Department of Computer and Informatics Engineering
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Subject: Report to the doctoral thesis "Advanced Moment-Based Methods for Image Analysis" by RNDr. Cyril Höschl

General Comments

This doctoral thesis deals with the development of advanced image analysis methods based on the moments' theory. The outcomes of the research executed during this dissertation were published in three scientific journals and four international conferences, while one journal paper is currently under review. It is worth to note that the journals and the conferences where the work of this thesis was published in of very high impact and reputation, while they constitute a common room for discussion among the scientists working in the fields of moments and image analysis and recognition. Without any doubt this is an import achievement.

Detailed Comments

This thesis includes a research work executed along two main directions. The first direction is the study and development of optimal binary image decomposition algorithms, able to provide a compact block representation of the images as a way to accelerate the moments' computation.

Initially, a survey and a comparison of image decomposition algorithms were developed and their performance in moments' computation was analyzed. This work was very constructive for the researcher towards the development of a new decomposition algorithm for the case of 3D shapes. Moreover, the survey is very useful for the scientists working in the field of moments, for accelerating the computation of the moment features into their applications. The second achievement of the research in this direction was the development of optimal 3D image block decomposition method. The developed algorithm is very useful, since there are several modern applications e.g. virtual reality, medical imaging, based on the processing of 3D volumes of data. The contribution of the thesis as far as the research in image decomposition is concerned, is important for many disciplines e.g. graphics, computer vision, image analysis.

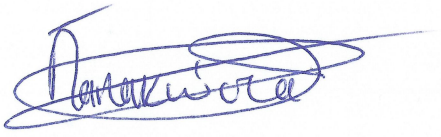
The second research direction of the thesis is along the development of novel moment blur invariants, which are robust to noise and also invariant to translation, rotation and scaling transformations. These new invariants are very useful in image recognition applications, where noisy environments and geometric transformations of the object under recognition, cases need to be handled. The

development of these moment invariants constitutes a substantial contribution of this thesis, since no other such invariants was proposed in the literature in the past. As a consequence of the work in moment invariants, the researcher applied them in image retrieval. However, the way these invariants were applied is very novel, since instead of describing the content of the images, in this thesis the description of the images' histograms with moment invariants was proposed. This technique embodies invariance properties to the histograms and thus enables the retrieval of (not) degraded images using (not) degraded query image.

Final Statement

I found this thesis with substantial contribution to the theory of moments and their applications as well. The novel 3D image decomposition guaranteed optimal image decomposition in rectangular blocks constitutes a useful tool not only for accelerating the moments' computation but for several image processing algorithms. The work in blur, noise, translation. rotation, scaling moment invariants constitutes one of the most important contributions in moment theory for the last ten years. The application of the moment invariants to the image histograms is a breakthrough not only for image retrieval but also to any application that uses image histogram to describe a pattern e.g. forensics, computer vision.

I feel very privileged for reading the source of this work but most of all for sharing my scientific comments to this highly scientific thesis, with other scientists working in the field of image moments.



Signed: Prof. George Papakostas (Head of Visual Computing division)

EMaTTech, Kavala, Greece, November 15th, 2017