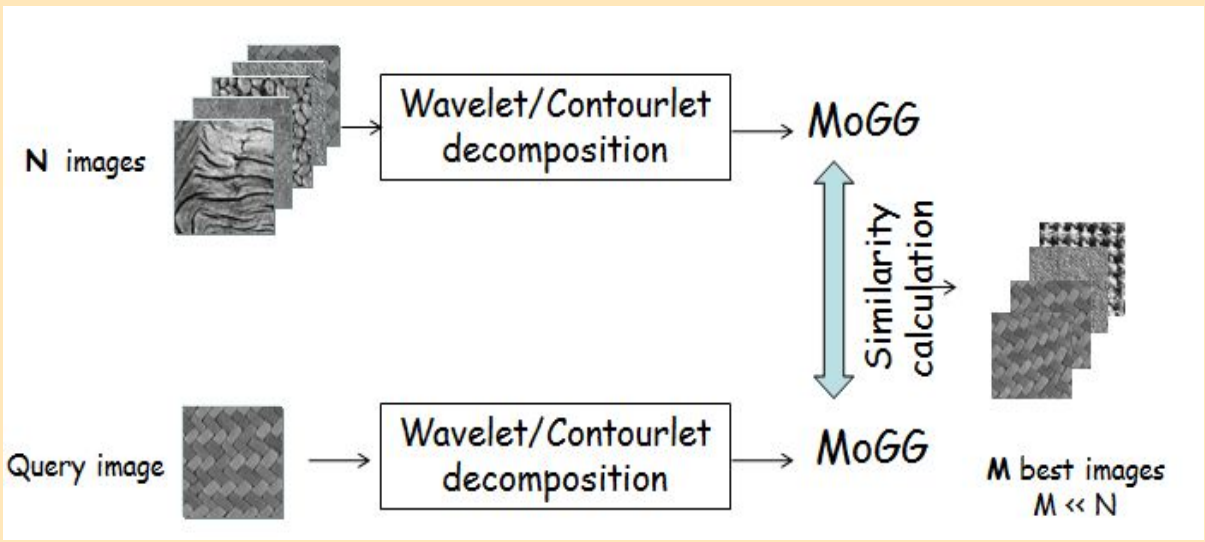
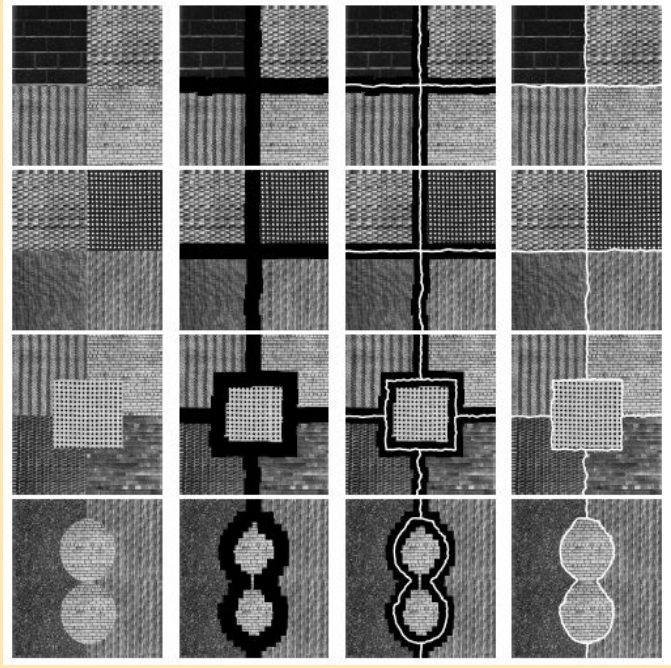
Texture modeling and discrimination

Texture analysis and representation play an important role in visual perception. As such, texture information is used in several computer-vision, remote-sensing, medical-imaging and content-based image retrieval applications. In this research, we focus on building new statistical methods based on finite mixture models for wavelet/contourlet coefficients representation. Recently, we used the MoGG formalism for wavelet/contourlet coefficients modeling. MoGG gathers the advantages of using the Generalized Gaussian Density (GGD) and mixture modeling to provide a powerful tool to fit multimodal data histograms with heavy-tailed and sharply peaked modes. Compared to mixture of Gaussians (MoG), MoGG achieves high precision data fitting using lesser numbers of components (i.e., model parsimony). These properties make it an ideal tool to represent different shapes of wavelet/contourlet subband histograms. It provides also precise signatures for texture discrimination and retrieval.



