# Hardware Accelerated Neural Networks
## Stanislav Toman

# State of Art

Artificial neural network is computational model that is inspired by the structure and function of biological neural networks.
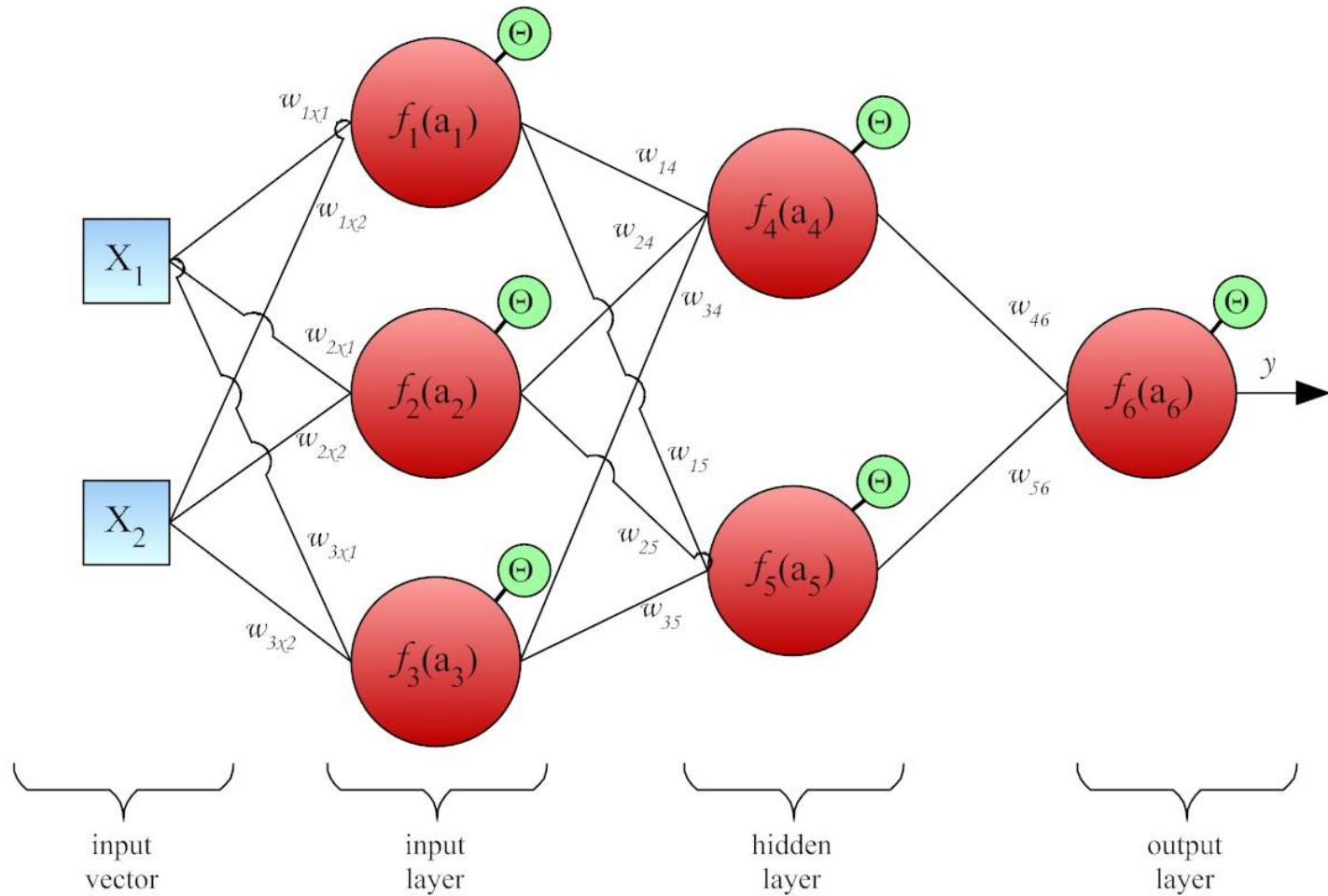
**Usage:**
- Classification
- Regression analysis
- Prediction
- Data processing
- Control

