Tiago Carneiro Pessoa

Brazilian | ✈ Minsk, Belarus | ☎ +375 25 997 23 04
✉ tcarneiropessoa@gmail.com | ⌂ tcarneirop.github.io | ⊙ tcarneirop | ▣ tcarneiropessoa

I am a researcher and software engineer with a strong background in high-performance computing (HPC), distributed systems, and combinatorial optimization. I have extensive experience designing and implementing software solutions that balance performance and productivity, leveraging technologies such as CUDA, OpenMP, MPI, and high-productivity languages like Chapel. My work includes optimizing large-scale applications, collaborating with interdisciplinary teams, and contributing to research through publications, workshops, and software development. I am particularly focused on improving computational efficiency in large-scale systems.

TABLE OF CONTENTS

SKILLS

HPC & Programming	C/C++, CUDA, Python, Chapel, OpenMP, MPI, HIP, AVX, PGAS
Performance Profiling & Analysis	NVIDIA Nsight Systems, NVProf, PERF, Intel VTune, LIKWID
Platforms & Tools: Linux/Unix	Git, Build Systems (CMake, Make), Containers (Docker, Singularity)
Domain Expertise	HPC, Distributed Systems, GPU computing, combinatorial optimization

LANGUAGES

· Portuguese (Native), English (full professional proficiency), French (professional working proficiency) and Russian (A2).

EDUCATION

PhD in Computer Science   2013 - 2017
Federal University of Ceará (UFC). Fortaleza - CE, Brazil

· *International mobility*: from September 2015 to August 2016 at INRIA Lille - Nord Europe, under the supervision of Prof. Nouredine Melab (Dolphin team).
· *Thesis*: GPU-Based Backtracking Strategies for Solving Permutation Combinatorial Problems. *Supervisor:* Dr. Francisco Heron de Carvalho Junior.

Master's Degree in Computer Science   2010 - 2012
State University of Ceará (UECE). Fortaleza - CE, Brazil

· *Thesis*: GPU-based branch-and-bound algorithms for the asymmetric travelling salesman problem (*text in Portuguese*). *Supervisors:* Dr. Gustavo Augusto Lima de Campos and Dr. Marcos Negreiros.

Bachelor's Degree in Computer Science   2004 - 2009
State University of Ceará (UECE). Fortaleza - CE, Brazil

· *Monograph*: The Jurema Method: a new branch-and-bound strategy for the asymmetric travelling salesman problem (*text in Portuguese*) *Supervisor:* Dr. Marcos Negreiros.

AWARDS AND HONORS

Outstanding Paper Award   2021
International Conference on High Performance Computing & Simulation (HPCS 2020)

· For the work *Towards Chapel-based Exascale Tree Search Algorithms: dealing with Multiple GPU Accelerators*

Certification of Outstanding Contribution in Reviewing   2016
Journal of Parallel and Distributed Computing (JPDC)

· Recognition for significant contributions in the peer-review process during the year 2016.

WORK EXPERIENCE

Senior Researcher   Sep 2022 - Jan 2025
Imec   Leuven, Belgium

Worked at Imec, a leading European research institute, developing a distributed software infrastructure for a European HPC and AI Processor.

. Participated in the development of a distributed programming library based on PGAS.

. Developed a distributed process management system in Bash for spawning and managing processes across cluster machines.

. Designed and implemented testing and profiling software for performance evaluation of HPC applications.

. Collaborated with multiple teams, programming and analyzing benchmarks to support hardware design research and performance evaluation.

. Contributed to the Supercomputing 2024 exhibit flyer, showcasing the ExaScience HPC Software Lab's work on cost-effective scaling of performance-oriented HPC and AI software

Technologies:

    Programming Models: PGAS, Distributed Computing, GPGPU, and Hybrid.

    Programming Languages: Bash, CUDA-C, Chapel, D, MPI, OpenMP, and Python.

    Profiling Tools: Nsight Systems, NVProf, PERF, Intel VTune, and LIKWID.

    Benchmarking Domains: BLAS, FEM, stencil applications, combinatorial optimization, and HPCG.

Research associate   Mar 2021 - Sep 2022
University of Luxembourg   Belval, Luxembourg

Member of the Parallel Computing & Optimisation Group (PCOG), contributing to the EuroCC project (promoting HPC in Luxembourg) and the productivity-aware ultra-scale optimization project.

. Designed and implemented large-scale distributed optimization algorithms, focusing on CPU-GPU heterogeneity and balancing programming productivity with parallel efficiency.

. Collaborated with interdisciplinary teams to advance HPC adoption.

. Organized a workshop and authored tutorial sessions on HPC and optimization.

Postdoctoral researcher   Nov 2018 - Jun 2020
INRIA Lille - Nord Europe   Lille, France

Worked at Inria, France's leading research institute in digital science, researching high-productivity languages for large-scale distributed exact optimization algorithms.

. Lead researcher of the Chapel-based Optimization Project (ChOP), recognized by the Chapel Team (Cray-HPE) as one of the key projects using the Chapel language.

. Researched and developed distributed large-scale applications, focusing on balancing productivity and parallel efficiency in branch-and-bound optimization algorithms.

. Worked with high-productivity languages including Chapel, Julia, and Python/Numba, alongside C/C++ (OpenMP and MPI) for performance baselines and benchmarking.

. Taught in the Master's Program in Nano-science and Nano-technologies for Civil Engineering at the University of Lille and organized tutorial and workshops on HPC and optimization.

. Published several papers in top-tier journals and conferences, contributing to advances in parallel optimization.

Technologies:

Programming Languages: Chapel, Julia, Python/Numba, C/C++ (OpenMP, MPI).

