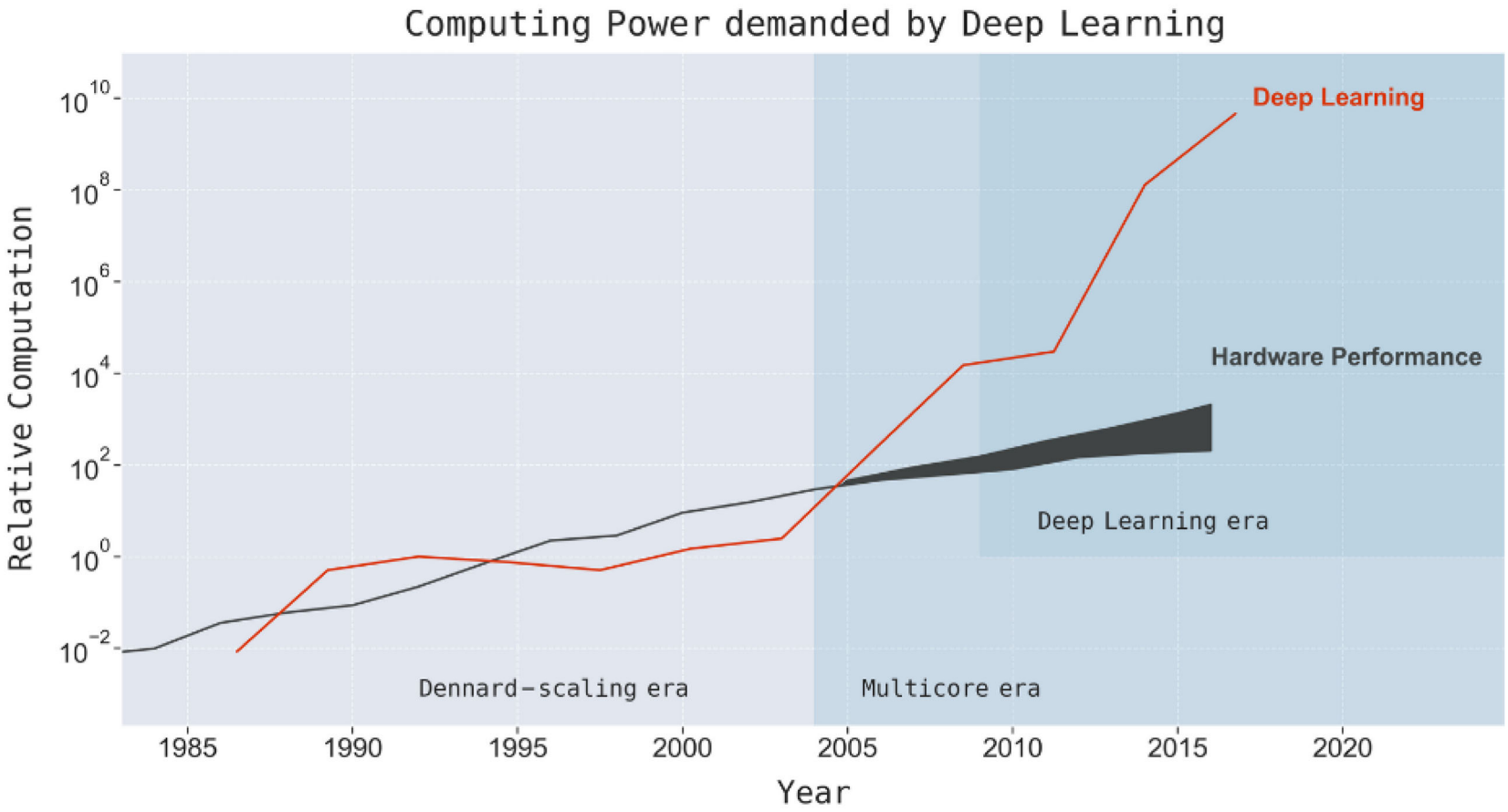
It’s CRNCH Time! (Summit 2022)

Georgia Tech Center for Research into Novel Computing Hierarchies

Hyesoon Kim, Rich Vuduc (co-dirs),
Tushar Krishna (assoc. co-dir), Jeff Young (RG)
Ruthie Book (admin + logistics)

Satiating the Beast



Thompson et al. (2020). “The computational limits of deep learning.” arXiv:2007.05558.

