Novel Recognition System using XP-ReRAM

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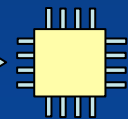
Motivation

- Deep Learning enables chip to recognize everything!
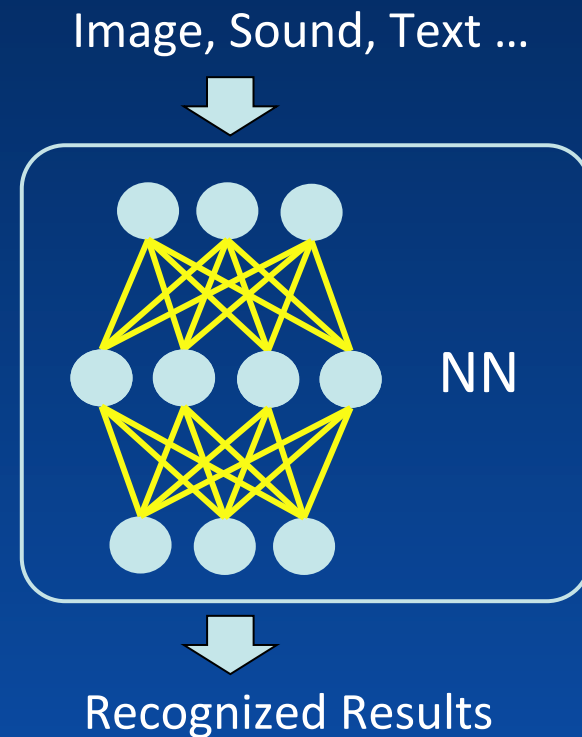- Which memory device is good for DL?

How DL Recognition works

- **Neural Network** discovers what inputs mean

- NN have lots of **parameters**

- To store parameters and process NN efficiently, **special hardware** is required

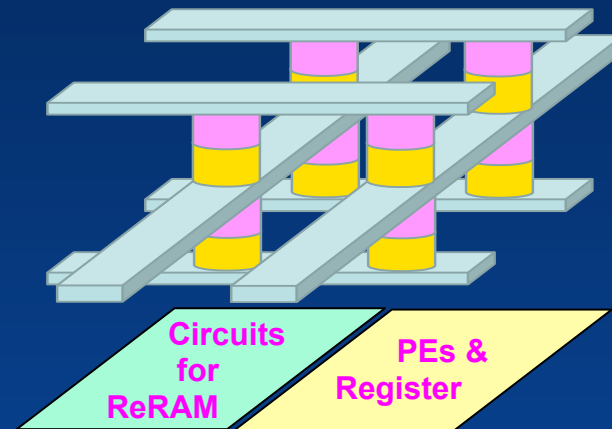Image, Sound, Text …
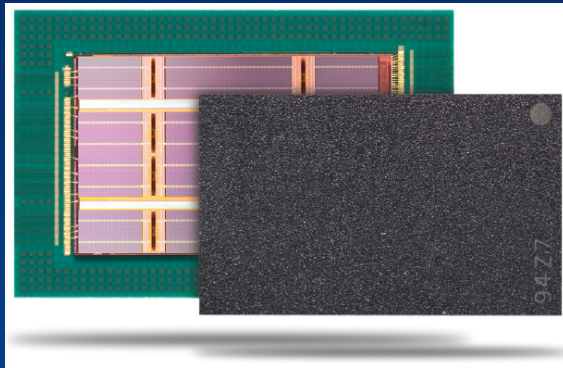
NN

Recognized Results

Expected Parameter Memory

- Capacity >1GB
- Read >1GB/sec
  - For real-time recognition
- Non-volatility
  - Keep parameters while power-off
  - ReRAM is simpler solution than DRAM + Flash
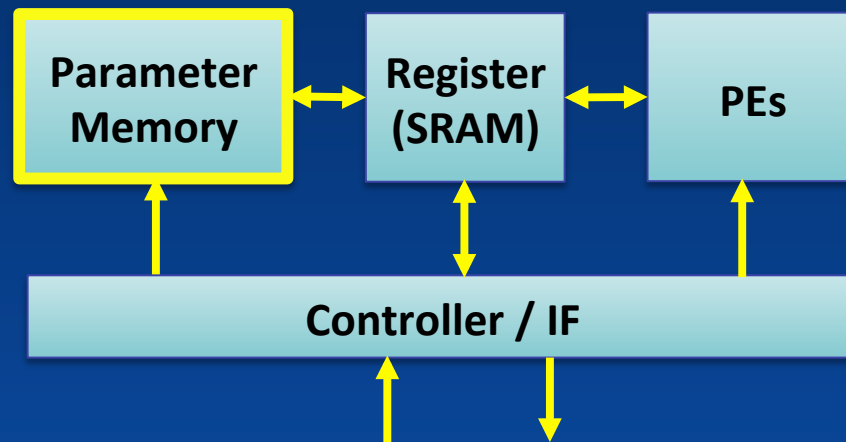
Achievement and Perspective

