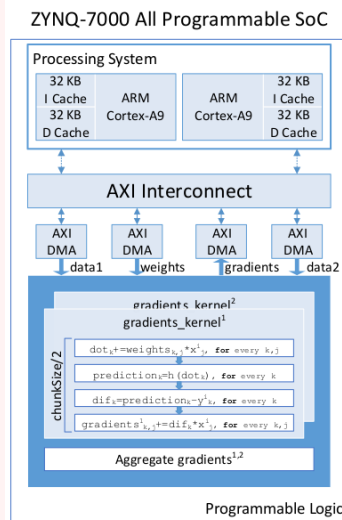


Contributions

SPYNQ: Spark on PYNQ: A framework for Spark execution on the Pynq platform

- An efficient framework for the seamless utilization of hardware accelerators for Spark applications in Zynq FPGAs.
- Development of an efficient set of libraries that hide the accelerator's details to simplify the incorporation of hardware accelerators in Spark. The ML suite is offloaded to Reconfigurable logic.



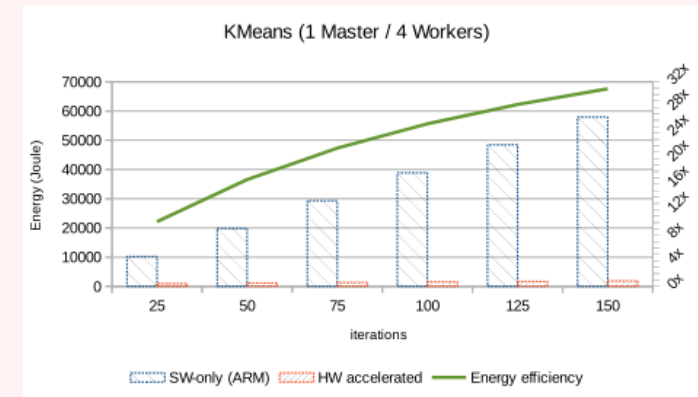
Use case applications

Two algorithms have been evaluated using Spark ML on Pynq

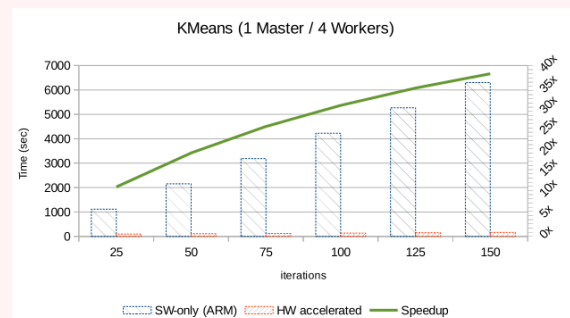
- Logistic Regression** is used for building predictive models for many complex pattern-matching and classification problems.
- K-means** is one of the simplest unsupervised learning algorithms that solve the well known clustering problem and is applicable in a variety of disciplines, such as computer vision, biology, and economics.

Energy efficiency

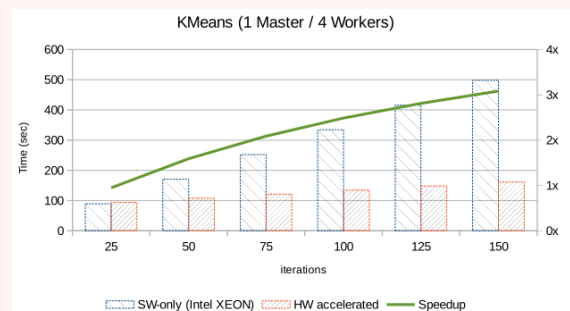
- Up to 28x reduction on energy-consumption compared to ARM-only solution and up to 32x reduction on energy-consumption compared to Xeon



Speedup compared to Xeon/ARM



- Up to **37x** speedup compared to ARM-only execution



- Up to **3x** speedup compared to single-thread Xeon platform

Cluster of PYNQs

A cluster of 4 Pynq nodes have been developed that shows the scalability and the feasibility of hardware acceleration of Spark on energy-efficient Zynq FPGA devices. The cluster can be scaled to hundreds of nodes utilizing the FPGAs.



Future Work

- Hardware acceleration of Spark ML suite on Amazon AWS F1 FPGA, seamlessly.

Future accelerators:

- Recommendation engines – Collaborative filtering, Decision trees, Naïve Bayes
- Future frameworks: Caffe, H2O

Open source: <https://github.com/vineyard2020/SPynq>

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