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Comments from the Editors

Dear ACM/SIGDA members,

We are excited to present to you April E-Newsletter. We encourage you to invite your students and colleagues to be a part of the SIGDA newsletter. The newsletter covers a wide range of information from the upcoming conferences and hot research topics to technical news and activities from our community. Get involved and contact us if you want to contribute an article or announcement.

The newsletter is evolving. Please let us know what you think.

Happy reading!

Debjit Sinha, Keni Qiu, Editors-in-Chief, SIGDA E-News

To renew your ACM SIGDA membership, please visit http://www.acm.org/renew or call between the hours of 8:30am to 4:30pm EST at +1-212-626-0500 (Global), or 1-800-342-6626 (US and Canada). For any questions, contact acmhelp@acm.org.

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Ying Wang, E-Newsletter Associate Editor for SIGDA Technical activities column

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SIGDA News

(1) "Huge Growth Seen for 5G Mobile Devices"
[https://www.eetimes.com/huge-growth-seen-for-5g-mobile-devices/]

The number of 5G-capable mobile devices announced and commercially available has passed the 600 mark this month, the Global Suppliers Association (GSA) said in its latest survey, published this week.

(2) "Samsung, TSMC are Spending to Widen IC Manufacturing Lead"

[https://www.eetimes.com/samsung-tsmc-are-spending-to-widen-ic-manufacturing-lead...]

Samsung and Taiwan Semiconductor Manufacturing Co. (TSMC) are poised to widen their IC manufacturing lead in the chip industry this year as they outspend rivals in production technology, according to industry watcher IC Insights.

(3) "Automotive Industry Likely to Face Materials Shortage"

[https://www.eetimes.com/automotive-industry-likely-to-face-materials-shortage/]

A decade ago, the automotive industry could not foresee a semiconductor shortage disrupting vehicle production. A decade from now, automakers may face a scarcity of materials required for EV batteries and other essential components. Shortages might even come sooner than that.

(4) "Arm v9: First New Architecture in a Decade Doubles Down on AI and Security" [https://www.eetimes.com/arm-v9-first-new-architecture-in-a-decade-doubles-down-o...]

Arm has launched a major architecture revision, Arm v9, which provides additional features for security, confidential computing and AI as well as boosting overall performance. Arm said it expects v9 to deliver more than 30% performance uplift in the next two mobile and infrastructure generations. AI features, thus far most typically available with GPUs, will be available across the company's GPUs, CPUs, and NPUs.

(5) "Xilinx Opens Up Vitis HLS Tool for FPGAs"

[https://www.eetimes.com/xilinx-opens-up-vitis-hls-tool-for-fpgas/]

The news that Xilinx has open-sourced the Vitis HLS (high-level synthesis) front-end is another push to democratize software development for FPGAs.

(6) "Xilinx Puts UltraScale+ in InFO form for Low-Cost Intelligent Edge" [https://www.eetimes.com/xilinx-puts-ultrascale-in-info-form-for-low-cost-intelli...]

Xilinx has expanded its UltraScale+ portfolio with new cost-optimized devices. They' re made with TSMC' s state-of-the-art integrated fan-out (InFO) packaging technology, enabling high compute density in compact form factors for intelligent edge applications.

(7) "AMD, TSMC & Imec Show Their Chiplet Playbooks at ISSCC" [https://www.eetimes.com/amd-tsmc-imec-show-their-chiplet-playbooks-at-isscc/]

A lot has been said about the shift from a system-on-chip integration of functionality to a technology integrating each IP block as a physically distinct chiplet. Perhaps the emergence of this new paradigm is most aptly represented by the devotion of a full forum session to chiplets at the International Solid-State Circuits Conference. The virtual conference just wrapped up.

(8) "Intel' s Horse Ridge II Improves the Control for Quantum Computing" [https://www.eetimes.com/intels-horse-ridge-ii-improves-the-control-for-quantum-c...]

During the 2021 International Solid-State Circuits Conference (ISSCC), Intel reported technical details for its second-generation cryogenic quantum control chip, Horse Ridge II, which puts careful team design work into practice with a combination of testing and technology development.

(9) "Diamond-Based Quantum Accelerator Might Make Quantum Practical" [https://www.eetimes.com/diamond-based-quantum-accelerator-might-make-quantum-pra...]

Quantum Brilliance will install a diamond-based quantum accelerator at the Pawsey Supercomputing Centre. Leveraging synthetic diamond technology, Quantum Brilliance is an Australian start-up supported by the Australian National University.

