represents the color histogram in the HSV color space, encoded by a Haar transform
- Color Layout (CL) specifies the spatial distribution of colors using YCbCr color space.
- Color Structure (CS) specifies both color content and the structure of the content.
- Dominant Color (DC) gives the percentage of each quantized color in observed area
- Edge Histogram (EH) specifies the spatial distribution of five types of edges in local image regions
- Homogeneous Texture (HT) characterizes the region texture using the energy and energy deviation in a set of frequency channel

Vector quantization approach

The proposed approach [Ivanova et al, 2010]:

- the images are tiled into non-overlapping rectangles to capture more detailed information;
- the tiles of the images are clustered for each MPEG-7 descriptor;
- vector quantization is used to assign a unique value to each tile, which corresponds to the number of the cluster where the tile belongs to, in order to reduce the dimensionality of the data.

Program realization

The proposed algorithm is realized as a research tool in the laboratory for art-painting semantic image retrieval "Art Painting Image Color Aesthetic and Semantic" (APICAS).

As a knowledge analysis tool PGN-1 classifier, which is realized in the data mining analysis environment PaGaNe [Mitov et al, 2009] is used.

Experiments

Dataset includes 90 paintings of 7 Israel contemporary artists, from Givon Art Gallery (www.givonartgallery.com):

Nurit David (23),

Maurice Ganis (13),

Moshe Gershuni (15),

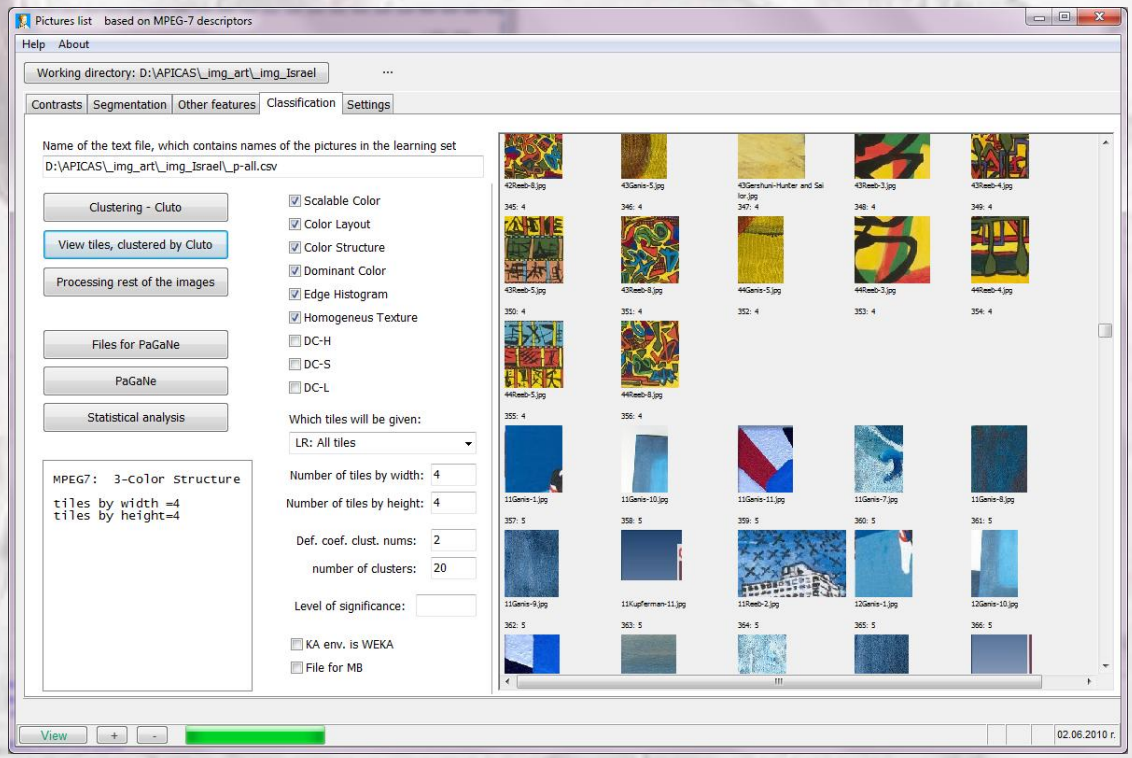
Moshe Kupferman (12),

Raffi Lavie (10), David Reeb (12),

Pesach Slabosky (5).

The background of the slides are painting from Moshe Gershuni .

Experiments



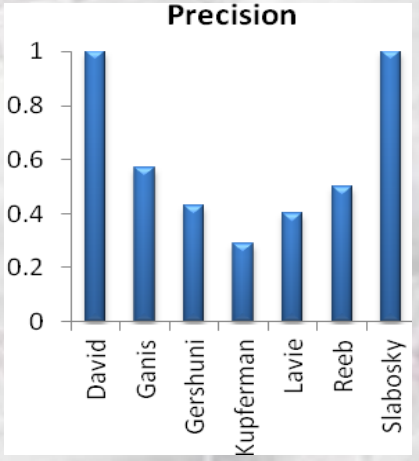
Visualization of tiles grouped by cluster labels for Color Structure Descriptor

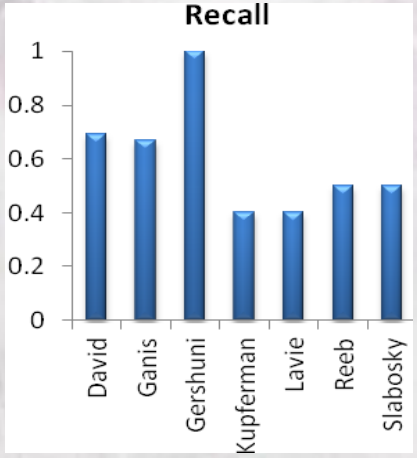
As a result each image is represented by a feature vector with 6x4x4 numerical attributes, where 6 is the number of MPEG-7 descriptors and 4x4 is the number of tiles.

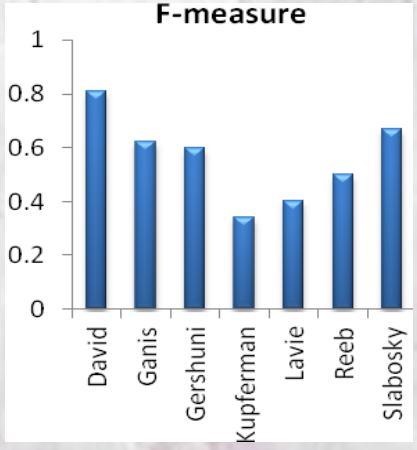
Experiments

The received dataset was split equally into learning and test sets, which are given as input in PGN-1 classifier.

The overall classification accuracy was 59.09%.







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