Hardware reliability assessment and enhancement for deep neural networks

Summary

Tallinn University of Technology, School of Information Technologies, Department of Computer Systems, Centre for Dependable Copmuting Systems offers a 4-year PhD position in ICT.

Research field:	Information and Communication Technology
Supervisors:	Jaan Raik Masoud Daneshtalab
Availability:	This position is available.
Offered by:	School of Information Technologies Department of Computer Systems
Application deadline:	Applications are accepted between September 01, 2020 00:00 and October 02, 2020 23:59 (Europe/Zurich)

Description

Emergence of Deep Neural Networks (DNN) has led to a proliferation of artificial intelligence applications. Among other tasks, DNNs have been trained to recognize speech, caption photographs, and translate text between languages at high levels of performance. Although applications of DNNs to real-world problems have become ubiquitous, there is a lack of understanding of how these circuits are affected by faults. Due to this fact, adoption of DNNs in safety-critical domain has been lagging behind. As there exist no commonly accepted reliability assessment metrics for DNNs, their certification for safety-critical applications is not possible. Existing state-of-the-art fault-tolerant solutions rely on redundant DNNs with implementation diversity. However, this solution is both costly and does not contribute to facilitating reliability assessment for the overall system.

To cope with the above-mentioned challenges, this **PhD thesis has the following targets:**

- Perform failure analysis of DNNs at the structural level to develop the low-level fault model for DNNs
- Develop high-level (functional) fault models for DNNs. Identifying mappings between low and high level fault models
- Based on these fault models, develop reliability assessment techniques for DNNs
- Propose architectural level fault-tolerant techniques for DNNs

Funding:
The work will be fully financed from the ITA ICT programme project.

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