(10) "NVDIMM Protocol Expands Non-Volatile Memory Options" [https://www.eetimes.com/nvdimm-protocol-expands-non-volatile-memory-options/]

The latest first-generation protocol announced by the JEDEC Solid State Technology Association has been driven by increased demand for DRAM capacity and bandwidth, as well as a flexible method for attaching emerging, persistent memory in computing systems.

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SIGDA Local Chapter News

On March 14, the China Semiconductor Technology International Conference (CSTIC) was held at the Shanghai International Convention Center. During the meeting, a new ACM/SIGDA local chapter, ACM/SIGDA East China Local Chapter, was announced.

East China is one of the core areas for China's IC industry. More than 50% of international and China's well-known IC industries, such as Cadence, Synopsys, and Intel are located there. Moreover, multiple reputed universities and institutes in the fields of computer science and electronic engineering are located in this region. ACM/SIGDA East China Local Chapter aims to work together with the local industries and academia, thereby promoting collaboration and innovation, and will serve the IC design and design automation industry.

The establishment of ACM/SIGDA East China Local Chapter can help enhance ACM/SIGDA's impact in China. Together with the local professional organizations, such as China Computer Federation (CCF), the local chapter will (co-)sponsor conferences, workshops and regular seminars, promote student visiting and host design contests to bridge academia and industry.

The organizing committee of ACM/SIGDA East China Local Chapter includes Prof. Cheng Zhuo from Zhejiang University, Prof. Li Jiang from Shanghai Jiaotong University, Prof. Fan Yang from Fudan University, Prof. Weigiang Liu from Nanjing University of Aeronautics and Astronautics, and Prof.

Mingsong Chen from East China Normal University. Prof. Zhuo and Prof. Jiang will, respectively, serve as Chair and Vice-Chair of the chapter. In the past season of 2021, the East China local chapter has successfully planned many activities in China, including ACM TURC 2021 EDA Workshop, the 6th ChinaDA Symposium, and the CFTC/CTC Embedded Forum.

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"What is" Column

What is General-Purpose Processing in Memory?

Jing Li,
Associate Professor,
Department of Electrical and Systems Engineering,
University of Pennsylvania

The ever-growing demand for machine learning and data analytics are driving the industry away from general-purpose microprocessors and creating a renewed interest in a decades-old concept, processing-in-memory (PIM). The basic idea of PIM is simple, moving computation closer to where data resides to reduce data movement cost – the major source of inefficiency. Although the common wisdom believes that the general-purpose computing is coming to an end, we argue that it might continue but probably exist in a different form, for example, paired with PIM, as programmability is a highly desirable feature in computing. There is an overwhelming amount of PIM papers in literature but very few provides elegant solutions to achieve general-purpose computing. Depending on the proximity where compute is placed with respect to memory array, there are three general categories to classify the state-of-the-art general-purpose PIMs.

The first category of PIM is near-memory processing (NMP). The underlying principle of NMP, is to perform computation in proximity of memory – by physically placing a monolithic compute unit, closer to a monolithic memory array. The early version of NMP may employ a full-fledged implementation of CPU, GPU, FPGA or their variants as the compute unit. One advantage of this class of PIM is the relatively low design complexity as the existing memory IP and compute IP can be largely reused. But the performance gain might be limited due to the bandwidth constraints between monolithic compute units and memory arrays.

On the other side of the spectrum, in-memory processing (IMP), as a second class of PIM (perhaps the most interesting PIM), grew out of NMP from processing in proximity of memory to processing inside memory. IMP employs memory array itself to perform computation. We list 4 representative work to illustration four fundamental methods of achieving general-purpose computing: (1) Liquid Silicon [1]: The basic idea is to employ a memory array to implement logic, search, routing and memory by applying different binary encodings on input/output as well as storage element of the memory cell. It uses dataflow programming model, similar to FPGA. (2) Hyper-AP [2]: It employs a memory array to implement search and memory operations. Programmability is achieved through a new execution model by converting an arbitrary arithmetic operation into a series of search and memory operations. The programming model is SIMD and any applications can be mapped onto this architecture with appropriate compiler support. Both (1) and (2) require minimal hardware changes to conventional memory. (3) MAGIC [3]: It employs a new memory structure to implement NOR/NOT by forming a voltage divider circuit using a number of memory cells. The computation is performed by repeatedly writing into the storage element of the memory cell. While achieving general-purpose computing, this may cause performance/reliability problems for nonvolatile memory which typically has long write latency and limited write lifetime. (4) Dot-product [4]: Numerous PIM ideas are built atop the concept of using memory array to perform dot-product operation. Expensive mixed-signal circuits are typically needed to convert signals between the array and the outside world. The programming model is SIMD like (to some extend).