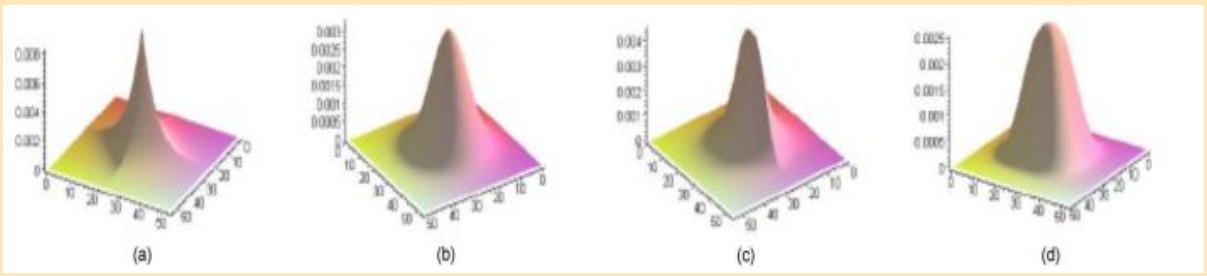


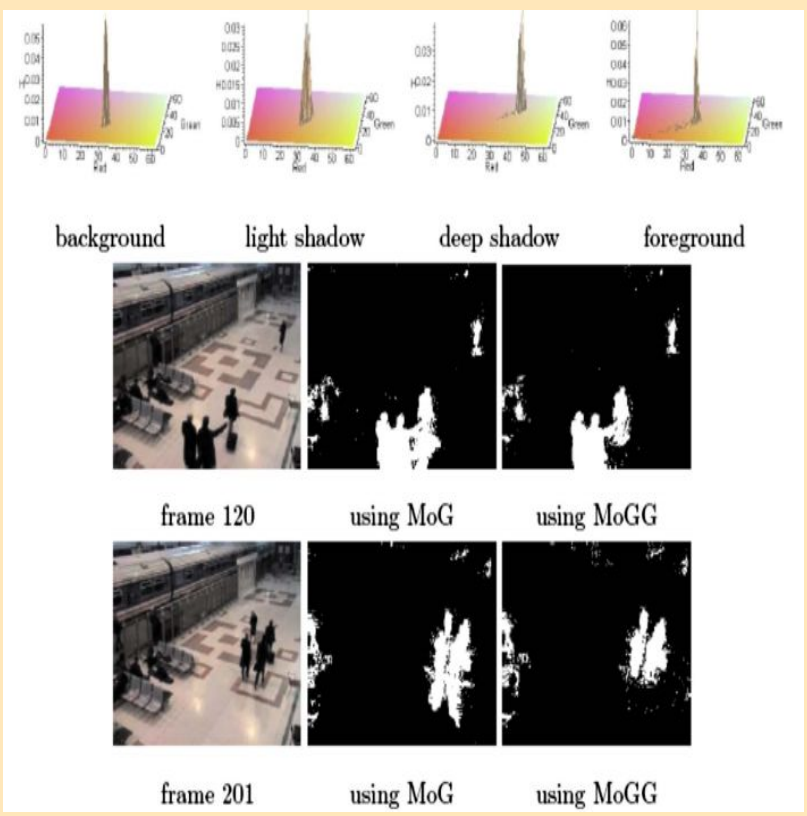
Related publications

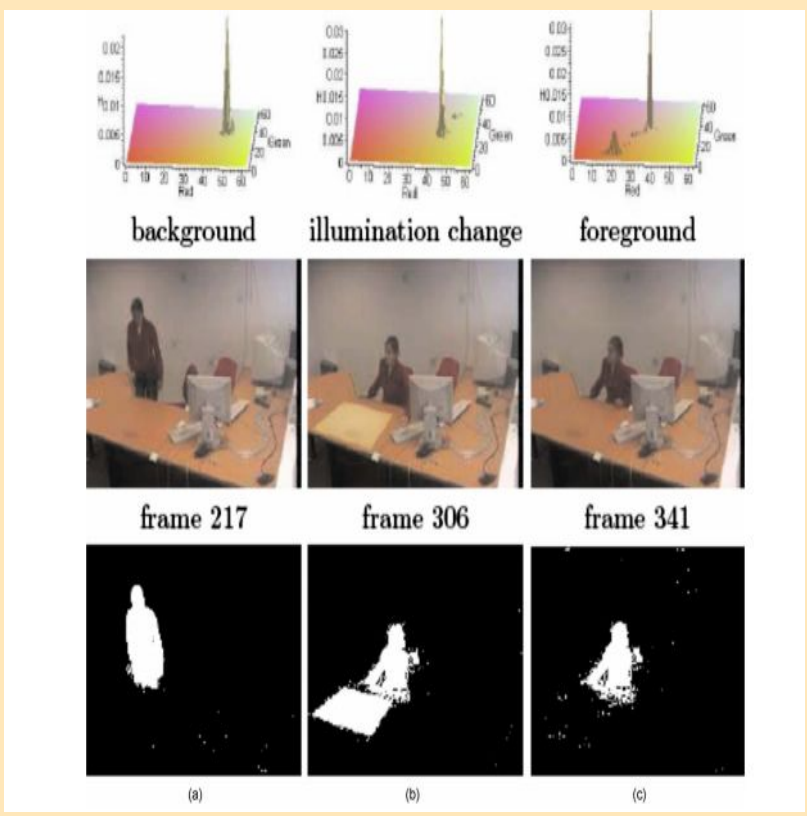
- M.S. Allili, N. Baaziz and M. Mejri. Texture Modeling Using Contourlets and Finite Mixtures of Generalized Gaussian Distributions and Applications. Submitted, 2013.
- M.S. Allili. Wavelet Modelling Using Finite Mixtures of Generalized Gaussian Distributions: Application to Texture Discrimination and Retrieval. *IEEE Trans. on Image Processing*, 21(4):1452-1464, 2012.
- M.S. Allili and N. Baaziz. Contourlet-Based Texture Retrieval Using a Mixture of Generalized Gaussian Distributions. *Int'l Conf. on Computer Analysis of Images and Patterns (CAIP)*, LNCS 6855, 446-454, 2011.

Statistical modeling using MoGGs and applications

Finite Gaussian mixture models are widely used in various fields of computer vision and image processing. This model-based approach to clustering makes it possible to validate a given model order in a formal way. However, it is well known that the Gaussian density has some drawbacks, such as the rigidity of its shape, which prevents it from yielding a good approximation to data with