CRNCH Overview

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CRNCH is focused on extending computing design beyond traditional paradigms

- Fostering the community at GT pursuing **revolutionary, long-term research**—in areas like neuromorphic, quantum, reversible and approximate computing—that addresses post-Moore scaling challenges
  - Engages faculty across sciences, engineering, computing, and GTRI and helping them connect with external partners such as ORNL, Sandia, and Northrop Grumman
- Developing **new educational initiatives** to help the next-generation of researchers "speak across the stack"
- Providing enabling **infrastructure and training**, as we do with the **"Rogues Gallery,"** a place for non-conventional computer hardware to be used by students, faculty, and industry partners

Rogues Gallery: A Community Research Infrastructure for Post-Moore Computing

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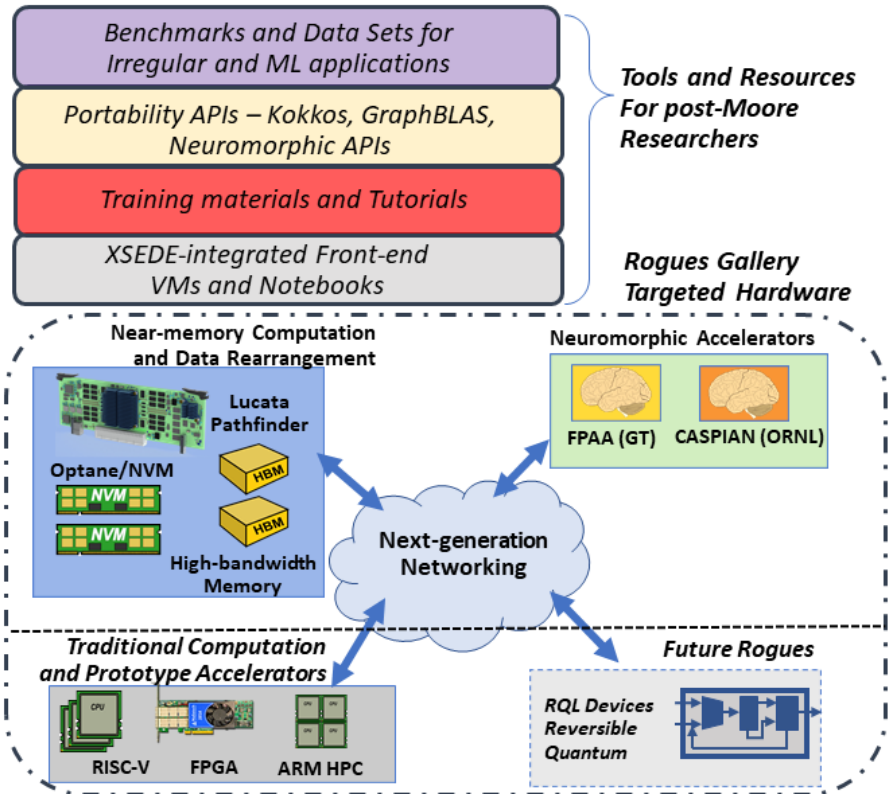
Director: Jeff Young



Rogues Gallery Users

- ~20 VMs, 30 servers, numerous boards
- **150** users overall; 35 external users
- **120+** students supported via GT TechFee associated work in 2021-2022

The Rogues Gallery is now an NSF funded post-Moore testbed for CISE researchers and the community

CNS-2016701, $1.3M over 3 years

Supports deploying:

-Rack-scale Lucata Pathfinder 16 node system

-Neuromorphic accelerators

-Smart networking and 5G equipment

-Backend infrastructure

-***Novel chips and related benchmarking and testing***

This grant focuses on ***community engagement and post-Moore training***

CRNCH Ph.D. Fellowship

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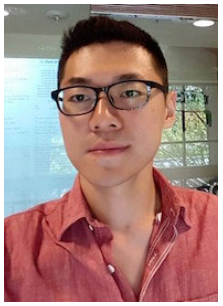
Samantha Noor, Spring 2021 winner



Dingtian Zhang, Fall 2020 winner

Muliang Zhu, Fall 2020 winner

Chunxing Yin, Fall 2020 winner

CRNCH launched the fellowship program in Fall of 2020 to support innovative student research in post-Moore computing topics.

