

GEOMETRIC COVARIANCE OF IMAGES' GABOR WAVELET TRANSFORM

Alexandre Nowosad and Valter Rodrigues
INPE, Caixa Postal 515
12201 São José dos Campos SP

Sônia M. Gomes
IMECC- UNICAMP, Caixa Postal 6065
13081-970 Campinas SP

Abstract

An object's image can change due to scaling, rotation and translation of the object, but its icon remains the same. If we call these affine geometric changes, then invariant encoding systems should not only perceive the icon of objects but explicitly characterize the variability. The purpose of this work is to show that the Gabor Wavelet transform can be used as a tool in pattern recognition because it is an affine-geometric covariant encoding method. The Gabor Wavelet Transform of images is a bidimensional wavelet version of the Gabor Transform of signals. Each Gabor elementary function minimizes the local uncertainty of the signal at the point where the function is centered, hence it captures both spatial and spatial-frequency information with maximum resolution. Changes in position, scale or orientation of an object's image have the effect of shifting the spectra of the Gabor Wavelet Transform representing the object in the position, orientation and scale dimensions. Rotation covariance is numerically verified experimenting through the calculus of a satellite images' bidimensional discrete Gabor Wavelet Transform by a convolution neural network simulator.