Kelly Kostopoulou

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EDUCATION

Columbia University, New York, USA

- **PhD in Computer Science** — Sep 2020 – Aug 2025
  - GPA: 4.22/4.00, Advisor: Asaf Cidon
  - Dissertation: Optimizing Privacy Budget Management in Differentially Private Systems

National & Kapodistrian University of Athens (NKUA), Athens, Greece

- **MSc in Data Science & Information Technologies** — Sep 2018 – Sep 2020
  - GPA: 9.7/10 *(first among graduate class of 10 students)*
  - *Specialization: Big Data and Artificial Intelligence*
  - *Thesis: Sparse Communication for Deep Learning*
- **BSc in Informatics & Telecommunications** — Oct 2012 – Sep 2018
  - GPA: 9.01/10 *(first among graduate class of 79 students)*
  - *Specialization: Data and Knowledge Management | Software*
  - *Thesis: Recursive Function Definitions in Static Dataflow Graphs & their Implementation in TensorFlow*

HONORS & AWARDS

2024 Avanessians Fellowship — Jan 2024

Gerondelis Foundation Scholarship — May 2023

Bodossakis Foundation Scholarship — Sep 2022

Onassis Foundation Scholarship — Sep 2022

Valedictorian, MSc, Dept. of Informatics and Telecommunications, NKUA — Jan 2021

Valedictorian, BSc, Dept. of Informatics and Telecommunications, NKUA — Mar 2019

Scholarship of Excellence, MSc of Data Science & Information Technologies, NKUA — Oct 2018

EXPERIENCE & RESEARCH

Core Systems, Meta, New York City — Sep 2025 – Present
Research Scientist

Gray Systems Lab, Microsoft Research, Redmond, Washington — Jun 2024 – Aug 2024
Research Intern

Visiting Student Research Program, KAUST, Saudi Arabia — Jan 2020 – Jun 2020
Research Student

National Center of Scientific Research - Demokritos, Athens, Greece — Sep 2018 – Dec 2019
Research Software Engineer, Research Assistant

Dab Ltd, Athens, Greece — Sep 2016 – Sep 2018
IT Consultant

PUBLICATIONS

- Kelly Kostopoulou. "Optimizing Privacy Budget Management in Differentially Private Systems", PhD Dissertation
- Kelly Kostopoulou, Ioannis Zarkadas, Ifesi Onubogu, Philip Bernstein, Asaf Cidon, Tamer Eldeeb. "Dances with Locks: An Adaptive Commit Protocol for Distributed Transactions", (under submission)
- Ioannis Zarkadas, Kelly Kostopoulou, Thomas Graham, Junfeng Yang, Phil Bernstein, Asaf Cidon, Tamer Eldeeb. "Rosé: Flexible Replication With Strong Semantics For Partitioned Databases", CIDR '26
- Pierre Tholoniat*, Kelly Kostopoulou*, Asaf Cidon, Mosharaf Crowdhury, Roxana Geambasu, Mathias Lecuyer, Junfeng Yang. "Efficiently Packing Privacy Budget with DPack", EuroSys '25 (*equal contribution)
- Pierre Tholoniat*, Kelly Kostopoulou*, Peter McNeely, Prabhpreet Singh Sodhi, Anirudh Varanasi, Benjamin Case, Asaf Cidon, Roxana Geambasu, Mathias Lecuyer. "Cookie Monster: Efficient On-device Budgeting for Differentially-Private Ad-Measurement Systems", SOSP '24 (*equal contribution)
- Kelly Kostopoulou, Angelos Charalambidis, Panos Rondogiannis. "Recursive Function Definitions in Static Dataflow Graphs and their Implementation in TensorFlow", arxiv '24
- Kelly Kostopoulou*, Pierre Tholoniat*, Asaf Cidon, Roxana Geambasu, Mathias Lecuyer. "Turbo: Effective caching in Differentially-Private Databases", SOSP '23 (*equal contribution)
- Hang Xu, Kelly Kostopoulou, Aritra Dutta, Xin Li, Alexandros Ntoulas, Panos Kalnis, "DeepReduce: A Sparse-tensor Communication Framework for Federated Deep Learning", NeurIPS '21

RESEARCH PORTFOLIO

Dances with Locks: An Adaptive Commit Protocol for Distributed Transactions

Sangria introduces a distributed commit protocol that dynamically adapts between conservative (two phase locking + two phase commit) and relaxed (early lock release) commit strategies. By enabling each participant to adjust its commit behavior based on local contention and resource conditions, Sangria achieves fine-grained, workload-aware coordination, improving throughput under diverse workloads while preserving strict serializability and atomicity guarantees.

