Interdisciplinary Research Challenges
Group A

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Mentors: Keigo Nitadori and Huthmann Jens

Topics

- Group Re-Introduction

- Discussion Method

- Interdisciplinary Research

- Conclusion

Introduction

Group members

4 young scientists from different fields

- Atsuki Hiraguchi, Kochi Univ., Japan
  - Lattice QCD
- Yu-Hsiang Tsai, Karlsruhe Institute of Technology, Germany
  - SpMV on GPU (NVIDIA vs AMD)
- Koya Kobayashi, Aichi Prefectural Univ., Japan
  - Deep learning (LSTM: Long Short-Term Memory)
- Carolee Nguyen, Univ. of California, USA
  - Imaging (Dendritic branch terminal and length detection)

Atsuki Hiraguchi:"Quark confinement and color monopoles"

- Lattice QCD simulation
  - having been the mainstream of traditional HPC
- Up to 48^4 lattice, *SU*(2) model, Quench approx.
- Single node SX-ACE in Osaka univ.
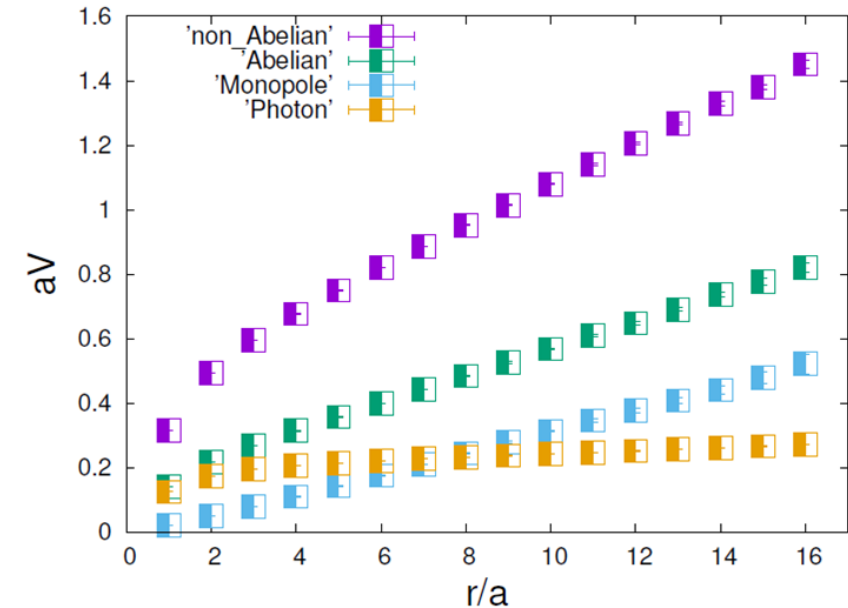
Yu-Hsiang Tsai:
"Ginkgo's SpMV on NVIDIA and AMD GPU architectures"

- Sparse Matrix Vector multiplication
- Mainstream of traditional HPC
- Compared NVIDIA Tesla V100 and AMD Radeon VII
- Porting from CUDA to HIP

	NVIDIA V100	Radeon VII
Warpsize	32	64
BandWidth	897 GB/s	1024 GB/s
FP64 Perf.	7.834 TFLOPS	3.360 TFLOPS
L1 Cache	128 KB	16 KB
L2 Cache	6 MB	4MB
Price	US $ 10,669	US $ 699

