|  |  |  |  |
| --- | --- | --- | --- |
| **Ours** | | **E-LSTM** |  |
| **153->1024** | | | **Problem Size** |
| 45nm, 1.1v | | Intel Arria10 SX660 | **Board** |
| 238MHz | | 200 MHz | **Frequency** |
|  | | 430.5 KB | **On-chip Memory** |
|  |  | 15.9 w | **Power** |
|  |  | 282.2 GOP/s | **Throughput** |
|  |  | 21052 FPS/w | **Energy efficiency** |
|  |  | - | **Area** |

|  |  |  |  |
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| **Ours** | | **LSTM-Sharp** |  |
| **200** | | | **Problem Size** |
| 45nm, 1.1v | | NVIDIA Titan V – 32nm | **Board** |
| 238MHz | | 250 – 500 MHz | **Frequency** |
|  | | 216 KB + 28.3 MB | **On-chip Memory** |
|  |  | 4 – 39.1 w | **Power** |
|  |  | 0.46 – 29.8 TFLOPs | **Throughput** |
|  |  | 9% - 78% of E-PUR | **Energy efficiency** |
|  |  | 63.4 – 577.7 mm2 | **Area** |

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| **Ours** | | **Peregrine** |  |
| **39->512->512->62** | | | **Problem Size** |
| 45nm, 1.1v | | 65nm, 1.2v | **Board** |
| 238MHz | | 200 MHz | **Frequency** |
|  | | 1148 KB | **On-chip Memory** |
|  |  | 36.76 mw | **Power** |
|  |  | 22.89 GOP/s | **Throughput** |
|  |  | 1.59 pJ/OPS | **Energy efficiency** |
|  |  | 509611.28 µm2 | **Area** |

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| 512->62 (Pregrine1) | | | 39->512 (Peregrine0) | | | P |
| 16 | 8 | 3 | 16 | 8 | 3 | M |
| 36 | 72 | 192 | 35 | 69 | 184 | MAP1 |
| 3 | 9 | 64 | 3 | 9 | 62 | CAP1 |
| 1 | 2 | 22 | 1 | 3 | 21 | CAP2 |
| 1 | 1 | 8 | 1 | 1 | 7 | CAP3 |
| 1 | 1 | 3 | 1 | 1 | 3 | CAP4 |
| 1 | 1 | 1 | 1 | 1 | 1 | CAP5 |
| 1 | 1 | 1 | 1 | 1 | 1 | CAP6 |
| 3 | 4 | 6 | 3 | 4 | 6 | N |
| 1 | 1 | ½ | 1/5 | 1/5 | 1/5 | Scale |
| 435901.645037 | 722475.412730 | 970192.168643 | 133943.235466 | 187079.395077 | 466948.633756 | Area |
| 35.091mW  10.420mW | 61.644mW  16.776mW | 90.904mW  21.636mW | 9.420mW  3.195mW | 14.490mW  4.373mW | 40.066mW  10.199mW | Power |
| 435901.645037 | 722475.412730 | 1940384.337286 | 669716.17733 | 935396.975385 | 2334743.16878 | A/S |
| 35.091mW  10.420mW | 61.644mW  16.776mW | 181.808mW  43.272mW | 47.100mW  15.975mW | 72.450mW  21.865mW | 200.330mW  50.995mW | P/S |

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| 153->1024 (E-LSTM) | | | P |
| 16 | 8 | 3 | M |
| 74 | 148 | 391 | MAP1 |
| 5 | 19 | 131 | CAP1 |
| 1 | 3 | 44 | CAP2 |
| 1 | 1 | 15 | CAP3 |
| 1 | 1 | 5 | CAP4 |
| 1 | 1 | 2 | CAP5 |
| 1 | 1 | 1 | CAP6 |
| 3 | 4 | 7 | N |
| 1/6 | 1/6 | 1/6 | Scale |
| 242609.022783 | 349545.809895 | 870725.459455 | Area |
| 15.088mW  6.100mW | 24.705mW  8.378mW | 78.156mW  18.908mW | Power |
| 1455654.136698 | 2097274.85937 | 5224352.75673 | A/S |
| 90.528mW  36.600mW | 148.230mW  50.268mW | 468.936mW  113.448mW | P/S |

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| 8000->1500 (LSTM-Sharp) | | | P |
| 16 | 8 | 3 | M |
| 594 | 1188 | 3167 | MAP1 |
| 38 | 149 | 1056 | CAP1 |
| 3 | 19 | 352 | CAP2 |
| 1 | 3 | 118 | CAP3 |
| 1 | 1 | 40 | CAP4 |
| 1 | 1 | 14 | CAP5 |
| 1 | 1 | 5 | CAP6 |
| 4 | 5 | 8 | N |
| 1/14 | 1/14 | 1/35 | Scale |
| 590916.336107 | 946746.661776 | 1100314.845953 | Area |
| 42.886mW  14.633mW | 74.080mW  22.599mW | 100.636mW  23.792mW | Power |
| 8272828.705498 | 13254453.264864 | 38511019.608355 | A/S |
| 600.404mW  204.862mW | 1.03712W  316.386mW | 3.52226W  832.72mW | P/S |