Finally, in addition to these two types, there is a middle ground where the computation can be

performed partially inside memory array and partially near the memory. The hybrid PIM appears to be less elegant than IMP due to the extra complexity introduced by more specialization and increased heterogeneity and thus may only find use in niche applications.

- [1] Yue Zha and Jing Li, "Liquid Silicon: A data-centric reconfigurable architecture enabled by RRAM technology," in Proceedings of the 2018 ACM/SIGDA International Symposium on Field-Programmable Gate Arrays (FPGA' 18)
- [2] Yue Zha and Jing Li, "Hyper-AP: Enhancing Associative Processing Through A Full-Stack Optimization," in 2020 ACM/IEEE 45th Annual International Symposium on Computer Architecture (ISCA' 20)
- [3] Kvatinsky, Shahar, Dmitry Belousov, Slavik Liman, Guy Satat, Nimrod Wald, Eby G. Friedman, Avinoam Kolodny, and Uri C. Weiser. "MAGIC—Memristor-aided logic." IEEE Transactions on Circuits and Systems II: Express Briefs 61, no. 11 (2014): 895-899.
- [4] Fujiki, Daichi, Scott Mahlke, and Reetuparna Das. "In-memory data parallel processor." ACM SIGPLAN Notices 53.2 (2018): 1-14.

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Paper Submission Deadlines

ESWEEK'21 - Embedded Systems Week (CASES, CODES+ISSS, and EMSOFT)

Virtual Conference

Deadline: Apr 9, 2021 (Abstracts due: Apr 2, 2021)

Oct 10-15, 2021

http://www.esweek.org

MICRO' 21 – IEEE/ACM Int'l Symposium on Microarchitecture

Athens, Greece

Deadline: Apr 16, 2021 (Abstracts due: Apr 9, 2021)

Oct 16-20, 2021

http://www.microarch.org/micro54

MDTS'21 – IEEE Microelectronics Design & Test Symposium

Virtual workshop Deadline: Apr 14, 2021 May 18-21, 2021 http://natw.ieee.org

PACT'21 - Int'l Conference on Parallel Architectures and Compilation Techniques

Virtual Conference

Deadline: Apr 19, 2021 (Abstracts due: Apr 15, 2021)

Sept 26-28, 2021

http://www.pactconf.org

ISED' 21 – 10th Int' | Symposium on Embedded Computing & System Design

Kollam, India

Deadline: Apr 25, 2021 Jul 16-18, 2021

http://isedconf.org

VLSI-SoC' 21 – IFIP/IEEE Int' I Conference on Very Large Scale Integration

Singapore

Deadline: Apr 26, 2021 (Abstracts due: Apr 19, 2021)

Oct 5-7, 2021

http://www.vlsi-soc.com

IWLS'21 - International Workshop on Logic & Synthesis

Virtual Conference

Deadline: Apr 26, 2021 (Abstracts due: Apr 19, 2021)

Jul 19-21, 2021 https://www.iwls.org

HOST'21 – IEEE Int' | Symposium on Hardware-Oriented Security and Trust

Washington DC

Deadline: May 4, 2021 (Abstracts due: Apr 27, 2021)

Dec 12-15, 2021

http://www.hostsymposium.org

BodyNets'21 – Int' I Conference on Body Area Networks

Virtual Conference Deadline: May 13, 2021 Oct 25-26, 2021

http://www.bodynets.org

ICCAD' 21 – IEEE/ACM Int' I Conference on Computer-Aided Design

Virtual Conference

Deadline: May 21, 2021 (Abstracts due: May 28, 2021)

Nov 1-4, 2021

http://www.iccad.com

FPT'21 - Int'l Conference on Field-Programmable Technology

Auckland, New Zealand

Deadline: Jul 19, 2021 (Abstracts due: Jul 12, 2021)

Dec 6-10, 2021 http://icfpt.org

HiPC'21 – IEEE Int'l Conference on High Performance Computing, Data, And Analytics

Bangalore, India Deadline: TBD Dec 17-20, 2021 http://www.hipc.org

SPSL'21 – Secure and Private Systems for machine Learning (SPSL) workshop, co-located with ISCA