Research Focus: High-productivity languages, combinatorial optimization, distributed branch-and-bound algorithms.

Postdoctoral researcher   Mar 2018 - Oct 2018
Federal Institute of Education, Science and Technology of Ceará (IFCE).   Fortaleza-CE, Brazil

Researched the parallelization of deep learning and machine learning applications for computer vision.

. Developed and optimized parallel implementations of deep learning models for computer vision applications.

. Accelerated image processing and inference tasks using CUDA and OpenCV.

. Leveraged cloud-based computing via Google Colaboratory for large-scale model training and experimentation.

Technologies:

Languages & Frameworks: CUDA, OpenCV, TensorFlow, Keras, PyTorch, and YOLO.

Computing Platforms: Google Colaboratory and GPU acceleration.

Researcher - International mobility   Sep 2015 - Aug 2016
INRIA Lille - Nord Europe   Lille, France

One-year research visit as part of PhD studies, supported by the PDSE-CAPES program.

. Conducted research on parallel optimization with the Dolphin team under the supervision of Prof. Nouredine Melab.

. Explored high-performance computing techniques to enhance optimization algorithms.

. Funded by the Institutional Program of Overseas Sandwich Doctorate (PDSE-CAPES), *Grant* 3376/2015-00.

Doctoral Researcher   Mar 2013 - Dec 2017
Federal University of Ceará (UFC).   Fortaleza-CE, Brazil

Member of the Parallelism, Graphs, and Optimization Group (ParGO) in the Graduate Program in Computer Science (MDCC).

. Researched and implemented exact parallel and heterogeneous algorithms to solve combinatorial optimization problems.

. Investigated the use of CUDA Dynamic Parallelism (CDP) to enhance performance in solving large optimization problems.

Technologies:

Languages: C/C++, MPI, CUDA, OpenCL, OpenMP and vectorization.

Accelerators: GPUs and Xeon Phi.

Lecturer   Aug 2012 - Jul 2014
State University of Ceará (UECE), Computer Science Department   Fortaleza-CE, Brazil

Taught 4 different courses, supervised 3 Bachelor's degree monographs, a research internship, and a young researcher project (see Tables 4 and 3).

Lecturer　　　　　　　　　　　　　　　　　　　　　　　　Aug 2012 - Jul 2013
Christus University Center (UniChristus), Informatics Department　　Fortaleza-CE, Brazil

Taught compilers and automata theory (see Table 4).

Master student / Research intern　　　　　　　　　　　　　　Mar 2010 - Jun 2012
State University of Ceará (UECE)　　　　　　　　　　　　　　Fortaleza-CE, Brazil

Member of the Scientific Computing Laboratory (LCC) in the Graduate Program in Computer Science (MACC).

. Investigated the feasibility of using GPUs for exact tree-based optimization, pioneering research in this area at the time.

. Worked with C/C++, OpenMP, and CUDA.

Research intern　　　　　　　　　　　　　　　　　　　　Mar 2008 - Jul 2009
State University of Ceará (UECE).　　　　　　　　　　　　　Fortaleza-CE, Brazil

Intern at the Computer Networks and Security Laboratory (LARCES).

. Focused on the design and implementation of bio-inspired distributed algorithms to solve peer-to-peer (P2P) network problems.

. Worked primarily with Java and the JXTA P2P protocol.

Trainee　　　　　　　　　　　　　　　　　　　　　　　　Feb 2007 - Sep 2007
State University of Ceará (UECE).　　　　　　　　　　　　　Fortaleza-CE, Brazil

Programmed embedded commercial C++ applications for x86 micro-terminals. Contributed to a project in cooperation with Bematech Co., a Brazilian company specializing in software and hardware solutions for commerce.

PUBLICATIONS

Table 1: Summary of publications

International journals	9
International conferences	24
National conferences	7
Project proposals	2
Journal papers under review	3
Tutorials	2
Other	3
Total	50

Selected publications:

[1] Carneiro, T.; Melab, N.; Hayashi, A.; Sarkar, V. Towards Chapel-based Exascale Tree Search Algorithms: dealing with multiple GPU accelerators. In: The International Conference on High Performance Computing & Simulation - HPCS 2020 - held in March 2021. **Outstanding Paper Award - HPCS 2020**.

[2] Carneiro, T.; Kayraklioglu, E.; Helbecque, G.; Melab, N. Investigating Portability in Chapel for Tree-based Optimization on GPU-powered Clusters. The 30th International European Conference on Parallel and Distributed Computing - Europar 2024. ⓓ 10.1007/978-3-031-69583-4_27.

[3] Carneiro, T.; Gmys, J.; Melab, N.; Tuyttens, D. Towards Ultra-scale Branch-and-Bound Using a High-productivity Language. Future Generation Computer Systems, 105: 196-209 (2020). ⓓ 10.1016/ J.future.2019.11.011.

[4] Carneiro Pessoa, T.; Gmys, J.; de Carvalho Junior, F. H.; Melab, N.; Tuyttens, D. GPU-accelerated Backtracking Using CUDA Dynamic Parallelism. Concurrency and Computation: Practice and Experience, Wiley Online Library, 30(9): e4374 (2018). ⓓ 10.1002/cpe.4374.

More information about my publication record can be found in my 🅖 Google Scholar [1], ⓘ Orcid (0000-0002-6145-8352) and 🏠 Web Of Science (J-3061-2019) profiles.

Publications presented in reverse chronological order.

International journal publications:

[2023] Helbecque, G.; Gmys, J.; Carneiro, T.; Melab, N.; Bouvry, P. Parallel distributed productivity-aware tree-search using Chapel. Concurrency and Computation: Practice and Experience. ⓓ 10.1002/ cpe.7874.

