







# KONSTANTINOS KONSTANTINIDIS

Ph.D. Candidate  
Department of Electrical and Computer Engineering  
Iowa State University  
Ames, IA 50011

## PERSONAL INFORMATION

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## EDUCATION

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JANUARY 2017 **Ph.D. in Electrical and Computer Engineering**  
- DECEMBER 2022 Department of Electrical and Computer Engineering,  
(expected) Iowa State University, Ames, IA.  
Thesis: “*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 **M.Eng. in Electrical and Computer Engineering**  
- AUGUST 2022 Department of Electrical and Computer Engineering,  
Iowa State University, Ames, IA.  
GPA: 3.94/4.0.

SEPTEMBER 2011 **Diploma in Electrical and Computer Engineering (5-year program)**  
- DECEMBER 2016 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

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

## ACADEMIC EXPERIENCE

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- 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

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- 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  $4.7\times$ . Extended this work to the case when the desired functions can be aggregated (amenable to deep learning applications). Its speedup is  $4.3\times$  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

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- MAY 2022    **Software Engineer Intern at Meta (Facebook)**
- AUGUST 2022    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    **Software Engineer Intern at C3.ai**
- AUGUST 2021    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

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### 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

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- 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

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- JULY 2020 **Speeding Up Distributed Computing via Coding** ([video](#))  
Theoretical and Applied Data Science Initiative, Ames, IA.

## REVIEWING SERVICE

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- *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

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- AUGUST 2016 School of Mineral Resources Engineering,  
Technical University of Crete.  
Interned in 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 in 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 in 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

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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

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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

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### 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, L<sup>A</sup>T<sub>E</sub>X.

## VOLUNTEERING

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SEPTEMBER 2021	<b>Mathematics Tutor for CyMath Kids</b>
- MAY 2022	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 <a href="#">4U Promise</a> initiative aiming to inspire and motivate students with an increased interest in STEM fields in their early years of education.