

Selected publications

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1. Hamid LAGA, M.Nakajima, and K.Chihara, **“Discriminative Spherical Wavelet Features for Content-based 3D Model Retrieval”**, International Journal on Shape Modeling, Vol.13, No1, pp. 51-72, June 2007.
 - **Best Paper Award at** IEEE International Conference on Shape Modeling and Applications SMI’2006.
 - **International CG Paper Grand Prix Award, Best Paper Award (2008)**, the Society of Art and Science Japan.

This paper deals with the problem of extracting global features that allow to discriminate between 3D models. The main contributions are: (1) a new spherical parameterization methods that maps the 3D shape features onto a unit sphere, and (2) A set of spherical wavelet features extracted from the spherical representation of 3D shapes and used for estimating the similarity between two 3D models. This research spans several fields such as Digital Geometry Processing, Pattern Recognition, and Information Retrieval. The conference version of the paper received two awards.

2. Sofiane Yous, Hamid Laga, Kunihiro Chihara, **“GPU-based Shape from Silhouettes”**, in the 5th International Conference on Computer Graphics and Interactive Techniques in Australasia and South East Asia GRAPHITE 2007, Australia, pp.71-77, Nov. 2007.

This work in collaboration of Dr. Sofiane Yous deals with the problem of real-time 3D reconstruction for 3D video applications. In the context of 3D video project of Nara Institute of Science and Technology, a cluster of 128 PCs has been used for 3D reconstruction. We proposed in this paper to replace the cluster of PCs with one PC equipped with a Graphics Processing Unit achieving real-time 3D reconstruction.

3. Sofiane Yous, Hamid Laga, Kunihiro Chihara, **“People Detection and Tracking with World-Z map from a Single Stereo Camera”**, in the 8th International Workshop on Visual Surveillance, ECCV 2008 Workshop, October 2008.

In this paper, we proposed a new algorithm for 3D people tracking in complex environments. The algorithm operates on 3D range data which can be obtained using passive sensors, such as a stereo camera, or active sensors, such as TOF cameras. We introduced the concept of World-Z map which allows robust people segmentation in the presence of high occlusions. A patent is pending, and videos demonstrating the system are available at:

<http://www.img.cs.titech.ac.jp/~hamid/publications/VS2008/PeopleTracking.html>

4. Hamid Laga and Masayuki Nakajima, **“Supervised Learning of Salient 2D Views of 3D Models”**, the Journal of the Society for Art and Science, Vol. 7, No.4, pp.124-131, 2008.
 - **Best paper award at** NICOGRAPH 2007 Paper Contest – Japan.

5. Hamid Laga, **“3D Shape Classification and Retrieval Using Heterogenous Features and Supervised Learning”**, in Machine Learning, Chapter 15, pp. 305-324. ISBN 978-953-7619-56-1. Publisher: IN-TECH, January 2009.

This chapter develops an effective 3D shape classification and retrieval method that uses discriminative shape features automatically selected from a large set of heterogeneous features. The construction of the representative set can be regarded as a machine learning task. Particularly, supervised learning allows capturing the high-level semantic concepts of the data using low-level geometric features. Our key idea is to use a large set of local and global features, eventually not orthogonal, then use a supervised learning algorithm to select only the most efficient ones. We experimented with AdaBoost which provides a mean for feature selection and classifier combination. Boosting, like many machine-learning methods, is entirely data-driven in the sense that the classifier it generates is derived exclusively from the evidence present in the training data itself. Moreover, allowing redundancy and overlapping in the feature set has been proven to be very efficient in recognition and classifications tasks than orthogonal features. Specifically, we make the following contributions:

- An algorithm for learning the discriminative features of a class of shapes from a training set. The algorithm allows also quantifying the discrimination ability of a shape feature with respect to the underlying classification. Features of high discrimination ability of each class of shapes will be used for processing unseen objects (classification of the query, and retrieving the most similar shapes to the query).
- A method for matching shapes using only the most relevant features to each class of shapes. This approach can be used with either a flat or a hierarchical classification of the data resulting in a multi-scale organization of the feature space.
- The ability to use heterogeneous features for classification is a major deviation from previous work.