[2023] de Souza, A.B.; do Rego, P.A.L; Carneiro, T.; Rocha, P.H.G; de Souza, J.N; Chamola, V. A Bee Colony-based Algorithm for Task Offloading in Vehicular Edge Computing. IEEE Systems Journal (2023). ⓓ 10.1109/JSYST.2023.3237363

[2021] de Souza, A.B.; do Rego, P.A.L; Carneiro, T.; Rocha, P.H.G; de Souza, J.N. A Context-Oriented Framework for Computation Offloading in Vehicular Edge Computing using WAVE and 5G Networks. Vehicular Communications, 32: 100389 (2021). ⓓ 10.1016/j.vehcom.2021.100389

[2020] Carneiro, T.; Gmys, J.; Melab, N.; Tuyttens, D.Towards Ultra-scale Branch-and-Bound Using a High-productivity Language. Future Generation Computer Systems, 105: 196-209 (2020). ⓓ 10.1016/ J.future.2019.11.011.

[2020] Gmys, J.; Carneiro, T.; Melab, N.; Tuyttens, d.; Talbi, E-G. A Comparative Study of High-productivity High-performance Programming Languages for Parallel Metaheuristics. Swarm and Evolutionary Computation, 57:100720 (2020). ⓓ 10.1016/j.swevo.2020.100720.

[2020] Souza, A.B.; Rego, P.A.L.; Carneiro, T.; Rodrigues, J.D.C.; Rebouças Filho, P.P.; De Souza, J.N; Chamola, V.; Sikdar, B.; de Albuquerque, V.H.C. Computational Offloading for Vehicular Environments: A Survey. IEEE Access. ⓓ 10.1109/ACCESS.2020.3033828.

[2019] Almeida, J.S.; Rebouças Filho, P.P.; Carneiro, T.; Wei, W.; Damasevicius, R.; Maskeliunas, R.; de Albuquerque, V.H.C. Detecting Parkinson's Disease With Sustained Phonation and Speech Signals Using Machine Learning Techniques. Pattern Recognition Letters, 125: 55-62 (2019). ⓓ 10.1016/J.patr ec.2019.04.005.

[2018] Carneiro, T.; Medeiros da Nóbrega, R.V; Nepomuceno, T.; Bian, G-B; de Albuquerque, V.H.; Rebouças Filho, P.P. Performance Analysis of Google Colaboratory as a Tool for Accelerating Deep Learning Applications. IEEE Access, 6: 61677-61685 (2018). ⓓ 10.1109/ACCESS.2018.2874767.

[2017] Carneiro Pessoa, T.; Gmys, J.; de Carvalho Junior, F. H.; Melab, N.; Tuyttens, D. GPU-accelerated Backtracking Using CUDA Dynamic Parallelism. Concurrency and Computation: Practice and Experience, Wiley Online Library, 30(9): e4374 (2017). ⓓ 10.1002/cpe.4374.

Peer-reviewed international conferences:

[**2024**] Carneiro, T.; Kayraklioglu, E.; Helbecque, G.; Melab, N. Investigating Portability in Chapel for Tree-based Optimization on GPU-powered Clusters. The 30th International European Conference on Parallel and Distributed Computing – Europar 2024. 🔵 10.1007/978-3-031-69583-4_27.

[**2024**] Helbecque, G.; Carneiro, T.; Gmys, J.; Melab, N.; Bouvry, P. PGAS Data Structure for Unbalanced Tree-Based Algorithms at Scale. The 24th International Conference on Computational Science – ICPP 2024. 🔵 10.1007/978-3-031-63759-9_13.

[**2024**] Helbecque, G.; Ezhilmathi, K.; Carneiro, T.; Melab, N.; Bouvry, P. A Chapel-based Multi-GPU Branch-and-bound Algorithm. The 22nd International Workshop on Algorithms, Models and Tools for Parallel Computing on Heterogeneous Platforms – Heteropar 2024, Europar 2024 workshop.

[**2023**] de Carvalho Junior, F.H; Carneiro, T. A Component Model for Multilevel Parallel Programming. SBLP 2023 – 27th Brazilian Symposium on Programming Languages. 🔵 10.1145/3624309.3624318.

[**2023**] Helbecque, G. ; Gmys, J.; Carneiro, T.; Melab, N.; Bouvry, P. Towards a scalable load balancing for productivity-aware tree-search. The 10th Annual Chapel Implementers and Users Workshop (CHIUW 2023).

[**2023**] Helbecque, G. ; Gmys, J.; Carneiro, T.; Melab, N.; Bouvry, P. Productivity-aware Parallel Distributed Tree-Search for Exact Optimization. International Conference on Optimization and Learning (OLA 2023).

[**2022**] Carneiro, T.; Koutsantonis, L; Melab, N; Kieffer, E; Bouvry, P. A Local Search for Automatic Parameterization of Distributed Tree Search Algorithms. In: 12th IEEE Workshop Parallel / Distributed Combinatorics and Optimization - IPDPS 2022 Workshops (PDCO 2022). 🔵 10.1109/ IPDPSW55747.2022.00132.

[**2022**] Helbecque, G.; Gmys, J.; Carneiro, T.; Melab, N.; Bouvry, P. A performance-oriented comparative study of the Chapel high-productivity language to conventional programming environments. In: Proceedings of the Thirteenth International Workshop on Programming Models and Applications for Multicores and Manycores – PMAM '22. 🔵 10.1145/3528425.3529104.

[**2021**] Carneiro, T.; Melab, N.; Hayashi, A.; Sarkar, V. Towards Chapel-based Exascale Tree Search Algorithms: dealing with multiple GPU accelerators. In: The International Conference on High Performance Computing & Simulation - HPCS 2020 - held in March 2021. **Outstanding Paper Award**.

