# A Neural Architecture for Textured Color Image Segmentation and Recognition

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## Abstract

We propose a neural architecture to segment textured color images using perceptual groupings and to recognize the scene according to the obtained segmentation.

This architecture offers an approximation to the visual system structure related to the processing of color and texture informations,

*Retinal ganglion cells* → *LGN* → *V1* → *V2* → *V4* → *Inferior Temporal Cortex (IT).*

This architecture is made of three main modules. The first module, called Color Opponent System (COS), transforms a RGB color signal into three signal, two chromatic ones as a result of red-green and blue-yellow color opponent processes, and an achromatic one, black-white. This system models the antagonist mechanisms, with *ON-center/OFF-surround* structures, that take place in the retinal glanglion cells. Each color opponent process is modelled as a bidimensional field with *shunting ON-center/OFF-surround* interactions.

The processing continues in a Chromatic Segmentation System (CSS) module. This module proposes an extension of the BCS/FCS visual model to achieve a preattentive color segmentation. The CSS extracts the real and illusory contours from the three channels and makes a perceptual grouping of the emergent textural characteristics. It is necessary to extract the contours in the chromatic channels because there can exist chromatic contours invisible to the achromatic channel.

In each channel a simple cells or oriented contrast detectors stage is processed. Our network uses receptive fields modelled by Gabor functions for these cells. The selection of this kind of functions has been favored by an important number of investigators that have pointed out that these functions approximate perfectly the shape of the receptive fields that striate cortex simple cells have. Four kind of receptive fields are used in our architecture , two of them come from even components and the other two from odd components of the Gabor function. The receptive fields used can be seen as two pairs of opposed polarity Gabor filters. Such opposed pairs exist in the visual system and would be required to preserve the information that would otherwise be lost by truncation.

Meanwhile, two FCS stages, regulated by the contour structure, activate both *filling-in* processes that allow a diffusion of the chromatic qualities in all directions except in those where there are strong contours. Each of these two FCS stages processes a chromatic channel (Red-Green or Blue-Yellow).

Finally, we propose a superior module to carry out the recognition process. This module, called MultiSignal Recognition Module (MSRM), is made up of a bidimensional architecture, 2D Multi-ART, based on the adaptive resonance theory (ART).

S. Gielen et al. (eds.), *ICANN '93*