Cookie Monster: Efficient On-device Budgeting for Differentially-Private Ad-Measurement Systems

Cookie Monster is an on-device budgeting component that can be integrated into differentially private ad-measurement systems. Powered by a robust theoretical framework known as Individual Differential Privacy (IDP), a variant of traditional differential privacy, Cookie Monster allows advertisers to conserve significantly more privacy budget compared to existing alternatives.

Publication: Pierre Tholoniat*, Kelly Kostopoulou*, Peter McNeely, Prabhpreet Singh Sodhi, Anirudh Varanasi, Benjamin Case, Asaf Cidon, Roxana Geambasu, Mathias Lecuyer. "Cookie Monster: Efficient On-device Budgeting for Differentially-Private Ad-Measurement Systems", SOSP '24 (*equal contribution)

Turbo: Effective caching in Differentially-Private Databases

Effective caching for linear query workloads over DP databases. Turbo builds upon private multiplicative weights (PMW), a DP mechanism that is powerful in theory but very ineffective in practice, and transforms it into a highly effective caching object, namely PMW-Bypass. A description of this project can be found on our paper, titled Turbo: Effective caching in Differentially-Private Databases.

Publication: Kelly Kostopoulou*, Pierre Tholoniat*, Asaf Cidon, Roxana Geambasu, Mathias Lecuyer. "Turbo: Effective caching in Differentially-Private Databases", SOSP '23 (*equal contribution)

Demo: Turbo integrated with Grafana

DPack: Efficiently Packing Privacy Budget

DPack is a framework designed to maximize the utility of private datasets while adhering to differential privacy constraints. Differential privacy provides theoretical bounds on privacy loss when querying a dataset, with each query consuming a portion of the privacy budget. Since the privacy budget is finite, the dataset can only answer a limited number of queries while maintaining privacy guarantees. In this work, we treat privacy consumption as a scheduling resource, elevating it to the same level as traditional computing resources like CPU, memory, and network bandwidth. DPack's objective is to schedule queries in a way that maximizes either the total number of queries processed or the overall utility achieved, considering the importance of each query. To achieve this, we framed the scheduling challenge as an optimization problem and developed a tool to simulate the dynamic arrival of data and queries. The tool includes a scheduler that allocates privacy resources for query execution. To extend DPack's applicability, we integrated the scheduler with Kubernetes.

Publication: Pierre Tholoniat*, Kelly Kostopoulou*, Asaf Cidon, Mosharaf Crowdhury, Roxana Geambasu, Mathias Lecuyer, Junfeng Yang. "Efficiently Packing Privacy Budget with DPack", EuroSys '25 (*equal contribution)

Sparse Communication for Deep Learning

I led this project as part of my MSc thesis at KAUST. I designed a compressed communication mechanism for distributed machine learning using Bloom filters to address the communication bottleneck caused by broadcasting and aggregating gradients in data-parallel neural network training. In such settings, each model replica generates local gradients that must be shared and aggregated across replicas for updates, leading to significant overhead. To mitigate this, I developed two TensorFlow operators for encoding and decoding the indices of sparsified gradients produced during training. The encoded gradients utilized Bloom filters, which, being lossy, introduced errors that degraded model accuracy due to inaccurate gradient reconstruction. To address this, I implemented a 'false-positive-aware' compression method that adaptively adjusted the encoded gradients by accounting for future Bloom filter errors, thereby improving accuracy.

Thesis: Kelly Kostopoulou, "Sparse Communication in Deep Learning"

Publication: Hang Xu, Kelly Kostopoulou, Aritra Dutta, Xin Li, Alexandros Ntoulas, Panos Kalnis, "DeepReduce: A Sparse-tensor Communication Framework for Federated Deep Learning", NeurIPS '21

Recursive Function Definitions in Static Dataflow Graphs & their Implementation in TensorFlow

I led this project as part of my BSc thesis at University of Athens. I investigated how recursive functions can be supported in dataflow systems, specifically TensorFlow. The primary challenge was to design static dataflow graphs capable of representing the logic of recursive functions without requiring dynamic expansion at runtime. Static graphs are crucial as they enable various graph optimizations, which can significantly accelerate the training of recursive neural networks, commonly used in natural language processing. To address this, I extended TensorFlow's API, introduced graph transformations to ensure the graphs remain static during execution, and enhanced TensorFlow's execution engine with a tagging mechanism to enable the correct execution of these static recursive graphs.

Thesis: Kelly Kostopoulou, "Recursive Function Definitions in Static Dataflow Graphs & their Implementation in TensorFlow"

Talk: 16th Programming Languages Seminar, Dec 2018, National and Technical University of Athens (NTUA)