KONSTANTINOS KONSTANTINIDIS

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Personal Information

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Education

January 2017 - December 2022 (expected) — **Ph.D. in Electrical and Computer Engineering**
Department of Electrical and Computer Engineering,
Iowa State University, Ames, IA.
Dissertation: "*Leveraging Redundancy and Coding Techniques for Speeding up Distributed Computing and Securing Distributed Learning.*"
Advisor: Professor Aditya Ramamoorthy.
Current GPA: 3.94/4.0.

January 2017 - August 2022 — **M.Eng. in Electrical and Computer Engineering**
Department of Electrical and Computer Engineering,
Iowa State University, Ames, IA.
GPA: 3.94/4.0.

September 2011 - December 2016 — **Diploma in Electrical and Computer Engineering (5-year program)**
School of Electrical and Computer Engineering,
Technical University of Crete, Chania, Greece.
Thesis: "*Fast Synchronization of OQPSK Signals.*"
Advisor: Professor George N. Karystinos.
GPA: 3.4/4.0.

Research Interests

- Distributed Computing.
- Machine Learning.
- Network Coding.

Academic Experience

January 2017 - May 2022	**Graduate Research Assistant** Leveraging Redundancy and Coding Techniques for Speeding up Distributed Computing and Securing Distributed Learning. Iowa State University.
Fall 2020	**Graduate Teaching Assistant** EE 571: Convex Optimization Enrollment: 20+ students Iowa State University.
Spring 2019	**Graduate Teaching Assistant** EE 322: Probabilistic Methods for Electrical Engineers Enrollment: 70+ students Iowa State University.
Fall 2018	**Graduate Teaching Assistant** EE 322: Probabilistic Methods for Electrical Engineers Enrollment: 50+ students Iowa State University. Received the Teaching Excellence Award upon nomination of the instructor.

Graduate Research Experience

January 2020 - Present	Department of Electrical and Computer Engineering, Iowa State University. **Project**: Robust Distributed Learning **Description**: Developed novel filtering and detection mechanisms for distributed deep learning scenarios in which computing devices may return erroneous or malicious gradients, which can derail the training. *Coding-theoretic* ideas are paired with *design theory* to minimize the fraction of corrupted computations. *Graph theory* is combined with computational redundancy to optimally assign tasks to devices, and *clique-finding* allows for the detection and exclusion of misbehaving devices from the training. The methods are robust to the most sophisticated attacks and achieve, on average, a 25% increase in top-1 accuracy on the CIFAR-10 dataset over defenses suggested by prior work. They maintain training convergence even when 30% of the devices behave adversarially, and the corresponding reduction of the fraction of corrupted gradients ranges from 16% to 99%. **Supervisor**: Prof. Aditya Ramamoorthy.
May 2017 - April 2020	Department of Electrical and Computer Engineering, Iowa State University. **Project**: Communication-Efficient Distributed Computing **Description**: Developed algorithms to reduce *MapReduce* communication time across the servers on the *AWS EC2* platform. The protocol uses *Single Parity Check* codes and design theory constructions to assign tasks to servers and splits files less finely than prior work. Tweaked the baseline *TeraSort* algorithm, popular for sorting large datasets (generated and fetched within the *HDFS* system), and adapted it to our scheme. *MPI* facilitates communication among the servers and achieves significant speedups of up to 4.7×. Extended this work to the case when the desired functions can be aggregated (amenable to deep learning applications). Its speedup is 4.3× over the baseline approach. The latter work on *aggregated* MapReduce achieves state-of-the-art communication load but with an exponentially smaller requirement on the minimum number of jobs. **Supervisor**: Prof. Aditya Ramamoorthy.

Industry Experience

May 2022 - August 2022 **Software Engineer Intern at Meta (Facebook)**
Developed multiple debugging tools for machine learning feature authoring used in the data pipelines of Facebook Marketplace. The main component was a framework that categorizes errors during feature compilation, generates alerts, and assigns tasks to the appropriate team; this framework was integrated with the CI/CD. Another end product of my work was an internal UI tool to fetch and display feature values from low-latency storage after a series of transformations.

June 2021 - August 2021 **Software Engineer Intern at C3.ai**
Implemented an end-to-end framework for cluster failure prediction; the framework has two components. The first is the data pipeline which loads cluster health metrics, handles missing data, and creates a training data set. The second component is the ML pipeline which trains a model and makes predictions regarding the cluster's state as soon as new test data becomes available. Followed the process of continuous integration / continuous deployment (CI/CD).