[**2021**] Koutsantonis, L.; Carneiro, T.; Kieffer, E.; Pinel, F.; Bouvry, P. A Data-Driven Reconstruction Technique based on Newton's Method for Emission Tomography. In: The 2021 IEEE Nuclear Science Symposium and Medical Imaging Conference (IEEE NSS-MIC). 🔵 10.1109/NSS/MIC44867.2021.9875 621.

[**2021**] Koutsantonis, L.; Makki, A.; Carneiro, T.; Kieffer, E.; Bouvry, P. A Bayesian Optimization Approach for Attenuation Correction in SPECT Brain Imaging. In: The 2021 IEEE Nuclear Science Symposium and Medical Imaging Conference (IEEE NSS-MIC). 🔵 10.1109/NSS/MIC44867.2021.9875691.

[**2020**] de Souza, A.B; Rego, P.A.L; Rocha, P.H.G; Carneiro, T.; Souza, J.N. A Task Offloading Scheme for WAVE Vehicular Clouds and 5G Mobile Edge Computing. In: IEEE Global Communications Conference - Globecom 2020. 🔵 10.1109/GLOBECOM42002.2020.9348130

[**2020**] Nepomuceno, T.; Carneiro, T.; Maia, P; Nepomuceno, T.; Adnan, M.; Martin, A. Autoiot: a framework based on user-driven MDE for generating IoT applications. In: ACM/SIGAPP Symposium on Applied Computing - SAC 2020. 🔵 10.1145/3341105.3373873.

[2019] Carneiro, T.; Melab, N. An Incremental Parallel PGAS-based Tree Search Algorithm. In: The 2019 International Conference on High Performance Computing & Simulation - HPCS 2019, pp. 19-26, ⓓⓞⓘ 10.1109/HPCS48598.2019.9188106.

[2019] Carneiro, T.; Melab, N. Productivity-aware Design and Implementation of Distributed Tree-based Search Algorithms. In: The International Conference on Computational Science - ICCS 2019. Lecture notes in computer science, vol. 11536 (253-266), Springer. DOI: 10.1007/978-3-030-15996-2_2.

[2018] Carneiro, T.; Gmys, J.; Melab, N.; de Carvalho Junior, F. H.; Rebouças Filho, P.P.; Tuyttens, D. Dynamic Configuration of CUDA Runtime Variables for CDP-based Divide-and-conquer Algorithms. In: 13th International Meeting on High Performance Computing for Computational Science - VECPAR 2018. Lecture notes in computer science, vol. 11333 (16-30), Springer. ⓓⓞⓘ 10.1007/978-3-030-15996-2_2.

[2018] Nepomuceno, T.; Carneiro, T.; Korn, C.; Martin, A. A GUI-based Platform for Quickly Prototyping Server-side IoT Applications. In: European Conference on Smart Objects, Systems and Technologies - Smart Systech 2018. Print ISBN: 978-3-8007-4694-1

[2016] Pessoa, T.C.; Gmys, J.; Melab, N.; de Carvalho Junior, F.H.; Tuyttens, D. A GPU-based Backtracking Algorithm for Permutation Combinatorial Problems. In: Algorithms and Architectures for Parallel Processing - IC3APP 2016. Lecture notes in computer science, vol. 10048 (310-324), Springer. ⓓⓞⓘ 10.1007/978-3-319-49583-5_24.

[2014] Pinheiro, A.B.; de Carvalho Junior, F.H.; Arruda, N.G.P.B.; Carneiro, T. Fusion: abstractions for multicore/manycore heterogenous parallel programming using GPUs. In: Brazilian Symposium on Programming Languages - SBLP 2014. Lecture notes in computer science, vol. 8771 (109-123), Springer. ⓓⓞⓘ 10.1007/978-3-319-11863-5_8.

[2014] Carneiro, T.; Arruda, N.G.P.B.; de Carvalho Junior, F.H.; Pinheiro, A.B. A Literature Review on Solving Combinatorial Optimization Problems Through the Use of GPUs - **text in Portuguese:** (*Um levantamento na literatura sobre a resolução de problemas de otimização combinatória através do uso de aceleradores gráficos*). In: XXXV Ibero-latin American Congress on Computational Methods in Engineering - CILAMCE 2014.

[2014] Arruda, N.G.P.B.; de Carvalho Junior, F.H.; Carneiro, T.; Pinheiro, A.B. An Evaluation of Code Optimization Techniques Applied to Modern Graphics Accelerators - **text in Portuguese:** (*uma avaliação de técnicas de otimização de código aplicadas a aceleradores gráficos modernos*). In: XXXV Ibero-latin American Congress on Computational Methods in Engineering - CILAMCE 2014.

[2011] Carneiro, T.; Muritiba, A.E.; Negreiros, M.; de Campos, G.A.L. A New Parallel Schema for Branch-and-bound Algorithms Using GPGPU. In: 23*rd* International Symposium on Computer Architecture and High Performance Computing - SBAC-PAD 2011. p. 41–47. ⓓⓞⓘ 10.1109/sbac-pad.2011.20.

[2011] Oliveira, T.Q. ; Pessoa, T.C. ; Cardoso, A. ; Celestino Júnior, J. Wchord: a hybrid and bioinspired architecture to peer to peer networks. In: Third World Congress on Nature and Biologically Inspired Computing - NABIC 2011. p. 353–358. ⓓⓞⓘ 10.1109/nabic.2011.6089617.

[2011] Carneiro, T.; Muritiba, A.E.F.; Negreiros, M.; de Campos, G.A.L. Solving ATSP Hard Instances by New Parallel Branch and Bound Algorithm using GPGPU. In: XXXII Ibero-latin American Congress on Computational Methods in Engineering - CILAMCE 2011.

