

Workshop and Community Orientation

How to participate and how and why to join the INRC

Spring 2022 INRC Workshop Agenda

Time	April 19	April 20	April 21	April 22
06:00 PDT 09:00 EDT 15:00 CET		<u>Loihi 2 Deep Dive</u> Option 2 Engaged Members	<u>Lava Basics Tutorial</u> Option 2	<u>Loihi for Robotics</u>
07:00 PDT 10:00 EDT 16:00 CET		<u>Signal Processing</u>	<u>Lava Deep SNN Tutorial</u> Option 1	
08:00 PDT 11:00 EDT 17:00 CET	<u>New Tools for a New Era of Neuromorphic Computing</u>	<u>Lava Deep Dive</u>	<u>Continual Learning</u>	<u>Working Groups #2</u> <u>Aerospace Applications</u>
09:00 PDT 12:00 EDT 18:00 CET			<u>Offline Training</u>	<u>Working Groups #3</u>
10:00 PDT 13:00 EDT 19:00 CET	Q&A / Break	<u>Application Frontiers</u>	<u>Optimization</u>	<u>Ecosystem Development</u>
11:00 PDT 14:00 EDT 20:00 CET	<u>Featured Community Results</u>	<u>Working Groups #1</u>	<u>Vector Symbolic Architectures</u>	<u>Conclusion</u>
12:00 PDT 15:00 EDT 21:00 CET				Intel Presentations Community Contributed Content
17:00 PDT 20:00 EDT 02:00 CET	<u>Loihi 2 Deep Dive</u> Option 1 Engaged Members	<u>Lava Basics Tutorial</u> Option 1	<u>Lava Deep SNN Tutorial</u> Option 2	Discussion Forums Restricted Content for Engaged INRC Members Only

3 Ways to Participate in the INRC Workshop

1. Join us on slack:

<https://tinyurl.com/inrc-slack>

2. Questions, comments,
suggestions for the organizers:

email: inrc@intel.com

slack: [#help-and-feedback](#)

3. Share your expertise in a working group

Working Groups #1 Wednesday 11:00 PDT / 14:00 EDT / 20:00 CET	Host
Lava Development & Planning	Andreas Wild
Audio Processing	Tim Shea
Offline Training	Sumit Shrestha
Working Groups #2 Friday 8:00 PDT / 11:00 EDT / 17:00 CET	Host
Continual Learning	Danielle Rager
Robotics	Yulia Sandamirskaya
VSA & HDC	Paxon Frady
Working Groups #3 Friday 9:00 PDT / 12:00 EDT / 18:00 CET	Host
Aerospace	Garrick Orchard
Optimization	Narayan Srinivasa
Digital Twin	Tim Shea
More to come? Slack #help-and-feedback	

Why Join the INRC:

The community collaborates...

...to produce real impact.

Conferences > 2020 International Joint Conf... [?](#)

Leveraging the Manycore Architecture of the Loihi Spiking Processor to Perform Quasi-Complete Constraint Satisfaction

Publisher: IEEE [Cite This](#) [PDF](#)

Chris Yakopcic ; Nayim Rahman ; Tanvir Atahary ; Tarek M. Taha ; Scott Douglass [All Authors](#)

Conferences > 2020 2nd IEEE International C... [?](#)

On-chip Few-shot Learning with Surrogate Gradient Descent on a Neuromorphic Processor

Publisher: IEEE [Cite This](#) [PDF](#)

Kenneth Stewart ; Garrick Orchard ; Sumit Bam Shrestha ; Emre Neftci [All Authors](#)

[Front Neurobot.](#) 2021; 15: 809903.
Published online 2021 Dec 16. doi: [10.3389/fnbot.2021.809903](https://doi.org/10.3389/fnbot.2021.809903)

Editorial: Robust Artificial Intelligence for Neurorobotics

[Joe Hays](#),¹ [Subramanian Ramamoorthy](#),^{2,*} and [Christian Tetzlaff](#)³



"Intel and Accenture Support Neuromorphic Research Project to Assist Wheelchair-Bound Pediatric Patients"



"The TechEdSat-13 team prepares the spacecraft... featuring the first orbital flight of a neuromorphic processor"

"...we identified Intel's first-generation neuromorphic chip Loihi as a promising approach for optimization problems such as route planning for our railway network."

