P R A C T I C A L   C O U R S E

Distributed Neurocomputing on Android

Problem description:

Neural networks and their variants have become increasingly important in the last years. For instance, deep learning methods have become a multi-million dollar business in industrial settings. However, these technologies require huge amounts of computational power. In the case of deep networks, the computational burden is typically moved to GPUs which reduces training times significantly.

However, parallelization of neural networks using GPUs is not always possible. For instance, spiking networks or other variants which rely on asynchronous message passing and information exchange between neurons are not well suited for graphics cards. Consequently, several distinct hardware platforms were developed during the last years to improve simulation efficiency of such networks.

Unfortunately, these neuromorphic chips are either expensive or academic prototypes. On the other hand, almost everyone has at least one smartphone with a powerful CPU that idles most of the time. The goal of this project is thus to identify if smartphones are useable to simulate distributed neural networks. The students shall research if there are already solutions available, or if existing technology can be adapted easily. If this is not the case, the students shall research if existing neural simulators, such as nest, can be ported to smartphones or if the simulation infrastructure has to be developed from scratch.

In any case, the students will have to characterize either a custom prototype, or existing technologies. An emphasis will be communication latencies in message passing from one device to anther due to the dependence of spiking neural networks on precise spike times. Furthermore, the students shall develop ideas how to distribute portions of neural networks onto several smartphones.

Tasks:

To succeed, the student are required to

1. learn about neural network simulators
2. research existing distributed high performance computation technologies for smartphones
3. develop software for android in C/C++
4. characterize system properties of interconnected smartphones which communicate by message passing and participate in a common computation
5. develop ideas how to automatically distribute computations on a network of smartphones

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