# Koya Kobayashi:"Blood flow prediction using machine learning"

- LSTM: Long Short-Term Memory
  ◦ A deep-learning method for time dependent stream like sound
- 3 days on 1 V100 GPU for training (with Keras and Python)
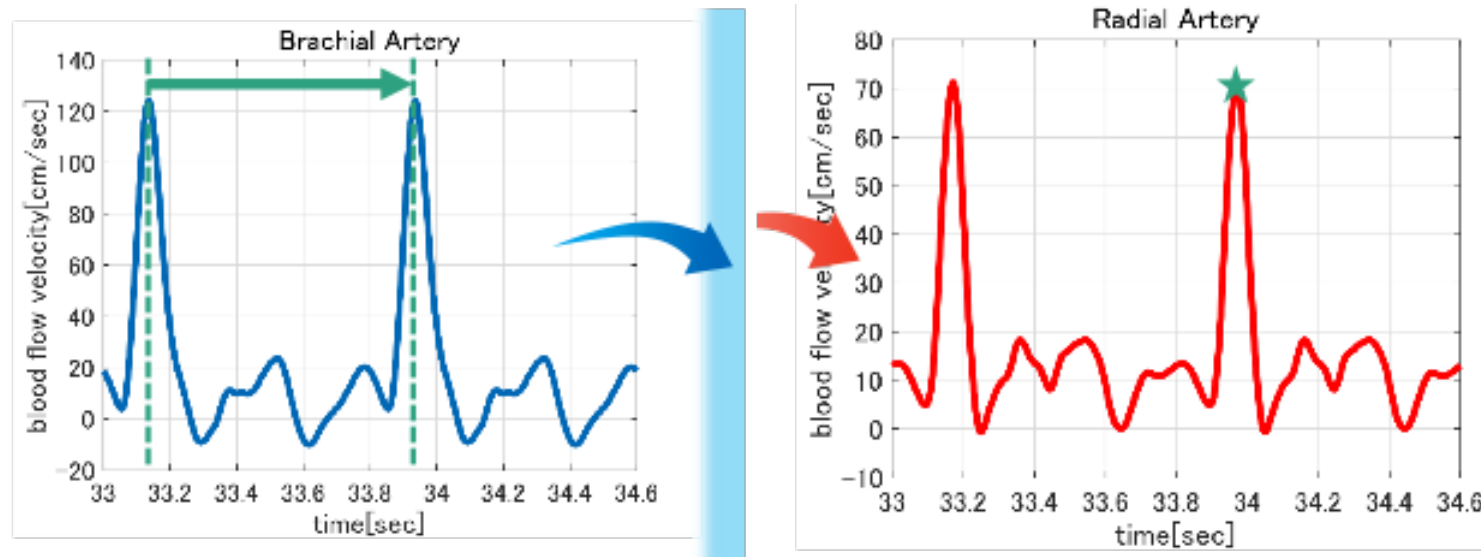
$$y_i = f(x_i, x_{i-1}, \ldots, x_{i-N})$$

Carolee Nguyen: "Automated reconstruction and quantification of regenerated Drosophila class IV da neurons"

