

FACULTY MENTOR

Mingu Kang

PROJECT TITLE

Deep neural network accelerator with analog switched-capacitors

PROJECT DESCRIPTION

Description: There has been increasing interest in analog-based hardware implementation to achieve aggressive energy efficiency in the neural networks by exploiting the inherent error resiliency in the machine learning algorithms. This project exploits the matrix multiplication with switched-capacitor circuitry in analog domain. Transistor-level full-custom circuit is designed with Cadence Virtuoso, and the statistical error behavior is captured through Monte-Carlo simulations. Finally, this error model is injected in the system simulations with Matlab/Python to observe the impact on application level accuracy.

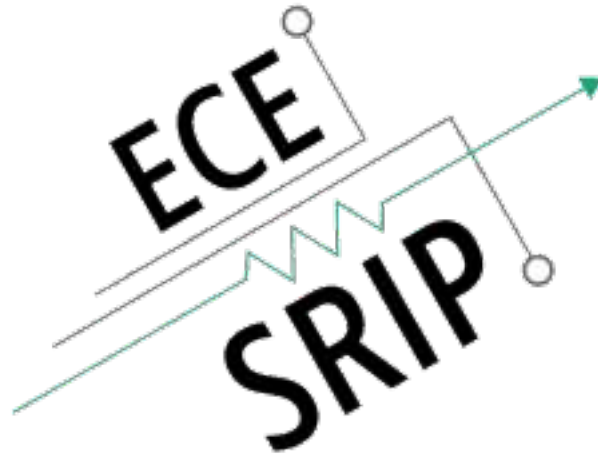
This project will be in person.

INTERNS NEEDED

2 Students

PREREQUISITES

1. Digital and analog circuit background, transistor-level full custom circuit design, Cadence virtuoso simulation, Hspice, Python
2. Knowledge in machine learning (optional)



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PROJECT TITLE

Natural language processing under resource constraints

PROJECT DESCRIPTION

Description: Recently, the field of natural language processing (NLP) witnessed rapid progress by leveraging an attention mechanism, achieving record-high accuracy in various NLP tasks exceeding human cognitive capability. Despite the benefits from recent models such as transformer and bert leveraging the attention mechanism, the NLP tasks often require demanding hardware resources including a large volume of computing and storage devices, e.g., 340 million parameters with tens of GMAC operations. On the other hand, emerging applications such as sensor, mobile translator, and smart devices increasingly demand the in-situ classification at the edge. As a result, highly energy and latency efficient natural language processing algorithm are increasingly emphasized. In this project, we will study various aspects of NLP algorithms to minimize the cost of computation, storage, and others with various testbenches and state-of-art NLP deep learning models.

This project will be in person.

INTERNS NEEDED

2 Students

PREREQUISITES

1. Python, Pytorch, matlab, deep neural network training/inference experience
2. Strong mathematics background