2021 (Virtual)

Submissions Due: April 30, 2021

https://sites.google.com/usc.edu/spsl/home

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Upcoming Conferences and Symposia

DATE'21 - Design Automation and Test in Europe

Grenoble, France

Feb 1-5, 2021

http://www.date-conference.com

ISSCC'21 - IEEE Int'l Solid-State Circuits Conference

San Francisco, CA

Feb 14-18, 2021

http://isscc.org

VLSID'21 – International Conference on VLSI Design & International Conference on Embedded

Systems

Virtual Conference

Feb 20-24, 2021

http://embeddedandvlsidesignconference.org/

FPGA' 21 – ACM/SIGDA Int' I Symposium on Field-Programmable Gate Arrays

Virtual Conference

Feb 28-Mar 2, 2021

http://www.isfpga.org

ISPD' 21 – ACM Int' | Symposium on Physical Design

Mar 21-24, 2021

http://www.ispd.cc

ISQED'21 - Int'l Symposium on Quality Electronic Design

Virtual Conference

Apr 7-8, 2021

http://www.isqed.org

TAU' 21 – ACM Int' I Workshop on Timing Issues in the Specification and Synthesis of Digital

Systems

Monterey, CA

Apr 8-9, 2021

http://www.tauworkshop.com

FCCM' 21 - The 29th IEEE International Symposium On Field-Programmable Custom Computing

Machines

Orlando, FL

May 9 – May 12, 2021

https://www.fccm.org/

RTAS'21 – 27th IEEE Real-Time and Embedded Technology and Applications Symposium

Nashville, USA

May 18-21, 2021

http://2021.rtas.org

ISCA' 21 – Int' I Symposium on Computer Architecture

Valencia, Spain

May 22 – 26, 2021

https://iscaconf.org/isca2021/

ISCAS'21 – IEEE Int'l Symposium on Circuits and Systems

Daegu, Korea

May 23-26, 2021

http://iscas2021.org

LCTES' 21 – ACM Int' I Conference on Languages Compilers, Tools and Theory of Embedded

Systems

Virtual conference

Jun 20-25, 2021

https://pldi21.sigplan.org/home/LCTES-2021

GLSVLSI' 21 – ACM Great Lakes Symposium on VLSI

Virtual Conference

Jun 22-25, 2021

http://www.glsvlsi.org

ICDCS'21 – IEEE Int'l Conference on Distributed Computing Systems Virtual
Jul 7 - 10, 2021
https://icdcs2021.us/

ISVLSI' 21 – IEEE Computer Society Annual Symposium on VLSI Tampa, Florida
Jul 7-9, 2021
http://www.ieee-isvlsi.org

DAC' 21 – Design Automation Conference San Francisco Jul 11–15, 2021 http://www.dac.com/

ISLPED' 21 – ACM/IEEE Int' I Symposium on Low Power Electronics and Design Hybrid Zoom/Boston, MA Jul 26-28, 2021 http://www.islped.org

3rd ACM/IEEE Workshop on Machine Learning for CAD (MLCAD) Hybrid Workshop August 31 – September 2, 2021 http://mlcad.itec.kit.edu

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SIGDA Awards

Best Paper Awards at DATE 2021: The Design, Automation and Test in Europe Conference, https://www.date-conference.com/

D Track: "Leveraging Processor Modeling and Verification for General Hardware Modules" by Yue Xing, Huaxi Lu, Aarti Gupta, Sharad Malik - Princeton University, USA.

A Track: "A GPU-accelerated Deep Stereo-LiDAR Fusion for Real-time High-precision Dense Depth Sensing" by Haitao Meng, Chonghao Zho, Jianfeng Gu, Gang Chen - Sun Yat-sen University, China.

T Track: "Microarchitectural Timing Channels and their Prevention on an Open-Source 64-bit RISC-V Core" by Nils Wistoff (ETH Zurich), Moritz Schneider (ETH Zurich), Frank Gurkaynak (ETH Zurich), Luca Benini (Università di Bologna and ETH Zurich), Gernot Heiser (UNSW and Data61, CSIRO).

E Track: "Adaptive Design of Real-Time Control Systems subject to Sporadic Overruns" by Paolo Pazzaglia (Universität des Saarlandes), Arne Hamann (Robert Bosch GmbH), Dirk Ziegenbein (Robert Bosch GmbH), Martina Maggio (Lund University).

