

Toward new general-purpose processor with nonlinear transient computing

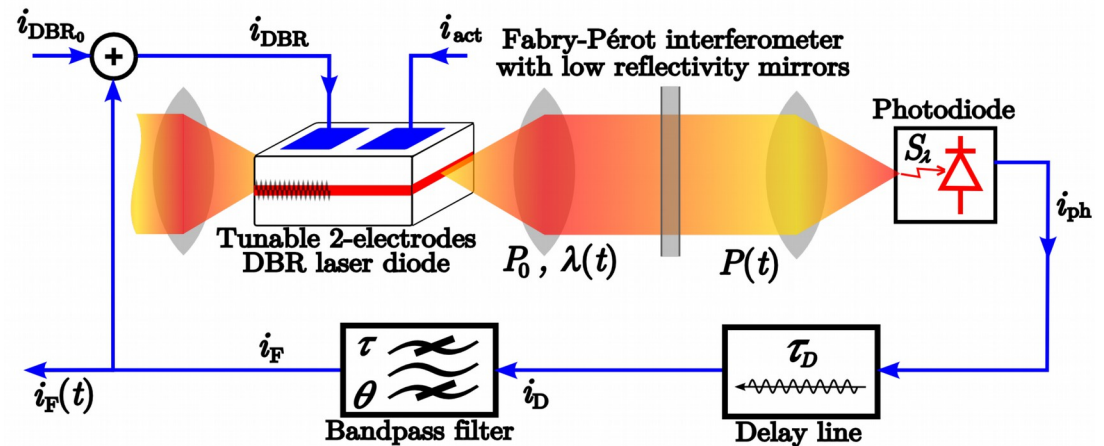
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Problem: machine learning is not supported directly by modern hardware

Proposal

Dynamical system with delay as an intelligent co-processor

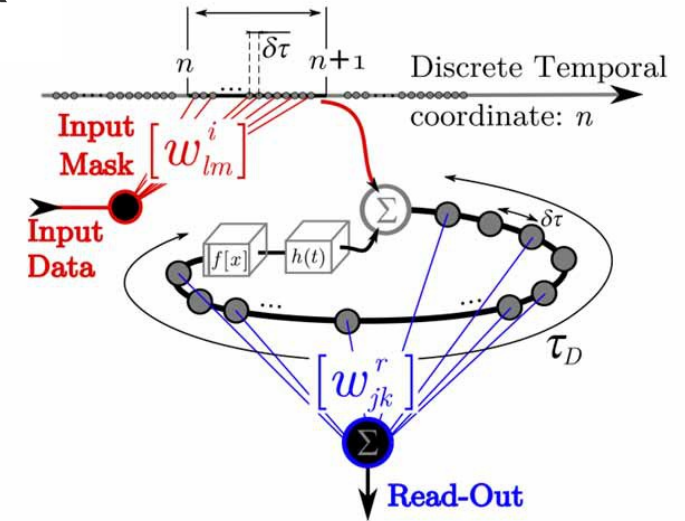
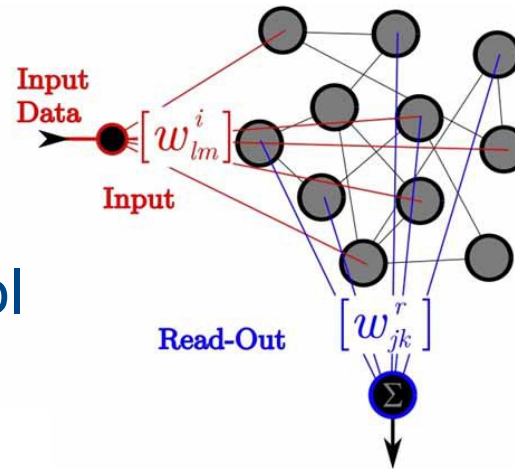


$$\begin{aligned} \varepsilon \cdot \dot{x} &= -x - \delta \cdot y + \beta F_{nl}[x(t - \tau_D) + \alpha u(t)] \\ \dot{y} &= x \end{aligned}$$

1) Recurrent neural network

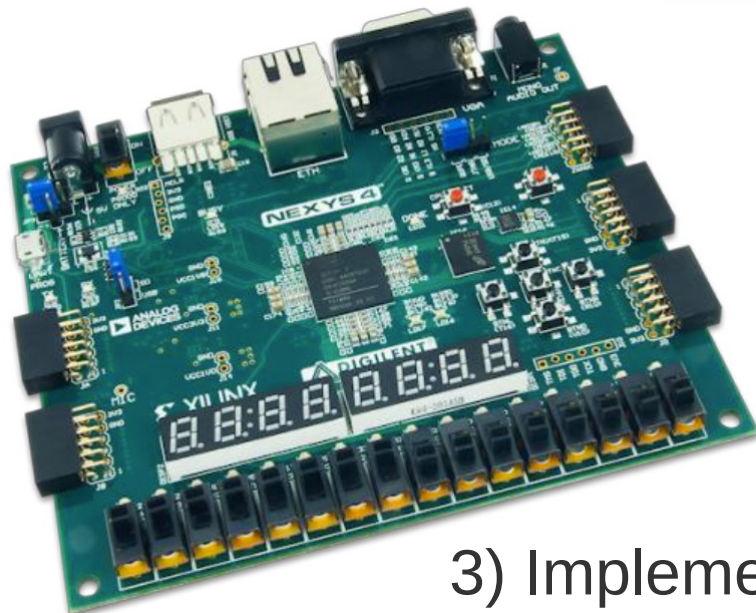
Applications:

- Speech recognition
- Handwriting recognition
- Fuel cells diagnostic
- Femto-second laser control



2) Time-multiplexed

- Benefits:
- 100% hardware
 - Works in hard real-time
 - Small
 - Low-cost
 - Energy-efficient



3) Implemented in FPGA