outliers. The focus of our research is the utilization of finite mixture models using the formalism of the Generalized Gaussian Density (GGD). This model is coined MoGG by analogy to the notation commonly used for finite mixtures of Gaussians: MoG. Because it has flexibility to fit the shape of data better than MoG, the new model is capable of yielding accurate data representation for image and video foreground segmentation.







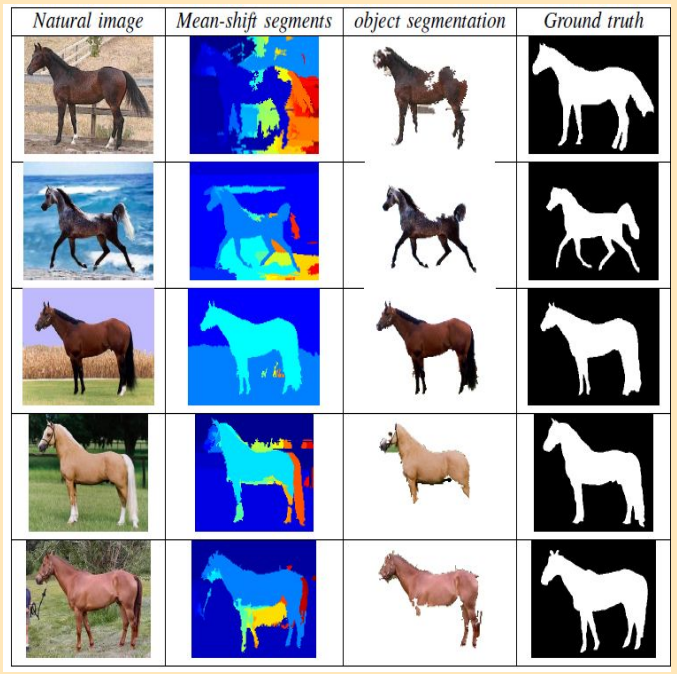
Related publications

- A. Boulmerka and M.S. Allili. Thresholding-Based Segmentation Revisited Using Mixtures of Generalized Gaussian Distributions. *IEEE Int'l Conf. on Pattern Recognition*, 2894-2897, 2012.
- M.S. Allili, N. Bouguila and D. Ziou. Finite General Gaussian Mixture Modelling and Application to Image and Video Foreground Segmentation. *Journal of Electronic Imaging*, Vol. 17, No.013005, 1-13, 2008
- M.S. Allili, N. Bouguila and D. Ziou. Finite Generalized Gaussian Mixture Modelling and Application to Image and Video Foreground Segmentation. *Proc. of IEEE Canadian Conf. on Computer and Robot Vision (CRV)*, Montreal, 183-190, 2007. (Received the IAPR Best Student Paper Award).

