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Experience

July 2023-* **Senior Solution Architect**: DevitoCodes Ltd.

*Core developer of **Devito** and [DevitoPro]*

Symbolic and functional API for stencil computation

Cross-platform code generation (MPI, OpenMP, OpenACC, CUDA, HIP, SYCL) for high performance computing

Training and educational material development

Client support and maintenance

CI/CD (github actions, docker, etc)

Applications development (wave-based inverse problems)

Cloud computing (AWS, Azure) and orchestration

July 2020–July 2023 **Postdoctoral Fellow**: Georgia Institute of Technology, Atlanta, GA

High performance/low memory randomized linear algebra for backpropagation based inverse problems

Cloud HPC for separable problems (task parallel)

Supervising the PhD and MSc students

*Managing and developping the software stack for the Lab (**slimgroup**)*

Machine learning for geophysical and medical wave-equation based inverse problems

HPC for machine learning

Geological Carbon Storage seismic monitoring

Computational experience

Open Source **Devito**: A symbolic domain specific language (DSL) for stencil computation with just-in-time compilation and code generation. Achieves state of the art performance while providing a high-level mathematical interface to the users for the development of stencil based applications.

JUDI: Linear algebra high level API for wave-equation based inversion. This pacage is built on top of Devito to have high performance wave-equation solvers. A new additional Azure batch extension was developped for scalability **JUDI4Cloud**.

XConv: High performance low memory convolutional layer. This repository implements both in julia (for Flux.jl) and in python (for pytorch) a convolutional layer that has virtually a zero memory imprnt for training using randomized linear algebra to compute an unbiased estimate of the gradient with respect to the weights. Additionaly, a byte only implementation of the ReLU layer leads to memry reduction by a factor of X2 for full networks.

dfno: Model parallel (MPI model decomposition) implementation of Fourier Neural Operators for PyTorch. Extension of distdl, a model parallel extension of PyTorch.

InvertibleNetworks.jl: Native Julia implementation of invertible networks for variational inference, generative models and normalizing flows.

Programming Languages

Python: Main programming language for the development of **Devito** and machine learning applications.

Julia: Heavy development of research software at Georgia Tech (**slimgroup**) in Julia

docker Developped and automatized the deployement of **Devito** and **JUDI** images through CI (github actions).

Knowledge of **C**, **Linux**, **Bash**, **PyTorch**, **Azure**, **AWS**, **Latex**, **Markdown**, **Matlab**, **MPI**, **OpenMP**, **OpenACC**, **CUDA**, **HIP**, **SYCL**.

HPC

Devito: Weak and strong scaling benchmarks of **Devito** on on-premise (Imperical college) and Cloud (Azure) hardware.

JUDI: Implementation and deployment at scale of **JUDI** on clusters and Azure Batch (up 300 nodes).

Optimum (2015-2018): Early PhD 50 nodes cluster. Development of parallel Matlab seismic inverse problem algorithms (FWI/RTM).

YEMOJA (2017-2018): Part of a collaboration with SENAI-CIMANTEC. Scaling of our Matlab and Julia framework to hundred of nodes.

Cloud (2018-): Serverless and clusterless framework for task parallel inverse problems on AWS and Azure.

Perlmutter (2022-): Scaling of MPI-parallel Fourier Neural Operator on Perlmutter (and previously Summit).

Education

2018–2020 **PhD, Computer Science**; Georgia Institute of Technology, Atlanta, GA

Thesis title: Modeling for inversion in exploration geophysics **Link**

Numerical and computational methods for large scale simulation based inverse problems and machine learning

2013–2018 **PhD, Earth Science**; University of British Columbia, Canada

Transfered to Georgia Institute of Technology in January 2018 following my supervior new position there.

2016 Feb-Aug **Visiting PhD, Computer Science**; Impertial College London, UK

Automatic code generation for geophysical exploration applications with finite differences

2011–2013 **MSc, Applied Mathematics**; Universite de Rennes 1, Rennes, France

Valedictorian

Required coursework: Calculus, Numerical Methods, PDE Resolution, Opti- mization, C/C++ Computing, Mathematics Modeling and Simulation, Finite Element Method*

Elective coursework: Fluid Mechanics, Continuum Mechanics and Thermo- mechanics, Bio-mechanics, Geophysics Modeling*

2008–2011 **BSc, Aeronautical Engineering,** ENSICA-ISAE, Toulouse, France

Leading French Aeronautical Engineering School.

Required coursework: Mathematics, Mechanics, Continuum Mechanics, Structures Mechanics, Signal Processing, Thermodynamics, Fluid Mechanics, Java progamming*

Elective coursework: Estimation Methods, Earth Observation Satellites, Microwaves Processing*

2006–2008 **Classe Preparatoires**; Lycee Chateaubriand, Rennes, France

Advanced undergraduate preparatory program for national ranking entry exam.

Internships

Summer 2013 **Research internship**; ONERA, Toulouse, France

Scattering patterns of atmospheric dust clouds analysis with the Discrete Dipole Approximation (DDA) method.

Summer 2012 **Research internship**; INRIA, Grenoble, France

Intern in NANO-D department at INRIA-Grenoble. L2-SVM for protein interactions. Runtime and accuracy improvement of the C implementation and algorithmic development.

Summer 2011 **Internship, Aeroconseil**, Toulouse, France

Developed an interface for aerodynamics calculus in JAVA. Reading and implementation of Excel and Scilab scripts through the interface.

Additonal skills

- Languages:
  - French (native speaker)
  - English (Fluent)