**Goal of the project:** In this project, we seek suitable compact models, together with the analysis and synthesis of texture images. The overall objective is to improve existing methods of classification of textures using statistical approaches in the field of complex transforms, namely the hyperanalytic wavelet transform.

Short description of the project:
Stochastic modeling of natural images is the subject of many applications: denoising, filtering, classification, compression, synthesis. The purpose is to have a statistical model of the image information. There is a large variability for natural images so a transform domain can be more appropriate. We propose to use a new transform with enhanced selectivity and quasi shift invariance, the hyperanalytic wavelet transform (HWT) proposed by the Romanian team and a new family of multivariate models based on copula theory proposed by the French team.

Spatial domain (large variability) → *Transform* → Transform domain (compact model) Variabilitate redusa
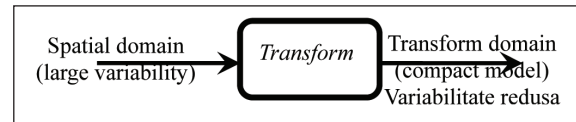
Project implemented by: Members of the Intelligent Signal Processing Research centre ISPRC, UPT, in partnership with members with members of the laboratory LAPS, of IPBENSEIRB MATMECA, from Bordeaux, France.

Implementation period:
31.03.2011-10.12.2012.

Bark.0000.ppm, Bark.0006.ppm, Bark.0008.ppm, Bark.0009.ppm, Brick.0001.ppm, Brick.0004.ppm, Brick.0005.ppm, Buildings.0009.ppm

Fabric.0000.ppm, Fabric.0004.ppm, Fabric.0007.ppm, Fabric.0009.ppm, Fabric.0011.ppm, Fabric.0014.ppm, Fabric.0015.ppm, Fabric.0017.ppm

Fabric.0018.ppm, Flowers.0005.ppm, Food.0000.ppm, Food.0005.ppm, Food.0008.ppm, Grass.0001.ppm, Leaves.0008.ppm, Leaves.0010.ppm

Leaves.0011.ppm, Leaves.0012.ppm, Leaves.0016.ppm, Metal.0000.ppm, Metal.0002.ppm, Misc.0002.ppm, Sand.0000.ppm, Stone.0001.ppm

Stone.0004.ppm, Terrain.0010.ppm, Tile.0001.ppm, Tile.0004.ppm, Tile.0007.ppm, Water.0005.ppm, Wood.0001.ppm, Wood.0002.ppm

"At every level the greatest obstacle to transforming the world is that we lack the clarity and imagination to conceive that it could be different"

Roberto Unger

Main activities:
Main activities for 2011: study and simulation of texture classification techniques and statistical analysis of a new implementation of a complex transform, namely the hyperanalytic wavelet transform, HWT, which is quasi shift invariant and has an improved directional selectivity. These different properties can be expected to lead in a better estimation of relevant stochastic parameters. The main objectives for 2012 were: applying stochastic criteria for texture classification in HWT domain. A novelty is the use of the copula model together with the interdependencies inter/ intra level, as well as inter/intra subband, for the complex coefficients.

Another objective was to evaluate the proposed techniques on well known texture databases, such as VISTEX or OUTEX using several criteria such as mean percentage of classification.

Results:
The final results have been disseminated in international scientific journals and conferences by the Partners. The activities were developed during the visits by the two teams: July 2011, (visit to Romania), November 2011 (visit to France), October 2012 (visit to France). In August 2012, the Romanian team as well the French director Yannick Berthoumieu participated to EUSIPCO 2012 in the framework of Brancusi, in order to present our paper on the Kullback-Leibler divergence for complex models usable in texture classification. One French collaborator attended the ISETC 2012 symposium organized in Timisoara, to present our common paper.

Fields of interest:
Signal and image processing, statistical signal processing.

Financed through/by:
ANCS/UEFISCDI, EGIDE.

Research team:
UPT team: Assist. Prof. Dr. Eng. Corina Nafornita (director), Prof. Dr. Eng. Alexandru Isar, Prof. Dr. Eng. Ioan Nafornita. *ENSEIRB MATMECA team:* Prof. Dr. Eng. Yannick Berthoumieu (director), Researcher Dr. Flavius Turcu, Researcher Dr. Ioana Turcu.

Research centre:
Research Centre for Intelligent Signal Processing- ISPRC

Applicability and transferability of the results:
The Signals Processing lab run by Professor Yannick Berthoumieu already has a known tradition in relations with industry partners, especially with Total, which allows us to believe the results obtained will be used. The Intelligent Signal Processing research centre "Adelaida Mateescu" from Timişoara had collaboration on denoising sonar images with IFREMER Brest and will continue it on image segmentation. We will use these results also in the framework of the Francophone Master Programme, Traitement du signal from the Communications department.

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http://www.tc.etc.upt.ro/isprc/context.html

"Like music and art, respect for the environment is a common language that can transcend political or social boundaries."

Jimmy Carter