

Optimized emulated digital CNN-UM (CASTLE) Architectures

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The CNN-UM [1],[2] (Cellular Neural Network-Universal Machine) is a stored program analog microprocessor array where the tiny processors are interconnected locally. The CNN-UM architecture can be implemented in analog VLSI [3], in an emulated digital way [4],[5] or by a software simulator. An emulated digital CNN-UM [4] (CASTLE) architecture was published few years ago. Some modified, extended CASTLE architectures are shown in this contribution. These new modified architectures are optimized and analyzed according to silicon area operating speed and dissipated power.

- (i) The CNN can be programmed with different templates. The size of the template (weight matrix) is variable, in most cases the size is 3×3 . The original CASTLE can operate only with this templates. There are some problems that cannot be solved with nearest neighborhood templates. New architectures are proposed where we can use templates with 3×3 and 5×5 with these re-configurable arithmetic cores.
- (ii) If we use symmetrical templates then the silicon area is decreased significantly. A new emulated digital CNN architecture is shown where we can use arbitrary templates (optimized to silicon area).
- (iii) The original CASTLE arithmetic unit was extended by pipe-lineing technique. The operation speed of the emulated digital CNN-UM is increased significantly with this solution (~ 10 times) and the silicon area was not changed practically.

References

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