Peer-reviewed national conferences:

[2024] de Carvalho Junior, F.H; Carneiro, T. Towards Multicluster Computing with Julia. SSCAD 2024 – XXV Brazilian Symposium on High-performance Systems. ⓓⓞⓘ 10.5753/sscad.2024.244307.

[**2023**] de Carvalho Junior, F.H; Dantas, A.B.; <u>Carneiro, T</u>.; Mendes, J.; Sales, C.; Sales, Pedro A. Structured platform-aware programming. WSCAD 2023 – XXIV Brazilian Symposium on High-performance Systems. 🔵 10.5753/wscad.2023.235920.

[**2018**] Honório Filho, P.; da Silva, S.P.P.; Almeida, J.S.; Marinho, L.B.; <u>Carneiro, T</u>.; Rodrigues, A.W.O.; Rebouças Filho, P.P. An Approach to Navigation in Outdoor and Indoor Environments With Unmanned Aerial Vehicle Using Visual Topological Map. In: 31st Conference on Graphics, Patterns and Images - SIBGRAPI 2018, Workshop of Works in Progress (WIP).

[**2016**] Nepomuceno, T.G.; <u>Pessoa, T.C.</u>; Nepomuceno, T.G. Formula Optimizer: fast way to formulate and solve multi-objective combinatorial optimization problems. In: XLVIII Brazilian Symposium of Operations Research - SBPO 2016.

[**2014**] Arruda, N.G.P.B.; de Carvalho Junior, F.H.; <u>Carneiro, T</u>.; Pinheiro, A.B. Analysis of Drawbacks in Loop Unfolding Relative to GPU Associative Caches - text in Portuguese (*Análise de drawbacks no desdobramento de laços relativo a caches associativas de GPUs*). In: Symposium on High Performance Computing Systems - WSCAD 2014.

[**2012**] <u>Carneiro, T</u>.; Nobre, R.H.; Negreiros, M.; de Campos, G.A.L. Depth-first Search Versus Jurema Search on GPU Branch-and-Bound Algorithms: a case study. In: NVIDIA's GPU Computing Developer Forum. Held by the XXXII Congress of the Brazilian Society of Computer Science - CSBC 2012.

[**2010**] <u>Pessoa, T.C.</u>; Gomes, M.J.N. Jurema, a New Branch & Bound Anytime Algorithm for the Asymmetric Travelling Salesman Problem. In: XLIII Brazilian Symposium of Operations Research - SBPO 2010.

Project proposals submitted to funding agencies:

[**2022**] Melab, N.; Talbi, E-G.; <u>Carneiro, T.</u>; Gmys, J.; Danoy, G.; Bouvry, P.; Pinel, F.; Kieffer, E. *Ultrascale Computing for solving Big Optimization Problems*. Joint project proposal between INRIA Lille - Bonus team and the Parallel Computing & Optimisation Group (PCOG), University of Luxembourg. **Proposal submitted to the French National Research Agency** (ANR).

[**2021**] Along with the professors of the ParGO research group (UFC), submitted the project *Prallelism and Algorithms for Combinatorial Optimization and Complexity*. **Proposal submitted to the Foundation for Scientific Development of the Ceará State (Funcap), Ceará, Brazil**.

Papers Under Review:

[**2025**] Herzeel, C., Gurdeep Singh, R., Vanmeerbeeck, G., <u>Carneiro, T.</u>, Verachtert, W., Wuyts, R. *Decentralized distributed task stealing using dependency counters*. IEEE Transactions on Parallel and Distributed Systems. Submitted on 19 Jul. 2025.

[**2025**] De Carvalho Junior, F. H., <u>Carneiro, T.</u> *Multicluster computing with Julia*. Submitted to Concurrency and Computation: Practice and Experience, SSCAD 2024 Special Issue. Submitted on 25 Jul. 2025.

[**2025**] Helbecque, G.; Ezhilmathi, K.; <u>Carneiro, T.</u>; Melab, N.; Bouvry, P. *Portable PGAS-based GPU-accelerated Branch-and-Bound Algorithms at Scale*. Submitted to Concurrency and Computation: Practice and Experience, HeteroPar 2024 Special issue. Under Major Revision.

Tutorials:

[2021] Carneiro, T., Koutsantonis, L. the Introduction to OpenCL programming. The 11th HPC School - University of Luxembourg.

[2021] Koutsantonis, L. Carneiro, T. Solving the Laplace Equation on GPU with OpenACC. The 11th HPC School - University of Luxembourg.

Other documents:

[2024] Cost-effective development and scaling of performance-oriented HPC and AI software. The Exa-Science: HPC software lab. Supercomputing 2024 exhibits flayer.

[2017] Pessoa, T.C. (2017), GPU-based Backtracking Strategies for Solving Permutation Combinatorial Problems. PhD Dissertation, Department of Computer Science, Federal University of Ceará (UFC), Brazil.

[2012] Pessoa, T.C. (2012), GPU-based Branch-and-bound Algorithms for the Asymmetric Travelling Salesman Problem (*text in Portuguese*). Master's thesis, Department of Computer Science, State University of Ceará (UECE), Brazil.

PARTICIPATION IN RESEARCH PROJECTS

Ultra-scale Computing for solving Big Optimization Problems   2023 - present
In collaboration with researchers from the Univ. of Lille, France, and the Univ. of Luxembourg

Summary: This project focuses on combining exact methods (e.g., Branch-and-Bound) with meta-heuristics (e.g., Evolutionary Algorithms) to solve large-scale optimization problems efficiently, leveraging MPI+X and PGAS-based approaches.
Funding: French National Research Agency (ANR) & Luxembourg National Research Fund (FNR).