- Depiction of total dendrite length and branch terminals parameters
- DeTerm
  - Open source software
  - CUI
  - Not easy to build and use
- Imaris
  - Commercial software ($30,000)
  - GUI
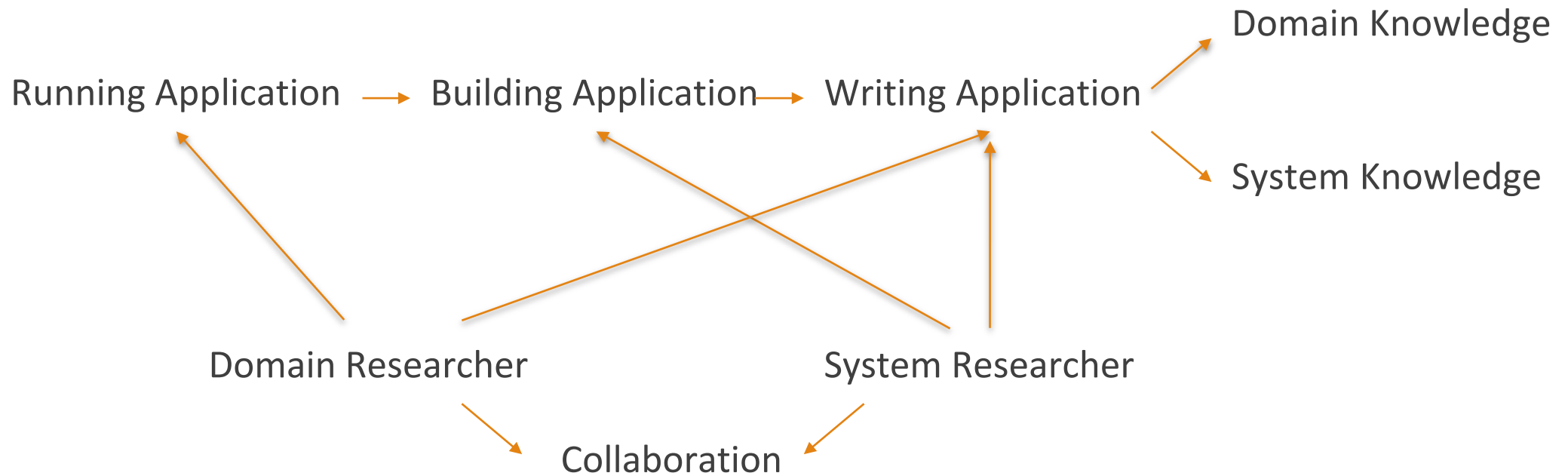 - Better accuracy and user interface
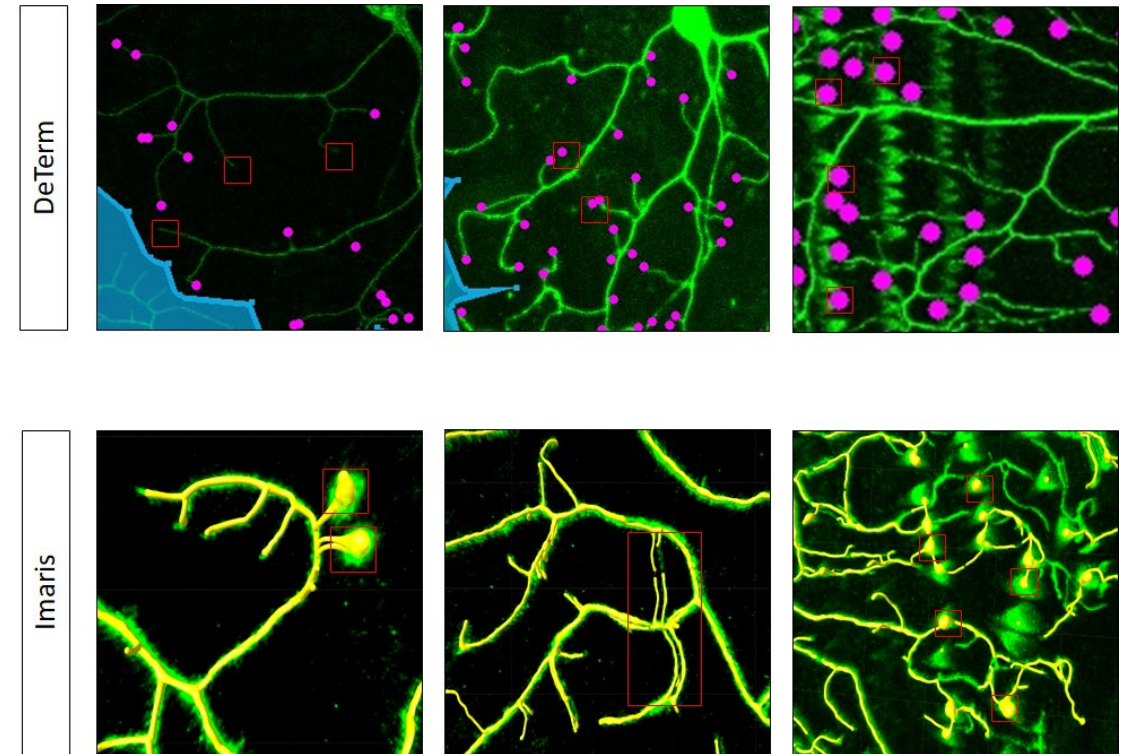
Our Discussion

We are from different domains

- Particle Physics

- Computational Biology

- Neuro Informatics Science

- High Performance Computing

Mindmapping

Supercomputer Usability Challenges

Interdisciplinary Research

Research Goals

Domain researcher

- Wants to solve domain problems

- No system knowledge

System researcher

- Wants to solve "how to solve domain problems"

- No domain knowledge

Research Challenges

Domain Researcher

- Which software can help solve my research problem?
  - Accuracy
  - Time efficiency

- How do I use/understand the software?
  - Input requirements
  - User interface

- What do I do if there are no software to use?
  - Write your own software?

System Researcher

- How do we attract people to use software?

- How to understand the requirement/purpose of domain researchers?

- Flexibility vs Usability

- How to make clear documentation for the domain researchers?

Conclusion

Conclusion

- Interdisciplinary Talk
  - Opportunity for casual talks
  - BDR and R-CCS both have regular open talks
    - Not many go from one center to the other
    - One station is to much?
- Outside of Japan:
  - University of California, Irvine - Opportunities for collaboration in graduate school where we take one year in interdisciplinary field.
  - Karlsruhe Institute of Technology, Germany - Find a good time suitable for different timezone. (US in -7, Germany in +1 and Japan in +9

- Intermediate Languages / Domain Specific Languages
  - Danger of: Yet another thing?