

Segmentation of Semantic Regions in Personal Image Collections

Stefanie Nowak

Fraunhofer Institute for Digital Media Technology IDMT, Germany

Introduction:

One challenging goal in the context of content-based image retrieval and semantic metadata enrichment, is the automatic extraction of semantics in images. Most problematic is the mapping of the image inherent attributes to a semantic interpretation of the image, the human brain performs autonomously. Recent research proposes two different methods, either solving the problem implicit by applying machine learning algorithms or explicit by utilizing ontologies or knowledge infrastructures to model rules and concepts. Both approaches only achieve satisfying results adopted to narrow domains. Frameworks for semantic image retrieval, combining both techniques, offer a promising perspective regarding broader domains, but still deliver insufficient results.



First Steps:

Our research focuses on expanding a low-level feature based image retrieval application to a higher conceptual stage. Therefore, in the first instance, we apply a graph-based segmentation approach to gather information about regions in images. [1] Initially every pixel in the image represents its own region in the graph. Iteratively, regions are merged through application of a cost function, by merging the two regions with lowest costs at first until a defined number of regions results. The used criterium is computed in dependance from the mean colour and the region size of the considered regions. Below, there are three images taken from the Corel dataset together with the segmentation results displayed. The used number of regions is mentioned in the right corner of the image.



Next Steps:

Adamek et. al. [2] propose a cost function composed of "syntactic features" with the goal to extract large regions from images but at the same time covering only one semantic area. These features try to represent the homogeneity, regularity, compactness and inclusion of regions. This cost function will be integrated into our segmentation algorithm. From the resulting segmented regions, low level features (edge, colour, texture features ...) will be extracted and classified. With the help of the principal component analysis and the linear discriminant analysis, clusters representing different semantic areas will be build and associated to the area.

Goal:

The overall goal is to implement a generic framework for semantic image analysis. The focus lies on employing semantic concepts that are independent from domains as far as possible. To achieve this, different relationships will be investigated and converted into a concept. These concepts will be structured in a concept hierarchy. The focus lies on the relationship between a) content of images and annotations, b) content of images and the context to metadata, c) content of images and the context to the real world and d) content of images and affect. The here presented segmentation algorithm is one approach to investigate the connection between image content and annotations.

Literature:

- [1] Cooray et al.: Semi-automatic video object segmentation using recursive shortest spanning tree and binary partition tree, In: WIAMIS 2001 - Workshop on Image Analysis For Multimedia Interactive Services, 2001
- [2] Adamek et. al.: Region-based segmentation of images using syntactic visual features, In: WIAMIS 2005 - Workshop on Image Analysis For Multimedia Interactive Services, 2005

