Pawan Kumar

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About Me

I have done my PhD and postdocs from Europe that gave me strong foundations in research. For past 5 years, I am working as assistant professor at IIIT-Hyderabad, India. I have guided 8 thesis students. I have obtained numerous industrial grants from Microsoft, Qualcomm, and TATA. I have taught numerous computer science and mathematics courses. I have proposed some modern elective courses in machine learning. I like working on all aspects of machine learning: theoretical, algorithmic and applied machine learning. I have published in some of the top journals such as SIAM J. of Optimization, Numerische Mathematik, etc. I also have published in some of the top machine learning venues such as SDM, ECML, etc.

Employment

Assistant Professor, 2017-now, IIIT, Hyderabad, India
Postdoc, 2014-2016, FU Berlin, Germany
Postdoc, 2013- 2014, Fraunhofer ITWM, Kaiserslautern, Germany
Postdoc, Sept. 2011-July 2013, KU Leuven and exascience lab, Belgium

Education

PhD (Highest honours ("très honorable" in French)), INRIA, France
MS, Indian Institute of Technology, Guawahati, India

Languages

English (Fluent), French (Intermediate), German (Beginner)

Computer Skills

Familiarity with: C, C++, Python, Fortran 77/90, MPI, OpenMP, Cilk plus, C++-11 threads, Parallel analysis tools: Scalsca, TAU analysis tool, Vtune, Likwid, HDF5, Paraview, Web tools: XML, HTML, PHP, CSS, Version Control: SVN, GIT, Other Protyping tools: MATLAB, Octave, Maple, mexfile (Matlab, C, Fortran interface), Documentation: Latex

Operating Systems: Windows, Unix (preferred!), MAC

Publications Reports

Data Mining and Machine Learning

- *Enhancing ML model accuracy for Digital VLSI circuits using diffusion models*, P. Srivastava, Z. Abbas, P. Kumar, ML for Systems, NeurIPS-W 2023.
- *alphaElimination: Using deep reinforcement learning for sparse Gaussian Elimination*, A. Dasgupta, P. Kumar, ECML 2023
- *marl-jax: Multi-agent Reinforcement Leaning framework for Social Generalization*, K. Mehta, A. Mahajan, P. Kumar, ECML 2023
- *Effects of Spectral Normalization in Multi-agent Reinforcement Learning*, K. Mehta, A. Mahajan, P. Kumar, IJCNN 2023.
- (**Best Paper Award**) *LightWeight Deep Extreme Multilabel Classification*, U. Mishra, A. Dasgupta, P. Jawanpuria, B. Mishra, P. Kumar, IJCNN 2023.
- *A Riemannian Approach to Extreme Classification Problems*, J. Naram, T. Sinha, P. Kumar, CODS-COMAD, 2022.
- *Hybrid Tokenization and Datasets for Solving Mathematics and Science Problems Using Transformers*, P. Mandlecha, S. Chatakonda, N. Kollepara, P. Kumar, SDM, 2022.

- *SCIMAT: Science and Mathematics Dataset*, S. Chatakonda, N. Kollepara, P. Kumar, DCAI, NeurIPS-W, 2021.
- *DXML: Distributed Extreme Multilabel Classification (arXiv)*, Springer (doi), P. Kumar, BDA 2021.
- *SCIMAT: An Extensive Dataset and Results with Transformer*, S. Chatakonda, N. Kollepara, P. Kumar, BDA 2021.

Computer Vision

- *Angle based dynamic learning rate for gradient descent*, N. Mishra, P. Kumar, IJCNN 2023.
- *Adaptive Concencous Optimization for GANs*, Sachin Danisetty, Santhosh, P. Kumar, IJCNN 2023.
- *Nonnegative Low-Rank Tensor Completion via Dual Formulation with Applications to Image and Video Completion*, T. Sinha, J. Naram, P. Kumar, WACV, 2022.
- *Structured Low-Rank Tensor Learning*, J. Naram, T. Sinha, P. K., NeurIPS-W, 2021.
- S. Das, S. Katyan, P. Kumar, *A Deflation Based Fast and Robust Preconditioner for Bundle Adjustment*, WACV 2021.
- S. Katyan, S. Das, P. Kumar, *Multigrid Preconditioned Solver for Bundle Adjustment*, WACV 2020.
- S. Das, S. Katyan, P. Kumar, *Domain Decomposition Based Preconditioned Solver for Bundle Adjustment*, NCVPRIPG 2019.

