SYNERGIZING ARTIFICIAL INTELLIGENCE AND REAL-TIME SUPERCOMPUTING: A SUMMARY OF SELECTED EDUCATION-ORIENTED EFFORTS

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Abstract:

This article sheds light on six books that synergize selected aspects of artificial intelligence, machine learning, and data mining, on the one hand, and on the other hand the architectures that bring speedup to applications using big data: dataflow, control flow, diffusion flow, and energy flow. Three of them were published by Springer, the USA, and the other three by IGI Global, USA.

Keywords: artificial intelligence, supercomputing, DataFlow, ControlFlow

1. Introduction

Artificial Intelligence. Machine Learning, Datamining, and Smart Applications need acceleration, in order to be effective for applications using Big Data. Several computing paradigms are available for the needed acceleration, some of which are best utilized if integrated on the same chip, while the others are best used if connected as external accelerators. In addition, issues like power consumption, size, and precision, are of importance, too.

2. Problem Definition

The major problem is how to synergize different computing paradigms (control flow, dataflow, diffusion flow, and energy flow), to obtain the maximal performance in a variety of applications. In addition, at the same time, the power consumption, equipment size, and computational precision have to be satisfactory.

3. Essence

This article proposes a symbiotic structure using two well-developed paradigms (control flow and dataflow), with I/O units that support its interface to two other paradigms yet to reach their full maturity (diffusion flow and energy flow).

The proposed symbiotic structure is depicted in Figure 1, and includes two different control flow architectures (flexible multiflow architecture as in Maxeler DFEs and fixed systolic architecture as in Google TPU) and two different control flow architectures (multicores as with Intel and manycores as with NVidia).

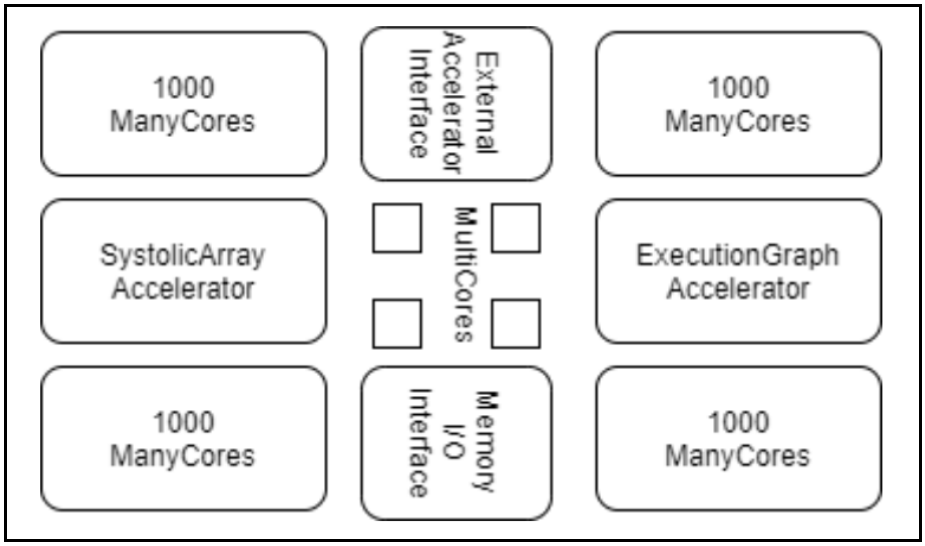

Fig. 1. The proposed structure which synergizes four paradigms.

The six books were written so that they could be used in educational missions, at universities and in industrial domains. So far, the six books were used in teaching and lecturing at Purdue, Indiana, MIT, and Harvard, in the USA. In Europe, these six books were used at ETH, EPFL (Geneva), Barcelona, Valencia, Salerno, Siena, Bogazici in Istanbul, Koc in Istanbul, Tirana, Shkodra, Manchester, Huddersfield, TUWIEN, UNIWIE, Ljubljana FE (Fakulteta za Elektrotehniko), Ljubljana FR (Fakulteta za Racunalnistvo), Podgorica, Kragujevac, Novi Sad, and Belgrade (ETF, MAT, FON, FFH).

Fig. 2.The covers of the six books presented in this article

Authors maintain constant touch with students at all the above-mentioned universities and keep improving the educational materials, for the best benefits of a number of projects that need well-educated researchers for future R+D activities.

4. Conclusions

This article presents six monographs with educational components that were and are being used at a number of universities worldwide. The newly open problems are those related to making the synergistic effects more effective as well as the teaching mission. The books stress not only the speedup, but also the power consumption, equipment size, and computational precision.

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