Each award provides seed funding to an early-career student to support research into a novel topic area.

Successful fellowship proposals include:

- A statement of research to be done over a semester with a focus on innovative approaches to a problem
- A detailed research plan with timelines and milestones for experiments, and a section detailing empirical measurements and metrics to assess whether the proposed techniques are successful.

- Students then present their results via the CRNCH Summit poster session and through a submitted publication.

CRNCH Ph.D. Fellowship

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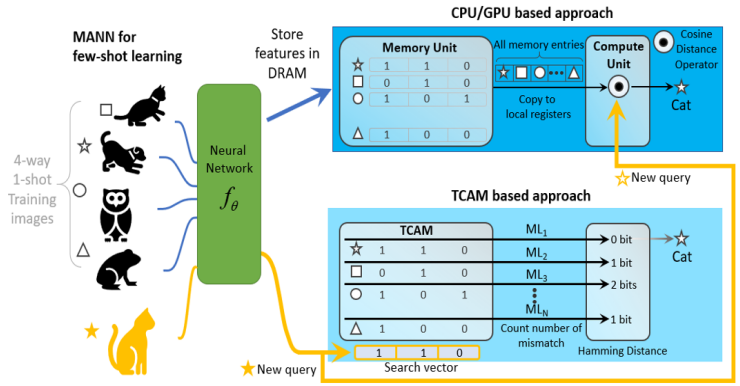
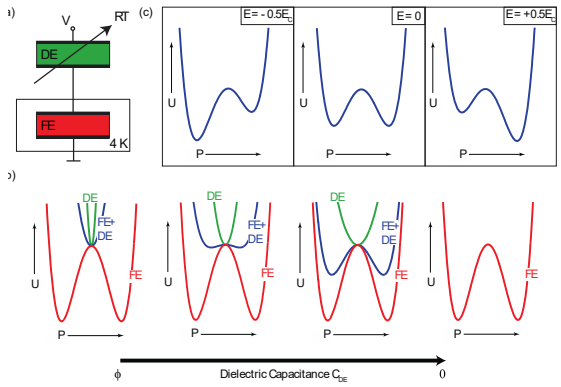


Narla: New circuit-level designs for memory that could yield better system architectures for ML



Ravindran: Exploring alternative material substrates for implementing qubits

Fall 2021 Winners

•Siri Narla (**ECE**), “Ultra-low power magnetoelectric random access memory for TCAM applications.” Advisor: Dr. Azad Naeemi

•Prasanna Ravindran (**MSE/ECE**), “Quantum annealing in ferroelectronic platforms.” Advisor: Dr. Asif Khan

•(Honorable mention) Daniel Zakha (**CS**), “Building disaggregated resource runtimes on next-generation interconnects.” Advisor: Dr. Ada Gavrilovska

Spring 2021 Winner

•Samantha Lubaba Noor (**ECE**), "System-level Figure of Merit Optimization of a Plasmon-based Integrated Computing Network", Advisor, Dr. Azad Naeemi

Fall 2020 Winners

•Chunxing Yin (**CSE**), "Tensorized neural networks for faster training and better co-design." Advisor: Rich Vuduc

•Dingtian Zhang (**IC**), "Self powered computational photodetectors based on organic semiconductor devices." Advisor: Dr. Gregory Abowd

•Muliang 'James' Zhu (**ECE**), "Cortex-inspired optical computing enabled by photonic metasurfaces", Advisor: Dr. Ali Adibi

Partner Highlights in 2021

CRNCH is grateful to its partners for enabling new efforts, so thanks, y'all!

RG expansion, research, tutorials, personnel transfers; CRNCH and Lucata were #46 on the Green Graph500 in 2021!

NORTHROP GRUMMAN

Novel computer architectures

PNNL

Sandia National Laboratories

Architecture, in-network computing, solvers, graphs, tensors, programming models

Just a (pseudo)random sample!

Summit 2022 — Themes

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Next-generation computer architectures and innovations in materials and manufacturing (also: CHIPS Act Panel)

Algorithms and applications for emerging and future platforms (also: “Beyond ML/AI” panel)

Meet students at the poster session @ 4:30 ET

crnch.gatech.edu