The branch of electronics concerned with the representation and manipulation of signals in digital form. Processing which comprises:

- Image Processing (including medical imaging)
- Non-linear signal processing applications like Artificial Neural Networks

Most of these systems have been implemented in software on conventional sequential computers, due to lack of appropriate hardware. Thus undermining the true potential of the inherent, parallel ANN.

DSP algorithms typically require huge numbers of multiplication and additions. For example the node j in a feed-forward ANN has a basic node function of the type:

\[ g(y) = \sum_{i} f(x) \]

Where \( g(y) \) is the output function and \( f(x) \) is the activation/squashing function for which the sigmoid/logistic function is the commonest. Consider the following implementations of the expression:

\[ Y = (A \ast B) + (C \ast D) + (E \ast F) + (G \ast H) \]

From the above sequence, the algorithm is expected to produce the foreground image when training converges.

Hardware Options

Research is not complete if an algorithm is not feasible to be implemented or the suitable hardware architecture is not available. A good hardware platform should provide good performance including high computation throughput, low power consumption and small design area.

Outlook

• ANN algorithms with the appropriate hardware can easily be used in solving computationally intensive signal processing problems.
• New implementation platform calls for new design process, for example multipliers can be replaced by hardware multipliers.
• The integration of storage and computation within a single FPGA unit are keys that make reconfigurable computing system potential for image processing.

Many Thanks...

• Nectar Electronics Ltd.
• Dan Ganosus, Top-Down DSP Design Flow to Silicon Implementation, March 2004

FPGA Applications in Signal and Image Processing

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