Publications

Preprint

- K. Konstantinidis and A. Ramamoorthy, "Efficient Detection and Filtering Systems for Distributed Training," (preprint), August 2022.
  Available online: https://arxiv.org/abs/2208.08085

Journal papers

- **K. Konstantinidis** and A. Ramamoorthy, "Resolvable Designs for Speeding up Distributed Computing," *IEEE Transactions on Networking (ToN)*, May 2020.
  Source code
- L. Tang, **K. Konstantinidis** and A. Ramamoorthy, "Erasure Coding for Distributed Matrix Multiplication for Matrices With Bounded Entries," *IEEE Communications Letters*, January 2019.
  Source code

Conference papers

- **K. Konstantinidis** and A. Ramamoorthy, "Aspis: Robust Detection for Distributed Learning," *IEEE International Symposium on Information Theory (ISIT)*, July 2022.
  Source code
  Presentation video
- **K. Konstantinidis** and A. Ramamoorthy, "ByzShield: An Efficient and Robust System for Distributed Training," *Machine Learning and Systems (MLSys)*, April 2021.
  Source code
  Presentation video
- **K. Konstantinidis** and A. Ramamoorthy, "CAMR: Coded Aggregated MapReduce," *IEEE International Symposium on Information Theory (ISIT)*, July 2019.
- **K. Konstantinidis** and A. Ramamoorthy, "Leveraging Coding Techniques for Speeding up Distributed Computing," *IEEE Global Communications Conference (GLOBECOM)*, December 2018.
  Source code

Awards

April 2022 **Research Excellence Award**
Iowa State University, Ames, IA.

June 2019 **Best Student Poster Award** (link)
Midwest Machine Learning Symposium (MMLS), Madison, WI.

April 2019 **Teaching Excellence Award**
Iowa State University, Ames, IA.

June 2018 **Academic Excellence Award**
Gerondelis Foundation, Lynn, MA.

March 2018 **John Hatsios and Andromache Tsandes Award**
Iowa State University, Ames, IA.

Seminar

July 2020 **Speeding Up Distributed Computing via Coding** (video)
Theoretical and Applied Data Science Initiative, Ames, IA.

Reviewing Service

- *IEEE* Transactions on Communications (TCOM) (2022, 2020, 2019).
- *IEEE/ACM* Transactions on Networking (ToN) (2021).
- *IEEE* International Symposium on Information Theory (ISIT) (2021, 2020, 2019).

Undergraduate Internship And Project Experience

August 2016 School of Mineral Resources Engineering,
Technical University of Crete.
Worked at Geodesy & Geomatics Lab.
Project: Development of an Android app that stores geodesy measurements on server.
Supervisor: Grad. student Dimitrios Galanakis.

July 2016 School of Mineral Resources Engineering,
Technical University of Crete.
Interned at SenseLab Laboratory.
Project: Representation of a cylindrical geological core in horizontal plane.
Supervisor: Assist. Prof. Panayotis Partsinevelos.

January 2015 School of Electrical and Computer Engineering,
Technical University of Crete.
Carried out research on probabilistic graphical models.
Project: Implementation of forward/backward inference (Viterbi) as well as learning (Baum Welch) algorithms on the Dishonest Casino problem.
Supervisor: Assoc. Prof. Aggelos Bletsas.

Selected Graduate Coursework

The following is a partial list of the graduate coursework I have completed at Iowa State University.

- **COMS573: Machine Learning**
  Grade: A.
- **EE525X: Data Analytics in Electrical and Computer Engineering**
  Grade: A.
- **EE523: Random Processes for Communications and Signal Processing**
  Grade: A.

- **EE526X: Deep Learning**
  Grade: A-.
- **COMS525: Numerical Analysis of High Performance Computing**
  Grade: A.

Selected Undergraduate Coursework

The following is a subset of the coursework I have completed at the Technical University of Crete.

- **TEL416: Information Theory and Coding**
  Grade: 10/10.
- **TEL415: Statistical Signal Processing for Telecommunications**
  Grade: 10/10.
- **TEL606: Probabilistic Graphical Models (graduate course)**
  Grade: 8/10.
- **TEL413: Convex Optimization**
  Grade: 8.5/10.
- **TEL414: Modeling and Performance Evaluation of Communication Networks**
  Grade: 10/10.

Skills

Programming Languages
Proficient: Python, SQL, MATLAB, **Good**: C++, Java, Bash, PHP.

Interfaces/Frameworks
Proficient: AWS, PyTorch, NumPy, MPI, MapReduce, **Good**: scikit-learn, Hadoop, HDFS, Git, Jenkins, Splunk.

Networking
FTP, SSH, DDNS, VPN, WOL.

Miscellaneous
Windows, Linux, Excel, LaTeX.

Volunteering

September 2021 - May 2022 **Mathematics Tutor for CyMath Kids**
Taught mathematics to 3rd-grade students on a weekly basis. The lessons involved creative problem solving as well as different methods to approach a problem by means of fun challenges. The program is part of the Iowa State University 4U Promise initiative aiming to inspire and motivate students with an increased interest in STEM fields in their early years of education.