

***Spatial and Spatio-Temporal Filters  
and their Implementation  
with Real-Time CNN FPGA Processors***

Cellular Neural Network (CNN) is a parallel computing paradigm, which can be used for many applications like image processing, artificial vision, solving differential equations, etc. A CNN is basically a 2-D structure consisting of a 2-D spatial grid of neural cells. The spatio-temporal dynamics of the system is tuned for specific tasks by defining local spatial interconnections between the neural cells.

In this presentation, first spatial Gauss-type filters and their implementation using resistive-grids and CNN will be introduced and the associated state equations and their solution using Jacobi iteration will be given.

Second, generation of LP, HP, BP and BS 2-D discrete-space filters from their analog counterparts and their implementation by CNN will be presented.

Third, Gabor-type spatial and spatio-temporal filters, and their implementation by CNN will be introduced.

The talk will be concluded with the presentation of the architecture of a real-time CNN emulator, which is realized on an FPGA, and capable of processing full-HD 1080p@60 (1980x1080 resolution, and 60 Hz frame rate) video signals in real-time, followed by a demonstration of a few applications of the processor.