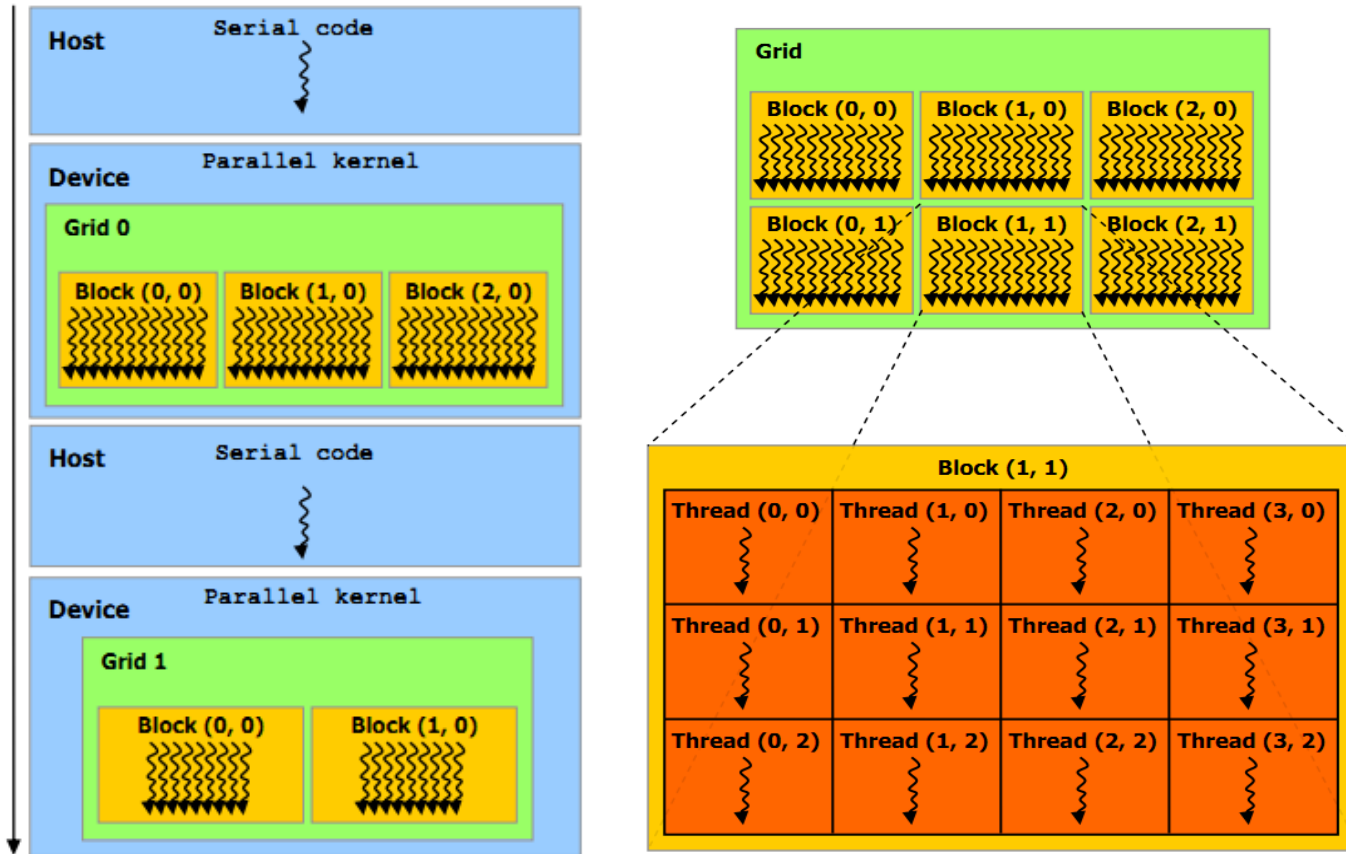**Drawback:**
- Time consuming learning process

