Siddhartha Kumar

Curriculum Vitae

Summary

Ph.D. with a proven track record of designing and implementing high-performance algorithms for distributed systems and advanced communication technologies. My expertise lies in **optimizing system efficiency, reliability, and data integrity** for large-scale applications in **telecommunications**, **computing**, **machine learning**, and **data storage**. I possess a strong foundation in applied mathematics, including linear algebra and graph theory, to solve complex engineering challenges.

Education

Aug 2015 – Aug 2018	**Ph.D., Informatics**, *University of Bergen*, Norway
Sep 2013 – Jun 2015	**MSc., Communication Engineering**, *Chalmers University of Technology*, Sweden
Jul 2009 – Jun 2013	**BSc., Electronics and Communications Engineering**, *Amrita Vishwa Vidyapeetham*, India

Skills

Programming	Python, C++, LaTeX, Emacs Lisp, Guile Scheme, MATLAB, and Bash
Tools	Emacs, Git, CMake, and VScode
Operating Systems	MacOS and GNU/Linux (distributions: NixOS and GNU Guix)

Technical Expertise

Telecommunications	Forward error correction (Reed-Solomon codes, BCH codes, LDPC codes), OFDM, QAM, Joint communication and sensing
Machine Learning	Regression, Classification, Neural networks, SVMs, and Dimensionality reduction
Miscellaneous	Linear algebra, Combinatorial design, and Information theory

Work Experience

Jun 2022 – Present **Senior Systems Engineer**, *Qamcom Research & Technology AB*, Sweden

Conducted research and development for telecommunications and sensing applications. More specifically,

- Carried out research and development for advanced communication systems, including 6G networks, focusing on **joint communication and sensing demonstrators (JCAS)** and **low-latency communication** algorithms.
- Developed and optimized algorithms for efficient data processing, including graph-based algorithms for network edge communication in 6G systems and **forward error correction codes** for ultra low-latency modems, resulting in significant performance improvements.
- Facilitated industry-academic collaborations (e.g, Ericsson, Volvo, Chalmers) by supporting field testing and validating data for automotive and communication applications, utilizing tools like Python and C++ for data collection, post-processing, and simulation.
- Published research findings and contributed to Swedish and EU funded projects through presentations and collaborations, demonstrating expertise in cutting-edge technologies and contributing to the advancement of 6G communication standards.

Aug 2018 – Feb 2022 **Postdoctoral Fellow**, *Simula UiB*, Norway

Under Prof. Alexandre Graell i Amat and Prof. Eirik Rosnes

Spearheaded research in **distributed AI and machine learning**, and **distributed computing** with a focus on next-generation network intelligence.

- Developed low latency distributed AI frameworks, enabling collaborative model training across decentralized networks without compromising data security.
  - Authored publications in a reputed scientific journal and a leading academic conference, achieving **71 citations** to date (source Google Scholar).
- Engineered highly efficient and secure algorithms for distributed and edge intelligence, optimizing computational resources and data privacy at the wireless network edge.
- Mentored and co-supervised two Ph.D. students, which involved directing their research and fostering collaborative research
- Teaching assistant for MSc. level courses at University of Bergen

Aug 2015 – Aug 2018 **Ph.D. Scholar**, *University of Bergen*, Norway

Under Prof. Alexandre Graell i Amat and Prof. Eirik Rosnes

Specialized in the **design of high performance algorithm** enabling **fault tolerance**, **data security and privacy** in large scale distributed storage systems in data centers.

- Developed secure and fault tolerant storage solutions for data centers.
- Designed novel privacy-preserving protocols to retrieve data from data centers.
  - Aforementioned protocols were the **first proven algorithms** to operate on arbitrary coded data in large scale distributed storage system.
- Authored influential papers in top tier, peer-reviewed journals and conferences **garnering over 300 citations** (source Google Scholar).
- Fostered international research collaboration with invited research visits to premier research institutions, including including the Technion (Israel) and Università Politecnica delle Marche (Italy).

Notable Projects

Author of **25 research publications** and accrued **501 citations** (source Google Scholar)

Dec 2023 – Apr 2025 **Hexa-X (I & II)**, *Qamcom Research & Technology AB*

Programming Languages: Python, C++ **Tools used:** Emacs, CMake, Git

- Developed novel graph based algorithm to achieve low-latency communication between the user and core network at the network edge in 6G networks. The work involved:
  - developing algorithms in Python for analyzing graphs
  - simulating results in Python
- Jointly developed JCAS demonstrator using Xilinx FPGA board and Sivers EVKs. Development consisted of
  - Creating efficient and reliable sensing algorithm in Python.
  - Optimizing the communication algorithm. The processing speeds is ~**30% faster** than the previous Python implementation.
  - Achieved by optimizing Numpy methods, and porting parts of the Python program to C++.
  - Designed encoder and decoder for the LDPC codes used in the 5G NR standard for the JCAS demonstrator, using Python and C++
- Provide support in carrying out JCAS measurements for IMEC. It involved
  - Writing Python scripts to collect sensing data from the JCAS demonstrator
  - Validating sensing data from the demonstrator
- Carried out JCAS measurements for Volvo and AstaZero for automotive sensing research
  - Writing Python scripts to collect sensing data from the JCAS demonstrator
  - Validating sensing data from the demonstrator
  - Provide support during the field measurements

Sep 2021 – Sep 2022 **Privacy-preserving Low-latency Federated Learning**, *Simula-UiB*

Programming Languages: Python, Latex **Tools used:** VSCode, Git

- Designed low-latency federated learning (FL) schemes, a distributed AI framework that preserves users' privacy
  - Engineered a novel FL algorithm that achieved **94% accuracy** on the MNIST benchmark data set.
  - Outperformed standard FL implementations by delivering **2x faster** model convergence, significantly reducing computational overhead and training time.
  - Ensured user privacy by design, enabling collaborative model training without centralizing sensitive data.

Nov 2016 – Feb 2018 **Private Information Retrieval Protocols**, *University of Bergen*

Programming Languages: Latex **Tools used:** MATLAB

Spearheaded the design of novel private information retrieval (PIR) protocols—a key **Privacy-Enhancing Technology (PET)**—for fault tolerant data centers utilizing storage codes.

- Designed the **first known class of optimal PIR protocols** for practical storage coded data, achieving **information-theoretic privacy** with **minimum overhead**.
- Rigorously proved the optimal efficiency of these protocols in the context of data encoded using optimal LRC codes that are integral to modern cloud systems, like Microsoft Azure.
- Designed a new robust protocol that preserves privacy in presence of multiple colluding servers within the data center.

Selected Publications

- **S. Kumar**, M. H. Moghaddam, A. Wolfgang, T. Svensson, "Path Assignment in Mesh Networks at the Edge of Wireless Networks," in *Proc. IEEE International Conference on Communications (ICC) Workshop*, Montreal, Canada, June 2025
- **S. Kumar**, R. Schlegel, E. Rosnes, A. Graell i Amat, "Coding for Straggler Mitigation in Federated Learning," in *Proc. IEEE International Conference on Communications (ICC)*, Seoul, South Korea, May 2022
- **S. Kumar**, H.-Y. Lin, E. Rosnes, A. Graell i Amat, "Achieving maximum distance separable private information retrieval capacity with linear codes," *IEEE Transactions on Information Theory*, vol. 65, no. 8, August, 2019

References

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