A COMPARATIVE ANALYSIS OF LOW LEVEL FEATURES EXTRACTION FOR CBIR

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Presentation Overview

• Introduction
• Research Background
• Research Objectives
• Research Scopes
• Research Methodology
• Low Resolution Documents Identification and Segmentation

• Visual Signatures
• Conclusion and Future Research
• Q & A, Discussion
1.0 Introduction

Idea

Illustrations
1.0 Introduction cont.

- Necessity of Video Database Management System
  - Increase in the amount of multimedia data.
  - Lack of tools for visual signature of low resolution image

- In education world
  - Need efficient way to handle and navigate large scale multimedia data.

- Flexibility in retrieval of Video Databases
  - Use of images as QBE
2.0 Research Background

- Applications:
  - Industrial
  - Academic

- In Academic, large documents in lecture / meeting / conferences
  - images
  - Videos
Problem Statement

- Digital content has become a significant and inevitable asset.
- Photo captured can be linked to the recorded presentation videos.
  - Overcome problem Imaging Device for QBE
    - low-resolution
    - positioning of the capture devices.
3.0 Research Objectives

The objectives of this research are:

➢ To examine and analyses different CBIR techniques’ low-level features and establish a comparison of their performance as tools that can be used with low-resolution CBIR.

➢ To enhance the extraction of layout feature and spatial feature through making use of new techniques, which utilize a simple matching process in the process of retrieving images in order to see into it that they can be indexed in an easy manner and as a result, searched.

➢ To create a fusion technique that is multi-technique in nature that makes use of simple techniques in order to ensure enhanced performance as compared to that of the techniques that are already in existence.
4.0 Research Scopes

- The proposed feature-based segmentation technique considers the stability rather than changes in video sequences.
- The technique does not require any document identification methods to confirm the change in video sequence.
- The video key frame will be extracted based on slide presentation.
4.0 Research Scopes Cont.

Example of recorded presentation videos

Audiovisual properties
1. Presenter moving pointing whiteboard or screen
2. Use of speech
3. Use gesture to support speech
4. Use of slide words

Slide properties:
1. High Quality without cross/blocking
2. ROI with text or ROI without text
3. Link / synchronized to audiovisual
4. Background and layout may change between slides
Background information

1. Content-based Image Indexing and Retrieval

Content-based image retrieval framework [Remco and Tanase, 2000].
6.0 Research Methodology

CBIR System Implementation

Front Office

User Interface
- Visualisation
- Query Formulation

Image Query

Retrieval Part

Matching Engine

Feature Extraction

Pre Processing

Archival Part

Index

Database
- Videos, Images
- Feature Vector

Back Office

Ranked Results

Pre Processing

Videos, Images
7.0 Low Resolution Documents Identification and Segmentation

Figure 3.12: (a) original image with noise. (b) noise removal image resulted
7.0 Low Resolution Documents Identification and Segmentation

Figure 3.16: Otsu segmentation: (a) original slide document, (b) output of Otsu segmentation.
7.0 Low Resolution Documents Identification and Segmentation

Figure 3.17: RLSA algorithm (adapted from Behera).
Figure 3.18: Output of the RLSA: (a) horizontal direction, (b) vertical direction and (c) combining both the directions.
Figure 3.19: Otsu segmentation: (a) original slide document, (b) output of Otsu segmentation.
Figure 3.20: Flowchart of text extraction.
Figure 3.21: The extracted text; (a) result for OCR of a binarised frame. (b) connected components.
9.0 Visual Signatures

Figure 4.1: Overview of Feature Extraction part in CBIR system
9.0 Visual Signatures Cont.

- **Color**
  - Histogram of RGB
  - CCV
  - EE of KDE
- **Shape**
  - Hu Moment
  - Zernike Moment
- **Layout**
  - Histogram Textual Layout
  - Weights of Content
  - Minimum Spanning Tree and Text Profiles (MSTTP)
Figure 4.2 The estimation of (a) the Kernel density of an original slide document, (b) a slide image output from a projector, and (c) a rectified image taken by a digital camera. Source: A. Behera, 2007.
9.0 Visual Signatures - Colour

Figure 4.3: The EE of reduced colour rg from global colour RGB.
Figure 4.4: Comparison Average Interpolated Recall-Precision Graph of Colour Descriptor Colour Histogram (Hist), Colour Coherent Vector (CCV) and Equivalent Ellipse Density Estimation (EE)
9.0 Visual Signatures - Shape

Figure 4.5: Comparison Average Interpolated Recall-Precision Graph of Shape Descriptor on Hu Moment (HM), Zernike Moment (ZM) and MSTSP (without layout)
9.0 Visual Signatures – Textual Layout

(a) Captured slide image      (b) extracted text lines      (c) line profiles

Histogram of textual lines profiles
9.0 Visual Signatures – Textual Layout

Weights for each features Text, Graphic, Bar, Bullets
Figure 4.8 Frequency Distribution of Connected Components per Sentence
9.0 Visual Signatures – Textual Layout

Figure 4.9 classify horizontal words into three categories: short, medium and long sentences.
9.0 Visual Signatures – Textual Layout

Figure 4.10: Low Resolution Document

Figure 4.11: Nodes and its Edges
9.0 Visual Signatures – Textual Layout

Figure 4.12: Edge and its weights

Figure 4.13: MST Cost
9.0 Visual Signatures – Textual Layout

Figure 4.14: Comparison Average Interpolated Recall-Precision Graph of Layout Descriptor on Layout Histogram (Hist), Layout Weightage and Proposed Layout Visual Signature (MSTTP)
Layout Result Example.
10.0 Conclusion

• Building blocks of CBIR system
  ➢ CBIR system create image database and colour, shape layout features. In addition, the program, which operates the CBIR system, is called the CBIR operation.

• User Interface
  ➢ A collection of GUI tools.

• Indexing and Structuring of Visual Signatures
  ➢ CBIR colour feature
  ➢ CBIR shape feature,
  ➢ CBIR layout feature (good result)
Allowed efficient and effective search and retrieval

The use of an image distance measure

It suffers from several problems including image segmentation, extracting features based on the images that capture the semantic and perceptual meanings, and matching all images in a database to a query image

The problem of large-scale image databases with effective indexing and searching

Methodology
Fusion Strategies

➢ There are two types of fusion strategies implemented in our system. These are early fusion (Liu, Zhang, Lu & Ma, 2007) and late fusion (majority voting) strategies (Liu, Zhang, Lu & Ma, 2007).

➢ Early Fusion

➢ **Late Fusion (Majority Voting)**

➢ **Proposed Late Fusion (Majority Voting plus Global Colour Clustering)**
Late Fusion Strategy

Image Features Extraction

Global Colour Features Clustering
- Feature Vector
  - \( C = 1 \)
  - \( k = 2 \)

Shape Features Segmentation
- Feature Vector
  - \( C = 2 \)

Graphic
- Feature Vector
- Textual
- Layout

Retrieving

Fuse Feature Vectors
Bibliography


Thanks for your attention

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