Toward new general-purpose processor with nonlinear transient computing

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Nowadays sustaining Moore's law requires new information processing methods to be developed. On the other hand, modern applications tend to deal more and more with complex, computationally heavy tasks in one or another way related to machine learning. With the growth of the number of smart devices, the volume of information, and thus, the demand of processing speed are dramatically increased. To address these and related technology challenges we propose a novel brain-inspired [1] architecture for general-purpose microprocessors.

The proposed architecture should comprise three components : arithmetical-logic unit (ALU), control unit (CU) and reservoir co-processor unit (RCU). The first two components are already part of today's CPUs. Their strengths are precision and ability to quickly operate on binary logic and numeric data. However, when dealing with images, sounds, time series and other kinds of fuzzy logic and data, CPU-based computers' performance falls considerably. On the contrary, reservoir computing refers to a generalized machine learning approach [4] for tasks of different complexity.

RCU is supposed to cooperate with CU on regular basis. This architecture will allow to free CPU from numerous complex and computationally intensive yet frequently encountered machine learning tasks. Relatively close analogy is GPU acceleration but for *non-linear* data. The unified architecture of smart RCU can drastically simplify machine learning workflow, thus, allowing developers to focus on their data and application.

Tasks reservoir co-processor is already capable of : high-speed pattern recognition and classification [2,3], forecasting and time series prediction [3], nonlinear control [3], DNA molecular computing [4]. That is making wide potential area of use : automotive, robotics, aerospace, security, medicine, data servers, communications, smart houses, personal computers and smartphones, entertainment and game industries.

Références

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