Object segmentation

Visual scene understanding requires the ability to recognize objects and their location in the image.

Essentially, these two goals are tackled by object recognition and object segmentation, each of which presenting a considerable challenge. Our research focuses on using learning-based approaches for performing object segmentation. Inspired by human vision system abilities for learning and recognition, we aim to develop statistical models for feature description that segment images into semantically meaningful objects.

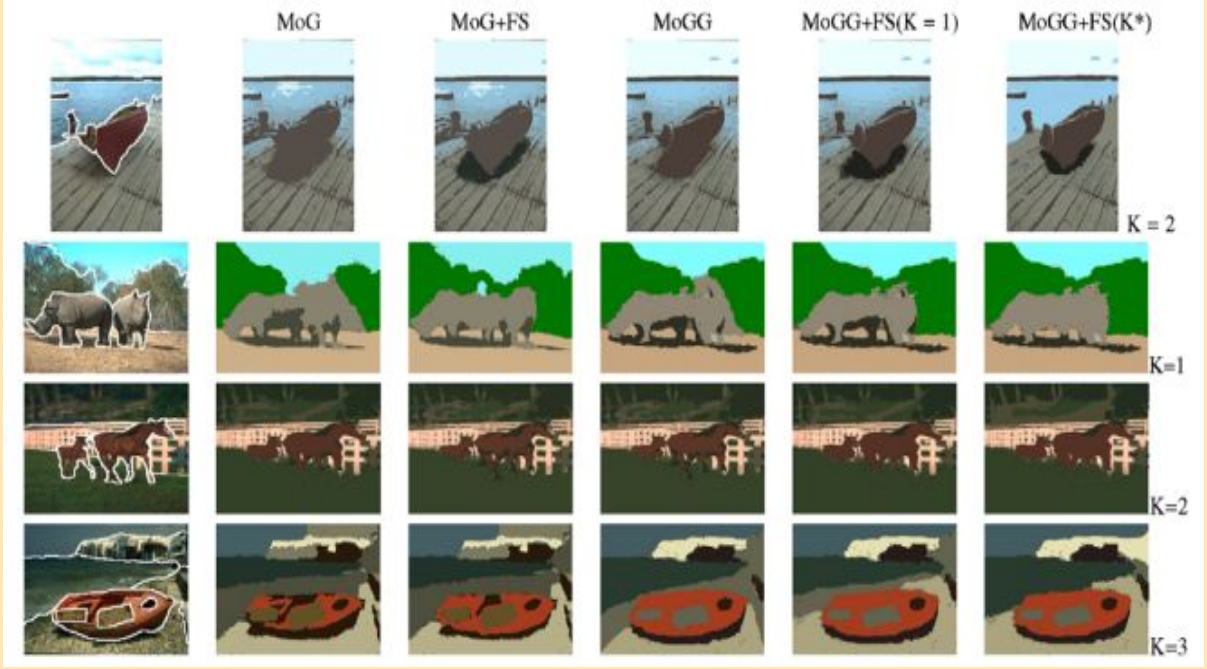


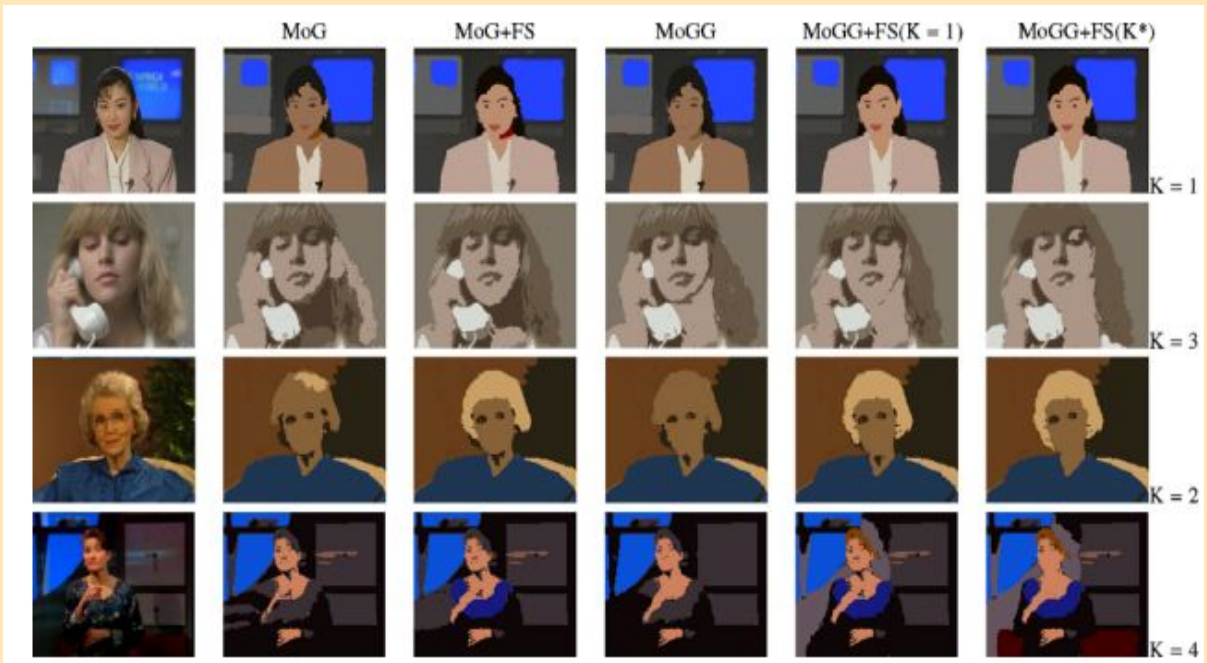
Related publications

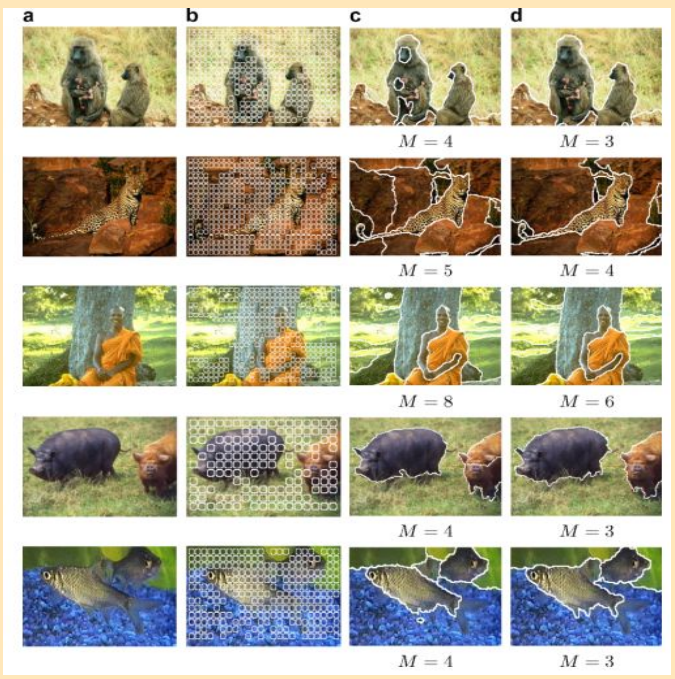
- G. Larivière and M.S. Allili. A Learning Probabilistic Approach for Object Segmentation. *IEEE Canadian Conf. on Computer and Robot Vision* , 28-94, 2012.
- M.S. Allili and D. Ziou. Object of Interest segmentation and Tracking by Using Feature Selection and Active Contours. *IEEE Conf. on Computer Vision and pattern Recognition (CVPR)*, Minnesota, 1-8, 2007.

Image and video segmentation

Segmentation is an important topic in computer vision and image/video processing. For example, newly established multimedia standards, such as MPEG-4 and MPEG-7, are based on the object content of videos. Therefore, successful representation and processing