A Novel Accelerator for Machine Learning Algorithms

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Learning from classified and unclassified data is generally categorized as semi-supervised learning (SSL). Traditional, graph-based SSL (GBSSL) algorithms operate by designing a relatively smooth function to classify the intrinsic structure of both types of data. However, these methods amass heavy computational costs in computing the inversion of the classification solution matrix. In order to alleviate this problem, a new accelerator is proposed to explicitly find this inversion faster through use of iteration. This algorithm was also made highly parallel, with each column of the accelerator capable of being found independently of other columns. All the test cases were from real world GBSSL sparse matrices. The number of steps m in the accelerator was varied according to specific requirements. When m was large, the accelerator matrix converged towards the inverse. However, a large m also produced fill-in and a reduced sparsity, increasing the number of calculations needed. The following methods were adopted to decrease the effect of fill-in: 1. varying m from 2 to 6 2. approximating the accelerator by deleting fill-ins below a certain, heuristically derived threshold. Comparative results of this new accelerator against similar iterative accelerators are also presented, with the new accelerator showing a 20-80% improvement over existing methods.

Awards Won:

Fourth Award of $500

Arizona State University: Arizona State University Intel ISEF Scholarship

National Security Agency Research Directorate : First Place Award "Mathematics" $1,500