# Neural Network

# Parallelization of Algorithm
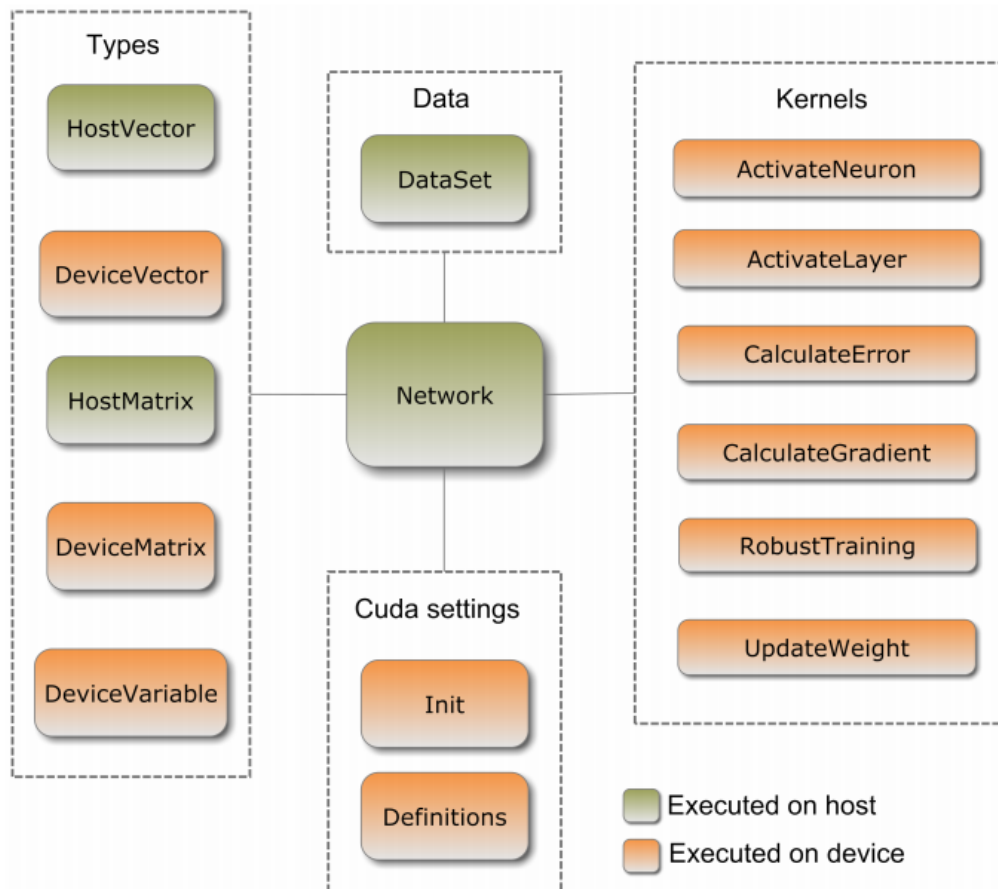
- Neuron parallelization
- Layer parallelization
- Dataset parallelization
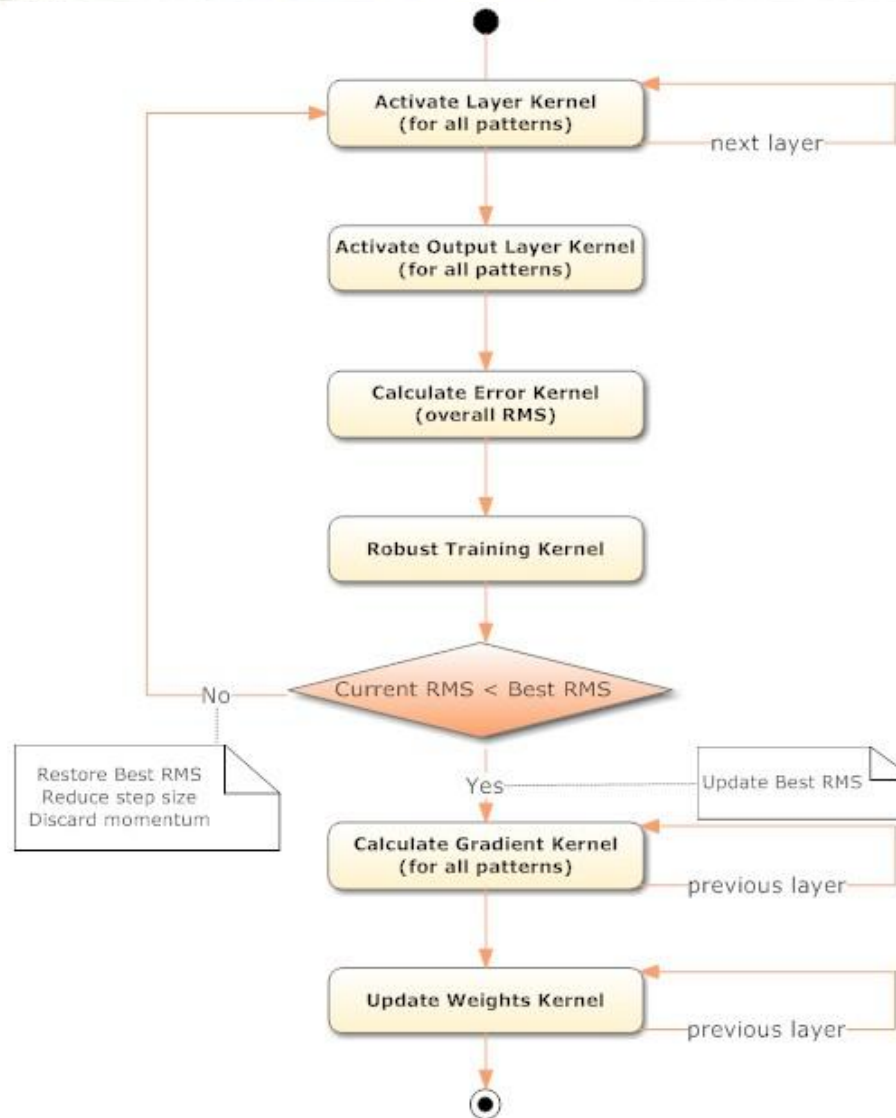- **Parallel atomic operations**