Parallel Algorithms for Combinatorial Optimization and Complexity   2022 - present
In collaboration with researchers from the ParGO group at UFC, Brazil, and other universities

Summary: This project focuses on developing models, formulations, and structural properties for combinatorial optimization problems, particularly in graph coloring, graph connectivity, and graph diffusion.
Funding: Foundation for Scientific Development of the Ceará State (FUNCAP), Brazil.

HPC Shelf - A Component-Based Cloud Computing Platform for HPC Applications and Services   2013 - 2017
ParGO Research Group, Federal University of Ceará (UFC), Brazil

Summary: HPC Shelf is a component-based cloud computing platform designed to support the development, deployment, and execution of HPC applications. Addresses problems that require substantial computational power, which justifies the integration of multiple parallel computing platforms to meet domain-specific needs.
Funding: National Council for Scientific and Technological Development (CNPq), Brazil.

Exact Combinatorial Methods for Dynamic Grouping Problems   2010
Federal University of Santa Maria (UFSM), Santa Maria-RS, Brazil

Summary: A scientific mission by the Federal University of Santa Maria, in collaboration with the State University of Ceará, focused on developing new exact and heuristic algorithms to solve Dynamic Grouping Problems.
Funding: National Council for Scientific and Technological Development (CNPq), Brazil.

SOFTWARE CONTRIBUTIONS

Chapel-based Optimization (ChOp) <div align="right">Status: *Active*</div>
 tcarneirop/ChOp <div align="right">Lines of code: 100K+</div>

A project focused on designing and implementing large-scale exact distributed optimization algorithms, considering CPU-GPU heterogeneity while balancing high productivity and parallel efficiency through the use of the Chapel Language.

Features:

Large-scale Distributed Algorithms: Optimized for CPU-GPU heterogeneity.

Solving Big Problems: Final algorithms tackle FSP and ATSP to optimality.

Pioneering Work: A new approach to parallel exact optimization.

Multicore and Distributed Search: High-performance backtracking searches to solve permutation-based combinatorial problems in Chapel.

Minimal Performance Loss: Achieves low performance loss compared to baselines.

Cross-Platform Comparison: Baselines include OpenMP, MPI, CUDA, HIP, and SYCL for performance benchmarking.

Recognition & Impact:

. Featured by the Chapel team (Cray/HPE) as a key Chapel-based project – "Chapel in Production".

. ChOp's CUDA N-Queens included in HeCBench, a collection of Heterogeneous Computing benchmarks supporting SYCL compiler development[2].

. Used by the Chapel team for GPU code validation.[3,4]

Selected Publications: Carneiro *et al.* (2020, 2021 and 2024).

Platform-aware Programming <div align="right">Status: *Active*</div>
 PlatformAwareProgramming <div align="right">Lines of Code: 5k+</div>

PlatformAware.jl is a package that aims at helping HPC package developers write Julia code for different versions of kernels according to the target platform.

Features:

Structured Platform-Aware Programming: structured approach to writing code that adapts to different execution platforms.

Multiple Dispatch: leverages Julia's multiple dispatch system to select appropriate code versions based on platform features.

Performance Tuning: facilitates the use performance tuning techniques to optimize code for target platforms.

Publications: de Carvalho Junior, F.H; Carneiro, T. (2023) and de Carvalho Junior, F.H. *et al.* (2023).

---

[2]https://www.intel.com/content/www/us/en/developer/articles/success-story/repo-evaluating-performance-productivity-oneapi.html

[3]https://chape-lang.org/CHIUW/2023/KayrakliogluSlides.pdf

[4]https://chapel-lang.org/perf/gpu/?graphs=choptime

Chapel-based P3D-DFS

Status: *Active*

 Guillaume-Helbecque/P3D-DFS Lines of Code: 10k+

Description: Distributed work stealing written in Chapel for solving combinatorial optimization problems. By leveraging Chapel's parallel programming capabilities, **P3D-DFS** efficiently handles distributed computations across multiple nodes in a cluster, ensuring scalability and high performance.

Features:

Adaptability: A generic solution applicable to a broad range of tree-based combinatorial optimization problems.

Distributed Work Stealing: Utilizes a work stealing mechanism to dynamically balance the workload across distributed nodes.

Scalability: Efficiently scales to handle large problem sizes across multiple nodes in a cluster.

Selected publications: Helbecque et al. (2023, 2024).

Formula Optimizer

Status: *Inactive*

 https://bitbucket.org/formulapaper/formulapaper/src/master/ Lines of Code: 3k+

Java-based software with a JavaFX GUI that enables users to easily formulate and solve multi-objective combinatorial optimization problems without programming expertise. It generates code for the jMetal framework, a popular metaheuristics library in Java, and provides real-time execution metrics.

Features:

User-Friendly Interface: Allows users to define optimization problems without programming knowledge.

Code Generation: Automatically generates Java code for solving problems using the jMetal framework.

On-line Metrics: Provides real-time metrics during execution for performance monitoring.

Efficient Execution: Solves problems with minimal performance loss compared to existing solvers.

Publication: Nepomuceno *et al.* (2016).

GRANTS

Partnership for Advanced Computing in Europe - PRACE

Project: EU2022D08-197, ID:90254 Ago 2022 – Jul 2023

Awarded grant support for the ChOP project, including 2,000 GPU hours on the Czech National Supercomputing Center (IT4Innovations).