Circuits for ReRAM

PEs & Register

- **1T1R-ReRAM** (Sony-Micron, 2014)
  - **2GB** Capacity by $6F^2$ cell design
  - **1GB/sec** Read Bandwidth

- **XP-ReRAM**
  - More **GB/$** by $4F^2$ cell & multi-deck
  - More **BW/$** by Circuits under Array
  - Less **Energy** by Embedded PEs

Comparison

Die Area [a.u.]

XP-ReRAM: 1
DRAM: 4

Active Power [a.u.]

XP-ReRAM: 1
DRAM (incl. IF): 4

Standby Power [a.u.]
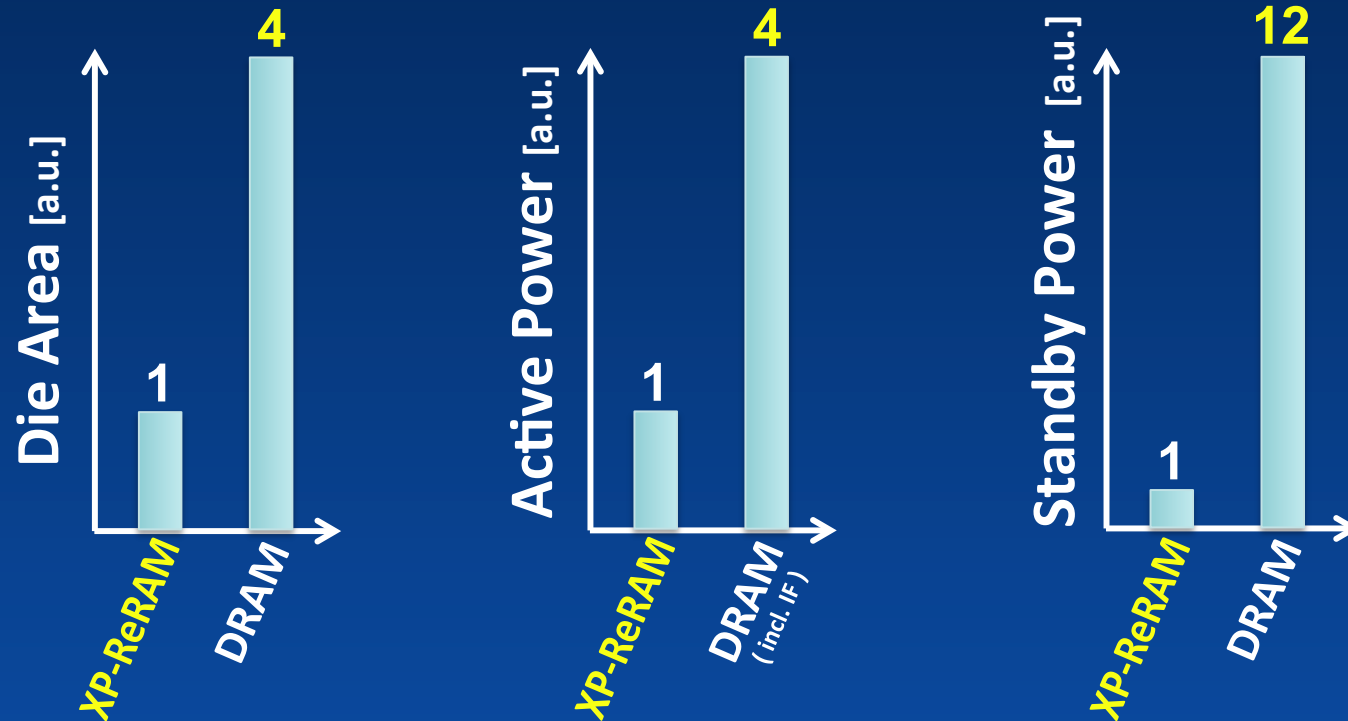
XP-ReRAM: 1
DRAM: 12

XP-ReRAM significantly improves area & power efficiency

Summary

- DL Recognition requires GB, GB/sec Read and non-volatility
- Our ReRAM achieved all those requirements
- XP-ReRAM contributes further small die area and low power

Thank you!

For questions, please contact

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