in these standards require ef?cient segmentation algorithms. This efficiency lies—among other things—on the capacity of the segmentation to yield meaningful regions (i.e., reduce over/under-segmentation). Over-segmentation occurs when the number of regions is over-estimated, leading to insigni?cant small regions; whereas under-segmentation occurs when real regions are erroneously fused. Both problems may compromise the application at hand using segmentation (e.g., video coding and indexing based on object shape). Our research focuses on developping efficient statistical models to yield image/video segmentations with lesser over(under)-segmentation.







Related publications

- M.S. Allili, D. Ziou, N. Bouguila and S. Boutemedjet. Image and Video Segmentation by Combining Unsupervised Generalized Gaussian Mixture Modeling and Feature Selection. *IEEE Trans. on Circuits and Systems for Video Technology*, 20(10):1373-1377, 2010.
- M.S. Allili and D. Ziou. Globally Adaptive Region Information for Color-Texture Image Segmentation. *Pattern Recognition Letters*, Vol. 28, No. 15, pp. 1946-1956, November 2007.
- M.S. Allili and D. Ziou. Automatic Color-Texture Image Segmentation by Using Active Contours.

IEEE Int'l Workshop on Intelligent Computing in Pattern Analysis/Synthesis, Springer LNCS 4153, 495-504, Xi'an (China), 2006.