-- Jörg Blechschmidt, DB Systel, subsidiary of Deutsche Bahn AG

Lifecycle of an INRC Project



New in the INRC: 2022 Funded Projects

Team	Organization/University	Project Title
<u>Tobias Fischer</u> & M. Milford	Queensland University of Technology	Active, adaptive & predictive robot localization
<u>Wolfgang Maass</u> , G. Chen, Y. Wu, C. Stockl, E. Kadile, T. Cormier	Graz University of Technology	Innovative Brain-inspired Architectures and Algorithms
<u>Ilya Kiselev</u> , D. Scaramuzza, T. Delbruck	INI, UZH/ETH Zurich	Separation of ego-motion induced DVS events...
<u>Arto Nurmikko</u> , J. Lee	Brown University	Efficient Decoding of Multipoint Spiking Events Recorded by a Network of Wireless Biosensors
<u>Maryam Parsa</u> & J. Hays	George Mason University & US Naval Research Laboratory	Learning Neuromorphic Physics-Informed Stochastic Regions of Attraction through Bayesian Optimization
<u>Dezhe Jin</u> , K. Sargent, L. Tavares	Pennsylvania State University	Auditory Object Detection in Spike Streams
<u>Jeff Orchard</u> , M. Furlong, N. Dumont & T. Stewart	University of Waterloo & National Research Council	Efficient Bayesian Optimization using Vector Symbolic Architectures
<u>Christian Tetzlaff</u> , C. Michaelis, A. Lehr, J. Luboewski, T. Stober	University of Göttingen, Frankfurt Institute for Advanced Studies	Brian2Lava: an emulator and software development kit

You can start this week:
INRC Working Groups



Robotics Working Group

Goal:

- Formulate requirements for HW and SW systems for robotics
- Work out the backbone of Lava-robo

**Host(s): Philipp Stratmann,
Yulia Sandamirskaya**

Questions we will discuss:

- Which applications the Kapoho Point systems will serve well, which applications are left out of reach at the moment?
- What interfaces, I/O, programming languages and paradigms does Lava need to support for robotic applications?
- What modules / processes shall Lava-robo implement?
- Low hanging fruits and moonshot for Loihi in robotics

Optimization Working Group

Goal:

Host(s): Narayan Srinivasa

- Discuss the tools and approach to accelerate solutions to hard optimization problems using Loihi?

Questions we will discuss:

- What are the methods & tools that yet need to be developed?
- What are the problems that will have a big impact for real-world apps?
- What are the challenges in using Loihi to deliver?

Offline Training Working Group

Goal:

- Share insights and shape the future of Surrogate Gradient training methods.

Host(s): Sumit Shrestha

Questions we will discuss:

- What is the killer application for event-based networks?
- Are we tackling the right datasets?
- What are practical alternatives to gradient-based training?
- Seeking community input!

Lava Community Working Group

Goal:

Ensure Lava solves your problems!

Host(s): Andreas Wild +
Intel Lava team

Questions we will discuss:

- Does Lava's vision resonate with you?
- What matters to you the most?
- Does Lava have the right architecture and feature set?

Aerospace Working Group

Goal:

- Support brain-inspired technology adoption in aerospace.

Host(s): Garrick Orchard

Questions we will discuss:

- What are the key milestones and workloads to advance toward TRL 9?
- What would be the most exciting and valuable application to launch on a nanosat?

Continual Learning Working Group

Goal:

- Shape applied R&D on continual learning algorithms and applications.

Host(s): Danielle Rager

Questions we will discuss:

- Are online approximations of backprop useful?
- How can we overcome the catastrophic forgetting problem in neuromorphic systems?
- What other learning paradigms should be considered?

Vector Symbolic Arch. / HDC Working Group

Goal:

- Define future VSA programming models and applications.

Host(s): Paxon Frady

Questions we will discuss:

- Today, VSAs have few if any state-of-the-art application results. What will it take to change this?
- How can neuromorphic architectures help?
- How can VSAs/HDC be used to build neural networks with capabilities beyond deep learning?

Audio Processing Working Group

Goal:

- Accelerate neuromorphic audio processing R&D through collaboration

Host(s): Tim Shea

Questions we will discuss:

- What are the limits to scale up neuromorphic speech systems from small to large vocabularies?
- How can we overcome them?
- How should we promote code and model convergence in audio applications?

Digital Twin Working Group

Goal:

- Explore physics-informed SNNs and dynamical simulations of real-world physical systems.

Host(s): Tim Shea

Questions we will discuss:

- How can we enable neuromorphic devices to sense and simulate real-world complex systems?
- What are the most relevant applications of neuromorphic digital twins?
- How can physics-informed SNNs leverage on-chip learning?