Optimization Methods and Preconditioners:

- *Generalized Structured Low Rank Tensor Learning*, J. Naram, T. Sinha, P. Kumar, CODS-COMAD, 2023.
- *Riemannian Hamiltonian methods for min-max optimization on manifolds*, A. Han, B. Mishra, P. Jawanpuria, P. Kumar, J. Gao, SIAM J. of Optimization, SIOPT, 2023.
- P. Kumar, *Fast Preconditioned Solver for Truncated Saddle Point Problem in Nonsmooth Cahn–Hilliard Model*, Book chapter, Recent Advances in Computational Optimization, 2016
- P. Kumar, L. Grigori, F. Nataf, and Q. Niu, *Combination preconditioning based on relaxed nested factorization and tangential filtering decomposition*, International Journal of Computer Mathematics, 2015, doi:10.1080/00207160.2014.998208
- P. Kumar, *Aggregation based on graph matching and inexact coarse grid solve for algebraic multigrid*, accepted, Int. J. Comp. Math., 2013, http://dx.doi.org/10.1080/00207160.2013.821115

Analysis

- Q. Niu, L. Grigori, P. Kumar, and F. Nataf, *Modified tangential frequency filtering decomposition and its Fourier analysis*, Numerische Mathematik, Volume 116, issue 1, p 123-148, 2010, doi: 10.1007/s00211-010-0298-3

High Performance Computing and Scientific Computing

- S. Rampalli, N. Sehgal, I. Bindlish, T. Tyagi, *Efficient FPGA Implementation of Conjugate Gradient Methods for Laplacian System using HLS*, short paper, FPGA 2019

- P. Kumar, *Multilevel Communication Optimal Least Squares Solver*, IEEE proceedings, International Conference on Computational Sciences, ICCS, vol. 51, p. 1838-1847, 2015, doi: 10.1016/j.procs.2015.05.410
- P. Kumar, *Communication Optimal Least Squares Solver*, accepted, IEEE proceedings, 16th international conference on high performance computing and communications, HPCC, 20-22 August 2014, Paris, France
- P. Kumar, *Multi-threaded direction preserving preconditioners*, IEEE proceedings, 13th international symposium on parallel and distributed computing, ISPDC, 23-27 June 2014, p. 148-153, Marseille (Porquerolles island), France
- P. Kumar, S. Markidis, G. Lapenta, K. Meerbergen, D. Roose, *High Performance Solvers for Implicit Particle in Cell Simulation*, ICCS, vol. 18, Procedia Computer Science, pp 2396-2405, 2013, http://dx.doi.org/10.1016/j.procs.2013.05.396
- P. Kumar, K. Meerbergen, and D. Roose, *Multi-threaded nested filtering factorization preconditioner*, vol. 7782, LNCS, pp. 220-234, 2013

Reports under submission

- P. Kumar, L. Grigori, Q. Niu, F. Nataf, *Fourier analysis of Modified Nested Factorization Preconditioner for Three-Dimensional Isotropic Problems*, HAL, INRIA report, 2019.
- L. Grigori, P. Kumar, F. Nataf, and K. Wang, *A class of multilevel parallel preconditioners*, submitted as INRIA tech. report no. 7410, available online at: `http://hal.archives-ouvertes.fr/docs/00/52/41/10/PDF/Paper.pdf`

Grants

- **KCIS Grant (TATA group)**: ML for biosensors
- **Microsoft Academic Partnership Grant (MAPG)**: Optimization for Generative Modeling
- **Ripple Center of Excellence**: Distributed Optimization and Blockchain
- INAE Conference Travel grant
- **MATRICS grant**: Solvers for saddle point problems
- **ERCIM**: Marie Curie Actions Fellowship

