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Multimedia Content Analysis and Mining

International Workshop, MCAM 2007
Weihai, China, June/July 2007
Proceedings

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Preface

Welcome to the International Workshop on Multimedia Content Analysis and Mining, MCAM 2007. Our workshop gives a snapshot of the current world-wide research in multimedia analysis. Through recent advances in computing, networking, and data storage, multimedia will create new interesting technical possibilities in a wide range of fields, such as entertainment, commerce, science, medicine, and public safety. To benefit from this potential, developers need reliable techniques for the analysis, search, and management of multimedia data, as well as distributed system architectures in which these techniques can be embedded to effectively help the users.

Recently, there have been many workshops and meetings dedicated to Multimedia, but most of them followed the standard pattern consisting mainly of oral and poster presentations. We all feel that there is a need for a meeting that really is a workshop, i.e., one that provides a lot of opportunities for discussions and dissemination. Consequently, the format of the workshop consists of 4 panels on hot topics in multimedia followed by discussions and poster presentations. The topics of the panels are: Multimedia Analysis and Applications, Multimedia Search and Mining, P2P Streaming, and Security. This volume contains a number of invited contributions from experts in the area as well as the selected regular contributions.

This year 139 submissions from 13 countries were submitted and 46 were accepted for presentation at the conference after being reviewed by the Program Committee members.

We would like to thank all members of the Program Committee, as well as the additional referees listed below, for their help in ensuring the quality of the papers accepted for publication. We would also like to thank the Organizing Committee for all their efforts in making this workshop happen.

April 2007

Nicu Sebe
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Invited Contributions

Regular Contributions

Multimedia Analysis by Learning

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Abstract. In this presentation for the panel at MCAM07, I put forward the transition of modeling the world as was done on a large scale in computer vision before the year 2000, to the current situation where there have been considerable successes with multimedia analysis by learning from the world. We make a plead for the last type of learned features, modeling only the scene accidental conditions and learning the object or object class intrinsic properties. In this paper, in respect to contributions by many others, we illustrate the approach of learning features by papers from our lab at the University of Amsterdam.

Keywords: multimedia analysis, invariants, learning, concepts.

In any sensory data analysis system, defining the problem at hand may already be half the solution. If looking into the history of computer vision, scene segmentation was redefined many times both in its place in the processing chain as in what it actually is. It can be said that any essentially new type of segmentation algorithms brings along a new definition of what segmentation actually is. Every new formulation of the problem brings along the appropriate class of data to work on, the list of goals to achieve precisely, the appropriate evaluation measure(s), and the appropriate set of previous methods to compare it to.

Let us consider the most trivial algorithm for segmentation: thresholding the intensity values. The goal is usually to localize the edges of the object precisely. Effectively this solves the problem of finding concatenated blobs of globally conspicuous intensity value(s). It could work on data like multi-spectra data, infra-red cameras, uniformly colored suits, non-black objects on a black conveyer belt, and other circumstances when there is a proper reason why a single set of intensity values would stand out from the rest. A proper evaluation measure is the number and position relative to the edge of the result relative to the reality. The list of methods to compare it to these days would include edge-based methods like snakes of Witkin and Duncan with built in edge smoothness criteria – when the result has to be accurate - and probabilistic shape profiles of Cootes and Taylor with built in edge knowledge when the result has to have a high probability of belonging to a class of shape with known variety. Alternatively, a region-based method can be chosen when the object has a fixed shape and a uniform background but carries high levels of noise. What is important here is to conclude that each of these various sophistications solve a slightly different problem depending on the amount of a priori knowledge or a priori information of the task or of the data which go into the solution.

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In general, the current distinction is between the following two alternatives:

- an a priori model instantiated with problem-dependent constraints to which the solution in its match to the data should adhere in order to qualify for a result, or
- a learned set of observed instances to which an instance matched to the data demonstrates similarity, sufficiently so to call it a good result.

A good example for the first one is the snake model with a priori but generic integral constraints on smoothness and edge strengths. A good example for the second class is the probabilistic shape model assigning a probability to the shape. See also [1] for a combination by functional data analysis.

In the literature, a shift can be observed from modeling to learning. And the shift comes for good reasons. Modeling in essence is an abstract generic rule set derived from reality. To understand the world in a small set of rules is the ideal since the birth of civilization, hence a very praiseworthy endeavor. But for sensory data processing it remains to be seen whether the model as assumed is indeed valid in all circumstances or whether such kinds of models exist at all. When learning from sufficiently large datasets [6], in any rate it is clear that the data are realistic and so is the solution. So, by choosing the road of learning to analysis at any rate the solution is reality proof.

The shift from modeling to learning comes in a time when ordinary sensors turn digital, storage is no limitation, work processes in routine use build large scale digital repositories and even the processing power to perform the machine learning on have become available.

What is valid for the example of segmentation also holds for compression, although here the list of different goals per type of method is smaller. The same holds for image processing tasks as image enhancement and image repair. Where machine learning always provides a growing capacity in their sets of tools, they have achieved a level of general applicability in computer vision. Given the achievements on these disciplines, the attention shift towards features once more, as features are the essence of analysis.

There is no reason to deviate from the usual division of features. In the core we have intensity, color and multi-dimensional intensity feature values. They may be supported by Gaussian smoothing over a neighborhood of N x N pixels reducing their noise characteristics but not their intent to measure a point property. Spatial filtering is necessary for obtaining differential Taylor expansions of the image field but still it is best to think of it as a point property.

In the second place we have texture features measuring image distributions orderly – as a regular pattern usually by Gabor filters – or un-orderly by statistics of histograms of the above point properties [3] The region over which the texture field is measured is usually data driven expanding a seed as long as the data show spatial coherence or alternatively a mesh of fixed regions is imposed on the image field a priori. SIFT by Lowe and related features by Schmid can be seen as a sparse feature set of regions measured around conspicuous points in the image.

In the third place we have global features. Some of them are arrived at through a global transform taking the average over the image. This may be done over the point feature values as hinted at above, or it may be a summarization or averaging of regional feature values.