Artificial Intelligent Processor & Neuron-chips Design Project Master Plan

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Research Road Map

Special Purpose Processor
- Multi-processing
- Custom-designed processor
- AI chip
- Fast Recognition system
- Neural networks
- Network processor

IP/Library DB
- Material (MEMS)
- FPGA: Imaging, vision, robot, A-Rip

Embedded system
- Power/Low power
- Optimization/Minimization

FPGA
- System
- Real time system
- Power/Low power
- Optimization/Minimization

IDEA
- Ultra-fast computing
- Wireless medical equip.
- BIW, Accelerator (MPEG)

Most “Blue Oceans” are created from within “Red Oceans”.

Profit Model with my knowledge

FPGA System
- Sensor, Instrument
- (Medical...)

Prof. Model
- FPGA System
- Application specific Purpose Processor design
- FPGA Vendor
- Chip design Company

Market
- Instrument company

Sensor system and FPGA

FPGA
- Pre-processing
- Compression
- Signal Processing

Interface
- USB, IEEE
- PCI Slot, K-line
- Wireless

PC
- (or Embedded)
- Hardware (C++, MATLAB, etc)

# Red: Possible Technology right away

# Most “Blue Oceans” are created from within “Red Oceans”
Embedded Processor Design

Thesis and Dissertation Topic

M.Sc. (Dec. 2006)
- Title: A Neural Network Face Detector Design Using Bit-Width Reduced FPU in FPGA
- The study
  - an FPGA-based face detector using neural networks + Floating Point arithmetic Unit (FPU)
- Scalable FPU
  - pros: dynamic range, small bits => memory reduction
  - cons: slow, big size (arithmetic units) => can be overcome by FPGA and bit reduction
- Motivation: How many bits the system need?
- Expanded to: DFP (Decimal Floating Point) following std. 754r (draft version)

Ph.D (2007~)
1. NOC (Network on Chip) for multi-processor
2. TCP/IP Off-load Engine Design
3. Special Processor Design
4. Neuro-chips
5. Recognition system
6. FPGA application

Embedded Processor Design

Design Environment

Computer

- System modeling
- Creating testbench to simulate HDL model
- Analysis output data from the HDL model

Test Bench

Input Data (Ascii)

Output Data (Ascii)

Matlab/Visual C++

System

Modelsim (Altera/Xilinx)

VHDL

System

Hardware

Embedded Processor Design

Canadian Caps Co. (Present)

CEO

Administration

Marketing & Sales

IT (Internet Shopping Mall)

R & D

IP Team (VHDL, etc.)

- Interface: USB, PCI-e, TCP/IP, etc
- Arithmetic
- Compression
- Micro-processor (Compatible Processor)
Embedded Processor Design

Confidential

Expected Company Organization

CEO
Marketing & Sales
Administration

R & D

ASIC Department
Design House Team (Level 1, Level 2)

System Department

IP Team (VHDL, etc.)

S/W Team (MATLAB, C++)

H/W Team (PSPICE, ORCAD)

- Interface
- Arithmetic
- Compression
- Micro-processor (Compatible Processor)

- Compiler
- Emulator
- Application SW

- Board Design
- RF analysis

- Neuro-chips
- DNA-chips

Biochemistry, Chemistry, Physics, Mathematics

Possible strategy: specific purpose processor design \(\rightarrow\) expand to the market

Embedded Processor Market Analysis

Fig. Embedded Processor Market Share

- ARM (75.8%)
- MI 6 (4.6%)
- Other (2.5%)
- PowerPC (1.9%) Other (2.5%)

Embedded processor market has been increasing by 17% every year
- Market share of ARM is 76.8%
- But there are also required various processors for specific market

Possible strategy: specific purpose processor design \(\rightarrow\) expand to the market

National Research Road Map

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<tr>
<td>Korea</td>
<td>robot, communication, semi</td>
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<td>U.S.</td>
<td>bio, space</td>
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<td>IRTS</td>
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