Accelerating Haar-Cascade Classifier on Curie Neurons using Parallel K-Nearest Neighbor Algorithm

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ABSTRACT

The 5G networks era is accelerating our computing devices into a hyper-connected environment at a rapid pace, in which there has been a movement of integrating computation into the edge of the network along with embedding intelligence on end-devices. Recently, as demand increases, solutions using artificial intelligence such as deep learning are widely used. In general, these technologies require high-performance computing power with high-cost and application-specific resource management. Suppose IoT (Internet of Things) technology can take advantage of machine learning for tasks such as object and pose detection, image and face recognition, language processing, obstacle avoidance, and so forth, we can expect that the range of IoT applications will be enormously widened. From the point of systems performance, this movement may have great advantage of more efficient energy consumption and network load distribution; however, developing robust AI for edge application could be complex and may require the integration of application-specific system and analysis software running on specialized hardware.

This paper proposes a fast Haar cascade algorithm for face detection on a low power device of Intel Curie module which comes with built-in neurons for K-Nearest Neighbor (KNN) attribute for pattern matching recognition. A stage of this algorithm compares the given feature value with the learned threshold to determine whether or not the image is a face, which consists of many loops for every sub window to compare the feature value extracted from the integral image in a 1:1 ratio with the threshold. We implement the repetitive parts of the corresponding comparison operation in parallel by applying KNN matching algorithm on Curie module. To measure the performance of the proposed algorithm, simulations is conducted using Face Detection Data set and Benchmark (FDDB). The result shows that the proposed method achieves 27.81% faster performance improvement on processing speed.