Communications in Computer and Information Science

979

Commenced Publication in 2007
Founding and Former Series Editors:
Phoebe Chen, Alfredo Cuzzocrea, Xiaoyong Du, Orhun Kara, Ting Liu, Krishna M. Sivalingam, Dominik Ślęzak, and Xiaokang Yang

Editorial Board Members

Simone Diniz Junqueira Barbosa

Pontifical Catholic University of Rio de Janeiro (PUC-Rio), Rio de Janeiro, Brazil

Joaquim Filipe

Polytechnic Institute of Setúbal, Setúbal, Portugal

Ashish Ghosh

Indian Statistical Institute, Kolkata, India

Igor Kotenko

St. Petersburg Institute for Informatics and Automation of the Russian Academy of Sciences, St. Petersburg, Russia

Takashi Washio

Osaka University, Osaka, Japan

Junsong Yuan

University at Buffalo, The State University of New York, Buffalo, NY, USA

Lizhu Zhou

Tsinghua University, Beijing, China

More information about this series at http://www.springer.com/series/7899

Esteban Meneses · Harold Castro · Carlos Jaime Barrios Hernández · Raul Ramos-Pollan (Eds.)

High Performance Computing

5th Latin American Conference, CARLA 2018 Bucaramanga, Colombia, September 26–28, 2018 Revised Selected Papers



Editors
Esteban Meneses D
Instituto Tecnológico de Costa Rica
Centro Nacional de Alta Tecnología
Pavas, Costa Rica

Carlos Jaime Barrios Hernández Universidad Industrial de Santander Bucaramanga, Colombia Harold Castro Universidad de los Andes Bogotá, Colombia

Raul Ramos-Pollan Universidad de Antioquia Medellín, Colombia

ISSN 1865-0929 ISSN 1865-0937 (electronic) Communications in Computer and Information Science ISBN 978-3-030-16204-7 ISBN 978-3-030-16205-4 (eBook) https://doi.org/10.1007/978-3-030-16205-4

Library of Congress Control Number: 2019935812

© Springer Nature Switzerland AG 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The use and development of high-performance computing (HPC) in Latin America is steadily growing. New challenges come from the capabilities provided by clusters, grids, and distributed systems for HPC, promoting research and innovation in many scientific disciplines. Building on the great success of the previous editions, the Latin American Conference on High-Performance Computing (CARLA 2018) was held in Bucaramanga, Colombia, during September 26–28. The main goal of CARLA 2018 was to provide a regional forum to foster the growth of the HPC community in Latin America through the exchange and dissemination of new ideas, techniques, and research projects. The conference featured invited talks from academy and industry as well as short- and full-paper sessions presenting both mature work and new ideas in research and industrial applications.

The list of topics included: parallel algorithms; multicore architectures and accelerators; parallel programming techniques; cluster, grid, cloud, fog, and edge computing; federations; HPC education and outreach; HPC infrastructure and data centers; large-scale distributed systems; scientific and industrial computing; modeling and evaluation; high-performance applications and tools; data analytics, data management, and data visualization; AI; machine learning; deep learning; and special topics in advanced computing.

All submitted papers were carefully examined by at least three reviewers. Out of the 38 submissions received, 24 were accepted to be presented at the conference.

March 2019

Esteban Meneses Harold Castro Carlos Jaime Barrios Hernández Raul Ramos-Pollan

Organization

Steering Committee

Mateo Valero Barcelona Supercomputing Center, Spain

Gonzalo Hernández University of Santiago, Chile

Carla Osthoff
National Laboratory for Scientific Computing, Brazil
Philippe Navaux
Federal University of Rio Grande do Sul, Brazil
Isidoro Gitler
Center for Research and Advanced Studies
of the National Polytechnic Institute, Mexico

Esteban Mocskos University of Buenos Aires, Argentina
Nicolas Wolovick National University of Cordoba, Argentina
Sergio Nesmachnow University of the Republic, Uruguay

Alvaro de la Ossa Osegueda University of Costa Rica, Costa Rica Esteban Meneses National High Technology Center, Costa Rica

Carlos Jaime Barrios Industrial University of Santander, Colombia Hernández

Harold Enrique Castro University of Los Andes, Colombia

Gilberto Javier Diaz Toro Industrial University of Santander, Colombia Luis Alberto Nunez de Industrial University of Santander, Colombia

Program Committee

Villavicencio Martinez

Barrera

Alvaro Coutinho Federal University of Rio de Janeiro, Brazil

Bruno Schulze National Laboratory for Scientific Computing, Brazil
Carla Osthoff National Laboratory for Scientific Computing, Brazil

Daniel Cordeiro University of São Paulo, Brazil Esteban Clua Federal Fluminense University, Brazil

Lucas Schnorr Federal University of Rio Grande do Sul, Brazil Marcio Castro Federal University of Santa Catarina, Brazil

Pedro Mario Cruz Silva NVIDIA, Brazil

Roberto Pinto-Souto National Laboratory for Scientific Computing, Brazil Luiz Angelo Steffenel Université de Reims Champagne-Ardenne, France

Luiz Derose Cray, USA

Ginés Guerrero University of Chile, Chile

Claudia Jiménez-Guarín University of the Andes, Colombia

Fabio Martinez Carrillo National University of Colombia, Colombia Gilberto Javier Diaz Toro Industrial University of Santander, Colombia