Foundation for Scientific Development of the Ceará State (Funcap - Brazil)

Grant: PS1-00186-00155.01.00/21 Jan 2022 – Jan 2023

Grant support for the project *Parallelism and Algorithms for Combinatorial Optimization and Complexity (PAPOCCO)*, ParGO research group, Federal University of Ceará (UFC- Brazil).

Centre de Recherche en Informatique, Signal et Automatique de Lille (CRIStAL - France)

Travel grant Dez 2019

Fully supported for a two-week visit to Cray Inc. in Seattle, USA, to collaborate with the Chapel team, in support of my research at INRIA Lille (2018–2020).

Institutional Program of Overseas Doctorate (PDSE-CAPES - Brazil)

Grant: 3376/2015-00 Sep 2015 – Aug 2016

One-year research visit to INRIA Lille, France (as part of PhD studies), supported by the PDSE-CAPES program of the Brazilian Ministry of Education.

Coordination for the Improvement of Higher Education Personnel (CAPES - Brazil)
Full Scholarship   Jun 2013 – Apr 2017

Scholarship awarded for my PhD studies based on a selection process.

Coordination for the Improvement of Higher Education Personnel (CAPES - Brazil)
Full Scholarship   Mar 2010 – Feb 2012

24 months scholarship for my Master's studies awarded based on a selection process.

Table 2: Examination committee membership summary

Level	Institution	Total
Master's Thesis Defense	UERJ, IFCE	2
Master's Thesis Proposal defense	UERJ	1
Undergraduate Final Project Defense	UECE, UniChristus	5
Total		8

EXAMINATION COMMITTEE

Served as a member of the thesis/dissertation committee for 3 Master's and 5 undergraduate final project defenses, as shown in Table 2.

Master's Thesis Defense Committees

. **Barros, D. A.**, Master's Thesis Defense, *Evaluating Shared Memory Parallel Computing Mechanisms of Julia Language*, State University of Rio de Janeiro (UERJ), 2023.
. **Barros, D. A.**, Master's Thesis Proposal Defense, *Evaluating Shared Memory Parallel Computing Mechanisms of Julia Language*, State University of Rio de Janeiro (UERJ), 2021.
. **Medeiros da Nóbrega, R. V.**, Master's Thesis Defense, *Lung Nodule Malignancy Classification in Chest Computed Tomography Images Using Transfer Learning And Convolutional Neural Networks*, Federal Institute of Education, Science and Technology of Ceará (IFCE), 2018.

Undergraduate Final Project Defense Committees

. **Mendes Filho, E. S.**, *Computational Offloading on UAVS* (text in Portuguese), Federal University of Ceará (UFC), 2025.
. **Moraes Freire, L. P.**, *A massively parallel GRASP approach to the Job-Shop Scheduling Problem* (text in Portuguese), State University of Ceará (UECE), 2014.
. **Oliveira Melo, S.**, *A Proposal of an integrated learning system for schools* (text in Portuguese). (text in Portuguese), State University of Ceará (UECE), 2014.
. **Facundo de Lima, T.**, *Dimensional reduction in color digital images using principal component analysis* (text in Portuguese), State University of Ceará (UECE), 2014.
. **Oliveira, G. F.**, *A Framework to Support the Achievement of Trust in Network Systems* (text in Portuguese), State University of Ceará (UECE), 2013.
. **Amaral Filho, C. A.**, *An Evaluation Analysis of Free Software Tools for Requirements Management in ERP Systems* (text in Portuguese), Christus University Center (UniChristus), 2013.

SUPERVISION ACTIVITIES

Table 3: Supervision activities summary

Level	Institution	Total
Bachelor's degree monograph	UECE	3
Young researchers supervision	UECE	3
Internship Supervision	UECE	1
Total		7

Bachelor's degree monograph supervisions: 2014
State University of Ceará (UECE), Department of Computer Science

· **Moraes Freire, L.P.** *A massively parallel GRASP approach to the Job-Shop Scheduling Problem* (text in Portuguese).

· **Samua, S.** *A Proposal of an integrated learning system for schools* (text in Portuguese).

· **Facundo, T.** *Dimensional reduction in color digital images using principal component analysis* (text in Portuguese).

Young researchers supervision: 2012
Institutional Research Scholarship Program (PIBIC), Brazilian Ministry of Education (MEC)

Supervised students under the Institutional Research Scholarship Program (PIBIC) of the Brazilian Ministry of Education (MEC), supporting young researchers. I guided Luana Samara Paulino Maia, Paulo Henrique dos Santos Alves, and Marcelina Pereira Bernardo, from the Robotics Laboratory at the Plácido Aderaldo Castelo School in Fortaleza, Brazil. The students developed an SMS system to broadcast school-related news. The research was presented at the XVII Congress of the State University of Ceará (UECE) and published in the conference proceedings.

Internship supervision 2012
State University of Ceará (UECE), Department of Computer Science

Supervised the final internship of Henrique Silva for his Bachelor's degree in Computer Science. Activities took place in the Intelligent Computing Laboratory (LACONI). Guided the design and implementation of tree-based search algorithms for solving combinatorial problems.

TEACHING EXPERIENCE

As shown in Table 4, I have taught over 650 hours in four higher education institutions in two countries, at the graduate and undergraduate levels. The 64 hours taught at the UFC were part of a teaching internship required for the completion of my Ph.D. in Computer Science. In addition, the Introduction to OpenMP course was taught during my postdoctoral fellowship at INRIA Lille.

WORKSHOPS AND TUTORIAL SESSIONS ORGANIZATION

Organizer – 2nd International Workshop on Parallel Optimization using/for Multi and Many-core High Performance Computing (POMCO 2020)
Co-organized with N. Melab March 22-27, 2021

· Held as part of the International Conference on High Performance Computing & Simulation (HPCS 2020), Online Event.
· Focused on the use of multi-core and many-core HPC architectures for accelerating optimization algorithms.

