پژوهشگاه دانش‌های بنیادی
پژوهشکده علوم کامپیوتر

سخنرانی علمی

Efficient Deterministic Approaches to Stochastic Computation

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Abstract

Stochastic Computing (SC) is a promising technique to perform computation with low-cost and low-power hardware, especially for applications that can tolerate some error, such as image processing and machine learning. However, the accuracy of SC depends on the length and quality of the stochastic bit-streams, which are usually generated randomly. To overcome this challenge, some recent works have proposed deterministic methods to generate and manipulate stochastic bit-streams, which can guarantee exact results. However, these methods also have drawbacks, such as long execution time, high energy consumption, and complex circuit design.

In this talk, I will present some of the latest developments in deterministic SC, and show how they can improve the performance and efficiency of SC hardware. I will introduce some techniques to speed up deterministic bit-stream multiplication, which is a key operation in SC. I will also show how to design generalized circuits for deterministic SC multiplication using residue number system (RNS) architectures, which are known for their low-power and high-speed arithmetic operations. As a case study, I will demonstrate how to implement hardware-efficient finite impulse response (FIR) filters using accurate unary SC. This talk will provide an overview of the state-of-the-art techniques to achieve deterministic SC with high efficiency and low cost in hardware.

Biography

Kamyar Givaki graduated from the University of Tehran with his PhD in Computer Engineering in August 2023. His research interests include computer arithmetic, machine learning accelerators, and approximate and stochastic computing. He is currently looking for a postdoctoral research opportunity at the Department of Computer Science at the Institute for Research in Fundamental Sciences (IPM).

زمان :سه‌شنبه ۱۴۰۲/۰۸/۰۲ – ساعت ۱۵:۰۰

ارائه به صورت مجازی انجام خواهد شد.

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