Idalides Vergara-Laurens University of Turabo, Colombia

Julian Ernesto Jaramillo Industrial University of Santander, Colombia

Luis Fernando Castillo University of Caldas, Colombia

Edmanuel Torres Cristian Camilo Ruiz

Sanabria

Esteban Hernandez

Barragan

Esteban Meneses Filip Krikava

Guilherme Peretti-Pezzi

Leonardo A. Bautista Gomez

Bruno Raffin Claudia Roncancio

Genoveva Vargas-Solar

Laercio Lima-Pilla

Michel Riveill Olivier Richard

Oscar Carrillo Rafael Escovar Thomas Ropars

Yves Denneulin Matthieu Dreher

Xavier Besseron Benjamin Hernandez Isidoro Gitler

Jaime Klapp

José Luis Gordillo Ulises Cortés Nicolás Erdödy

Eduardo Fernandez

Eduardo Rodrigues

Ernesto Bautista

German Schynder Gonzalo Tancredi Horacio Paggi

Luka Stanisic
Martin Pedemonte

Pablo Ezzati

Renzo Massobrio Sergio Nesmachnow Ulises Orozco-Rosas

Ignacio Laguna Nick Nystrom Pablo Guillen Canadian Nuclear Laboratories, Canada Industrial University of Santander, Colombia

csddlabs, Colombia

National High Technology Center, Costa Rica Czech Technical University, Czech Republic

Swiss National Supercomputing Centre, Switzerland

Barcelona Supercomputing Center, Spain

Laboratoire Informatique et Distribution, France

Grenoble University, France CNRS-LIG-LAFMIA, France

University of Paris-Sud, CNRS, France

University of Nice, France

LIG Laboratory Grenoble, France

CPE Lyon, France ASML, France

University of Grenoble-Alpes, France University of Grenoble-Alpes, France

Canadian Bank Note, Canada

University of Luxembourg, Luxembourg
Oak Ridge National Laboratory, USA
Center for Research and Advanced Studies
of the National Polytechnic Institute, Mexico

National Institute for Nuclear Research, Mexico National University of Mexico, Mexico Universitat Politècnica de Catalunya, Spain

Open Parallel Ltd, New Zealand University of the Republic, Uruguay

IBM. Brazil

DES-DACI, Universidad Autónoma del Carmen,

Uruguay

University of the Republic, Uruguay University of the Republic, Uruguay Universidad Politécnica de Madrid, Spain

Max Planck Computing and Data Facility, Germany

University of the Republic, Uruguay Universidad Rey Juan Carlos, Spain

Lawrence Livermore National Laboratory, USA

Pittsburgh Supercomputing Center, USA

University of Houston, USA

Contents

Artificial	Intell	ligence
------------	--------	---------

Parallel and Distributed Processing for Unsupervised Patient Phenotype	
Representation	3
Evolutionary Algorithms for Convolutional Neural Network Visualisation Nicolas Bernard and Franck Leprévost	18
Breast Cancer Classification: A Deep Learning Approach for Digital Pathology	33
Where Do HPC and Cognitive Science Meet in Latin America?	41
Accelerators	
A Hybrid Reinforcement Learning and Cellular Automata Model for Crowd Simulation on the GPU	59
In-situ Visualization of the Propagation of the Electric Potential in a Human Atrial Model Using GPU	75
GPU Acceleration for Directional Variance Based Intra-prediction in HEVC	90
Fast Marching Method in Seismic Ray Tracing on Parallel GPU Devices Jorge Monsegny, Jonathan Monsalve, Kareth León, Maria Duarte, Sandra Becerra, William Agudelo, and Henry Arguello	101
Improving Performance and Energy Efficiency of Geophysics Applications on GPU Architectures	112

FleCSPHg: A GPU Accelerated Framework for Physics and Astrophysics	
Simulations	
Applications	
Comparison of Tree Based Strategies for Parallel Simulation of Self-gravity in Agglomerates	
Parallel Implementations of Self-gravity Calculation for Small Astronomical Bodies on Xeon Phi	
Visualization of a Jet in Turbulent Crossflow	
Acceleration of Hydrology Simulations Using DHSVM for Multi-thousand Runs and Uncertainty Assessment	
Fine-Tuning an OpenMP-Based TVD-Hopmoc Method Using Intel® Parallel Studio XE Tools on Intel® Xeon® Architectures	
Performance Evaluation	
Performance Evaluation of Stencil Computations Based on Source-to-Source Transformations	
Benchmarking LAMMPS: Sensitivity to Task Location Under CPU-Based Weak-Scaling	
Analyzing Communication Features and Community Structure of HPC Applications	

Power Efficiency Analysis of a Deep Learning Workload on an IBM "Minsky" Platform	255
Mauricio D. Mazuecos Pérez, Nahuel G. Seiler, Carlos Sergio Bederián, Nicolás Wolovick, and Augusto J. Vega	233
Platforms and Infrastructures	
Orlando Tools: Development, Training, and Use of Scalable Applications in Heterogeneous Distributed Computing Environments	265
Methodology for Tailored Linux Distributions Development for HPC Embedded Systems	280
Cloud Computing	
Cost and QoS Optimization of Cloud-Based Content Distribution Networks Using Evolutionary Algorithms	293
Bi-objective Analysis of an Adaptive Secure Data Storage in a Multi-cloud	307
Fault Characterization and Mitigation Strategies in Desktop Cloud Systems	322
Author Index	337