Table 4: Summary of courses taught

Level / Degree / Institution	Module	Hours	Year(s)	Total (h)
Master's / Nano-science and nano-technologies for civil engineering/ Polytech'Lille	Introduction to OpenMP (in English)	4	2019	4
Graduate program / Computer Science / UFC	High-performance Computing	32	2013–2014 (2×)	64
Undergraduate / Computer Science / UECE	Concepts of programming languages	68	2012–2014 (4×)	272
Undergraduate / Computer Science / UECE	Data structures	68	2013	68
Undergraduate / Computer Science / UECE	High-performance computing	68	2012	68
Undergraduate / Informatics / UECE	Introduction to logic	68	2012	68
Undergraduate / Informatics / UECE	Computers architecture	68	2012	68
Undergraduate / Information Technology / UniChristus	Compilers	20	2012	20
Undergraduate / Information Technology / UniChristus	Formal languages and automata theory	20	2013	20
TOTAL	**9**	**416**	**-**	**652**

Organizer – International Workshop on the Synergy of Parallel Computing, Optimization, and Simulation (PaCOS)

Co-organized with N, Melab, J. Gmys, and B. Dorronsoro. July 15-19, 2019

· Held as part of the International Conference on High Performance Computing & Simulation (HPCS 2019).

· Explored synergies and challenges of parallel computing, optimization, and simulation.

Instructor – 11th HPC School, University of Luxembourg November 12–19, 2021

· Organized by the HPC Research Computing and Operations team.

· Provided instructions, hands-on exercises, and guided sessions on OpenCl and OpenACC.

· Focused on enabling researchers to leverage GPU acceleration for scientific computing.

Organizer/Intructor – GRID'5000: Getting Started and Introduction to GPU Computing

Co-organized with J. Gmys and D. Delabroye. December 7, 2018

· Taught how to access, reserve resources, and deploy jobs on Grid'5000 clusters, with a dedicated section on GPU computing.

· Tutorial organized by INRIA Lille's BONUS Team at the University of Lille.

CONFERENCE PROGRAM COMMITTEE

· ChapelCon 25, The Chapel Event of the Year. Online in a virtual format. October 7th, 2025.

· ChapelCon 24, The Chapel Event of the Year. Online in a virtual format. June 5–7, 2024.

· V Ibero-American Congress of Smart Cities – ICSC-CITIES 2022, 2022.

· IV Ibero-American Conference on Smart Cities – ICSC-CITIES 2021, held as part of the Ibero-American Program for Science and Technology Development, 2021.

· International Workshop on the Synergy of Parallel Computing, Optimization and Simulation - PaCOS. Held as part of the International Conference on High Performance Computing & Simulation (HPCS 2020). Online event, 2021.

· International Workshop on the Synergy of Parallel Computing, Optimization and Simulation - PaCOS. Held as part of the International Conference on High Performance Computing & Simulation (HPCS 2018), 2018.

JOURNAL REVIEWER

For more information about my review history access my Orcid (0000-0002-6145-8352) and Web Of Science (J-3061-2019) profiles.

· ACM Computing Surveys. ISSN: 0360-0300.
· Swarm and Evolutionary Computation (SWEVO). ISSN: 2210-6502.
· INFOR: Information Systems and Operational Research. ISSN: 0315-5986.
· The Journal of Supercomputing. ISSN: 1573-0484.
· IEEE Transactions on Parallel and Distributed Systems. ISSN: 1045-9219.
· IEEE Transactions on Vehicular Technology. ISSN: 1939-9359:
· IEEE Access. ISSN: 2169-3536.
· Journal of Parallel and Distributed Computing (JPDC). ISSN: 0743-7315.
· Journal of Computational Science. ISSN:1877-7503.
· Concurrency and Computation: Practice and Experience (CCPE). ISSN:1532-0634.
· Institute of Electronics, Information and Communication Engineers (IEICE) Transactions on Information and Systems. ISSN: 1745-1361.

TALKS AND SEMINARS

Investigating Portability in Chapel for Tree-based Optimization on GPU-powered Clusters, invited seminar. ULTRABO Workshop, University of Lille, France. **Date: 07/03/2025**.

Investigating Portability in Chapel for Tree-based Optimization on GPU-powered Clusters. The Chapel Language Conference - ChapelCon 2024. **Date: 07/06/2024**.

Ultra-scale Computing for Big Optimization, invited seminar. University of Malaga. T. Carneiro, N. Melab, and G. Helbecque. **Date: 01/03/2024**.

Chapel-based Ultra-scale Exact Optimization, invited seminar. Master Program in High Performance Computing, Simulation, specialized in scientific computing. University of Lille, France. **Date: 30/11/2023**.

Towards Exascale Tree-based Big Optimization, invited seminar. Master Program in High Performance Computing, Simulation, specialized in scientific computing. University of Lille, France. **Dates: 13/01/2022, 19/02/2021, 07/11/2019**.

GPU-based branch-and-bound for solving the asymmetric travelling salesman problem. Seminars of the Parallelism, Graphs and Optimization Group (ParGO), Federal University of Ceará (UFC), Brazil. **Date: 11/01/2013**.

GPU computing for solving combinatorial optimization problems. Teleinformatics Department (DETI), Federal University of Ceará (UFC), Brazil. **Date: 22/02/2013**.

A new GPU-based branch-and-bound algorithm„ invited seminar. XVI State University of Ceará Conference (UECE), Brazil. **Date: 21/11/2011**.

GPU and heterogeneous computing. Department of Electrical Engineering, Federal University of Santa Maria (UFSM), Brazil. **Date: 05/09/2010**.