Awards

- **Best Paper Award** (presented as poster) at IJCNN 2023, Gold Coast, Australia
- Marie-Curie ERCIM fellowship for independent postdoctoral research, 2013-2014
- European CORDIS scholarship (applied by Supervisor) for PhD studies at INRIA, Saclay, 2007-2010
- Secured a percentile of 96.6 (rank 88) in all India applied Mathematics category in GATE (Graduate Aptitude Test in Engineering, India), 2007
- Junior summer research scholarship from JNCASR bangalore, India to conduct undergraduate research for two months, 2005

Teaching

- Monsoon 2023: Discrete Structures, Topics in Applied Optimization
- Spring 2023: Mathematics of Generative Modeling, Advanced Optimization for Machine Learning
- Monsoon 2021: Probability and Statistics, Topics in Applied Optimization
- Spring 2021: Adavanced Optimization for Machine Learning
- Monsoon 2020: Discrete Structures, Probability and Statistics

- Spring 2020: Introduction to Parallel Scientific Computing
- Monsoon 2019: Topics in Applied Optimization, Discrete Structures
- Spring 2019: Introduction to Parallel Scientific Computing, Topics in Optimization on Manifolds
- Monsoon 2018: Discrete Structures, Topics in Applied Optimization
- Spring 2018: Introduction to Parallel Scientific Computing, Linear Algebra
- Monsoon 2017: Discrete Mathematics and Algorithms, Algorithms
- Spring 2017: Introduction to Parallel Scientific Computing

Proposal accepted

Scalable robust Schur complement preconditioners using PGAS (performed under ERCIM fellowship), accepted and completed under MArie-Curie Fellowship at Fraunhofer ITWM.

Talks

- *Effects of Spectral Normalization in Multi-agent Reinforcement Learning*, Gold Coast, Australia, 2023
- *Lightweight Deep Extreme Multilabel Classification*, IJCNN, Gold Coast, Australia, 2023
- *Adaptive Concensus Optimization Method for GANs*, IJCNN, Gold Coast, Australia, 2023
- *Multilevel Communication Optimal Least Squares Solver*, HPCC, 1-3 June 2015, Reykjavic, Iceland
- *High Performance Solvers for Implicit Particle in Cell Simulations*, ICCS, 5-7 June 2013, Barcelona, Spain
- *Multi-threading and auto-vectorization for direction preserving preconditioners*, SIAM conference on Computational Science and Engineering, 25 February - 1 March 2013, Boston, USA
- *Parallel aggregation based algebraic multigrid*, International Conference on Domain Decomposition, 25-29 June 2012, Rennes, France
- *Purely algebraic domain decomposition methods for the incompressible Navier-Stokes equation*, SIAM LA, 18-22 June 2012, Valencia, Spain
- *Multithreaded row and column sum based preconditioners*, PARA 10-13 June 2012, Helsinki, Finland
- *Purely algebraic domain decomposition methods for the incompressible Navier-Stokes equation*, Workshop on Recent Developments in the Solution of Indefinite Systems, April 17, 2012, Eindhoven, The Netherland
- *Combination preconditioning based on relaxed nested factorization and tangential filtering preconditioner*, IHP, 2008, Paris, France
- *Gershgorin circles and Poincare separates*, ESS sem. series, KU Leuven, Belgium

Visits Schools Workshops

- *Research visit (Prof. M. Gander) University of Geneva, Geneva*, 2-6 June 2014
- *Research visit (Prof. A. Napov) Universite Libre de Bruxelles*, 7-11 April 2014
- *Winter school on Hierarchical matrices*, Leipzig, Germany, 2014
- *Visit Lawrence Berkeley National Lab.:*, 4th March 2013, Berkeley, California
- *Ninth VI-HPS Tuning Workshop*, 23-27 April 2012, St-Quentin-en-Yvelines, France
- *INRIA school on solution of large sparse linear systems*, Sophia-antipolis, France, 2008

- *Winter school on Hierarchical matrices*, Leipzig, Germany, 2008
- *Workshop on FreeFEM++*, 14-15 September, 2009, IHP, Paris, France

Hobbies

- Playing chess, biking, travelling and cooking