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## PH.D. THESIS ABSTRACT

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**Title: Texture and Image Microstructure Analysis with Modulation Models, Energy and Variational Techniques: Detection & Separation.**

**Abstract:** The subject of the thesis is the emergence and analysis of visual texture microstructure for efficient modeling, descriptive feature extraction and image representation. Main objectives are the problems of image texture modeling and analysis in Computer Vision systems, with emphasis on the subproblems of texture detection, segmentation and separation in images. Advanced modeling and analysis method are developed in parallel directions: a) Multiband models of narrowband components and spatial modulations, b) Energy methods for texture feature extraction, c) Variational techniques of image decomposition and texture separation. The proposed methods are applied on a database of digitized soilsection images to quantify and evaluate the biological quality of soils and in different types and collections of natural images. The developed model is the common ground to approach texture in its different forms and applications. In total a complete system for texture processing and analysis is proposed that includes contributions and advances regarding: a) detection, b) feature extraction applied on segmentation and classification and multicue image segmentation, c) texture-from-structure separation through image decomposition for texture enhancement and improved modeling. The general conclusions drawn regard the nature of the phenomenon, ways to quantify and analyze it and the relationship of texture to other image structure. In parallel, the specialization of these ideas to one-dimensional signals is explored for the analysis of acoustic signal microstructures and speech detection.

**Keywords:** Computer Vision, Image Analysis, Image Texture, Computational Texture Models, Texture Analysis, Image Segmentation, Feature Extraction, Classification, AM-FM Models, Non-linear Models, Variational Methods, Multichannel Processing, Spatial Filters, Energy Operators, Demodulation, Image Decomposition, Soilsection Images, Speech Detection.