Best Paper Awards at ISPD 2021: The International Symposium on Physical Design, http://www.ispd.cc/?page=home

"Machine Learning-Enabled High-Frequency Low-Power Digital Design Implementation at Advanced Process Nodes", by Siddhartha Nath and Vishal Khandelwal, Synopsys, USA.

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Technical Activities

1. "Chiplets to Open Up Completely New More than Moore Roadmap"

The basic idea behind chiplets might not be entirely new, but the concept goes several steps further than the idea has been taken before...

[https://www.eetasia.com/chiplets-to-open-up-completely-new-more-than-moore-roadm...]

2. "Siemens delivers next-generation, comprehensive hardware-assisted verification system"

This highly cohesive system takes hardware, software and system verification to the next level of intelligent digitalization by streamlining and optimizing verification cycles while helping to reduce verification cost...

[https://www.edacafe.com/nbc/articles/1/1825961/Siemens-delivers-next-generation-...]

3. "What you should know when identifying a Wi-Fi MCU for IIoT"

In a recent article published to ElectronicProducts.com, Alex Li – a product line manager in the Wireless Solutions Group at Microchip Technology – reviews the importance of the Wi-Fi MCU as it relates to the incorporation of more (and more) functions in to the least amount of space and components...

[https://iot.eetimes.com/what-you-should-know-when-identifying-a-wi-fi-mcu-for-ii...]

Job Openings:															
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1. Computer Science University of Massachusetts Lowell, MA

Job Title: Assistant Professor

Description: The Computer Science Department at the University of Massachusetts Lowell invites applications for two tenure-track, Assistant Professor faculty positions to start in September 2021. Minimum Qualifications: Applicants must hold a Ph.D. in computer science or a closely related discipline and must be committed to developing and sustaining externally-funded research programs; Applicants must demonstrate strong potential to establish and maintain substantial research, teaching, and service, including the ability to publish refereed publications, obtain competitive external grants, and supervise postgraduate students; Applicants should have demonstrated capability of academic management and leadership. Successful applicants will develop a strong network of collaborations with established national and/or international researchers, leading to significant impact in computer science and related fields. Outstanding candidates in all major computer science areas will be considered, and are encouraged to apply. In addition to developing a strong research program, a successful candidate will be expected to teach undergraduate and graduate courses, including department core and specialty areas based on the candidate's expertise. For more information and to apply, please visit: https://careers.pageuppeople.com/822/lowell/en-us/job/507538/assistant-professor...

2. Shandong University, China

Job Title: Faculty Members in Theoretical and Computational Sciences

Description: Qingdao Institute for Theoretical and Computational Sciences (QiTCS; http://www.qitcs.qd.sdu.edu.cn/) is a newly founded research institute associated to Shandong University at Qingdao campus. QiTCS focuses on theories, methods, algorithms, software and applications in theoretical and computational chemistry, biophysics, materials, condensed matter and numerical mathematics. In each of the 5 directions there will be 2 to 3 principle investigators, each of

whom may lead a group of 2 to 3 faculty members (full, associate or assistant professors), totaling up to 40 faculty members. Personnels who are skilled at software development are especially welcome. For more information and to apply, please visit: http://www.gitcs.gd.sdu.edu.cn/

3. Imperial College London, United Kingdom

Job Title: Teaching Fellow in Software Engineering

Description: The Department of Electrical and Electronic Engineering is a leading department among the UK Universities with a reputation for excellence in both teaching and research. The department is part of the Faculty of Engineering and provides five degree programmes for approximately 750 undergraduate and postgraduate students. The post holder will be part of the team responsible for organizing, delivering and innovating teaching and learning support. We are looking for a dynamic person with an interest in teaching high-achieving students in our department in areas of software engineering. If you are an exceptional teacher with experience in higher education and excellent knowledge in software engineering and computer science then this position will be especially attractive to you. You will join our teaching fellows team who own different self-designed teaching modules that are popular with the student cohort and that form an example in innovative teaching and learning approaches. The teaching fellow career path is based on the Learning and Teaching job family of Imperial College London that can lead to a Professorship of Practice Education. Applications are invited for a Teaching Fellow in Software Engineering responsible for teaching computer science related topics using the best pedagogical tools that deliver the required learning outcomes and ensure student engagement. The appointed candidate will be working at the South Kensington Campus. For informal enquiries about the post please contact Dr. K. Fobelets: k.fobelets@imperial.ac.uk

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