# CUDA Technology



Kernel <<<dim3 GridDimensions, dim3 BlockDimensions>>> (A, B, C);

# Implementation

# Epoch

# Key Aspects of Implementation

- Batch backpropagation algorithm
- Robust approach with variable stepping size
- **Parallel operations on matrix data structures**

# Execution

## Nvidia Tesla C2050

| Processor clock rate | 1.15 GHz |
|---|---|
| Number of processor cores | 448 |
| Maximum block dimensions | (1024, 1024, 64) |
| Maximum grid dimensions | (65535, 65535, 1) |
| Warp size | 32 |
| Compute capability | 2.0 |

## Network configuration

| Network configuration | 784-25-15-10 |
|---|---|
| Initial learning rate | 0.5 |
| Momentum | 0.7 |
| Desired error | 0.04 |

## Dataset

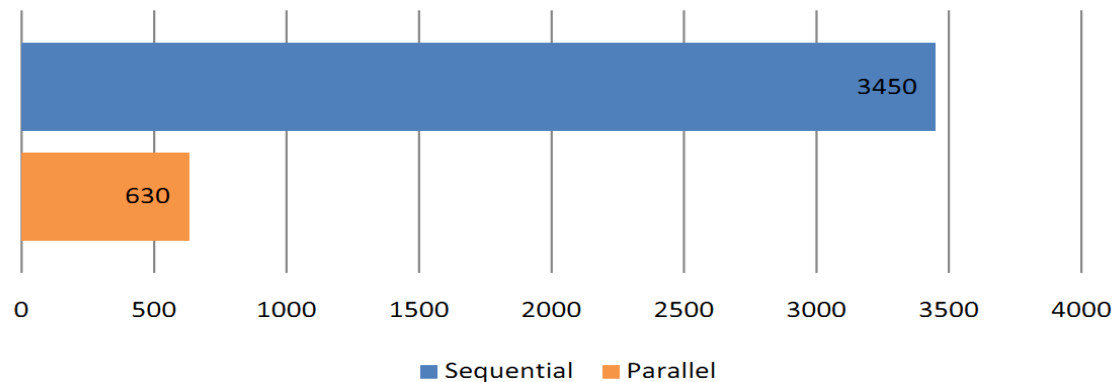| Number of patterns | 10 000 |
|---|---|
| Number of input values | 784 |
| Number of output values | 10 |
| Value range | (0..1) |

# Performance Results

Comparison of FANN sequential algorithm and CUDA parallel algorithm after 256 training epochs
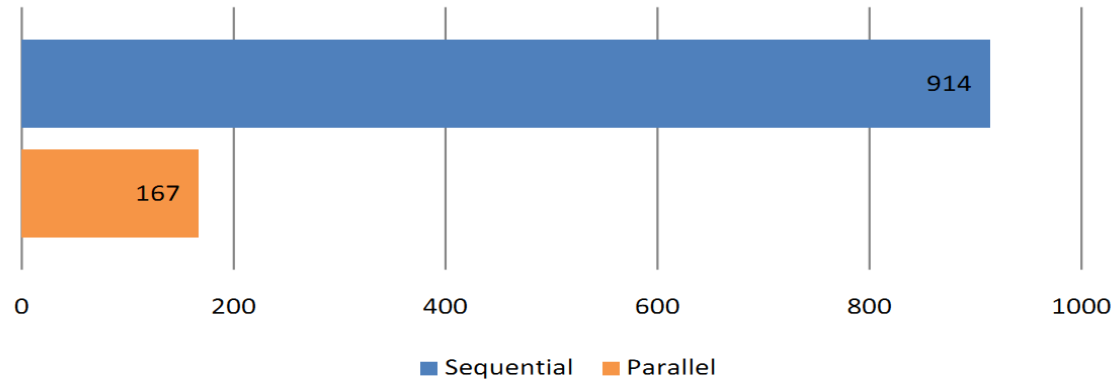
Thank you.
Your questions, please.