

# Baturalp Buyukates, Ph.D.

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School of Computer Science  
University of Birmingham

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## EDUCATION

### University of Maryland

*Ph.D.*, Electrical and Computer Engineering

Advisor: Prof. Sennur Ulukus

Thesis: Age of Information in Large Networks, Distributed Computation, and Learning

College Park, MD, USA

Aug 2016 – Dec 2021

### Bilkent University

*Bachelor of Science*, Electrical and Electronics Engineering

*Minor*, Economics

Ankara, Turkey

Sep 2011 - Jan 2016

### Telecom SudParis

*Exchange Student*, Computer and Communication Networks

Evry, France

Jan 2014 - Jun 2014

## RESEARCH INTERESTS

Machine Learning (ML), Trustworthy Generative Artificial Intelligence (AI), Human-Centred Computing, Distributed Systems, Wireless Communications, Networks, and Information Theory

### Current Focus:

- Reliable and explainable large language models (LLMs)
- Responsible data economics and valuation for collaborative ML
- Secure, trustworthy, and verifiable federated learning and analytics
- Privacy-preserving distributed ML
- Timely information exchange in distributed systems
- Semantics and age of information

## ACADEMIC & PROFESSIONAL EXPERIENCE

### Assistant Professor

University of Birmingham  
Socio-Technical Systems Group

Edgbaston, Birmingham, UK

Sep 2024 - Present

### Postdoctoral Research Associate

University of Southern California  
Information Theory and Machine Learning (vITAL) Research Lab  
Host: Prof. A. Salman Avestimehr

Los Angeles, CA, USA

Jan 2022 - Aug 2024

- Proposed a scalable, lightweight, and verifiable secure aggregation protocol for federated learning (*NeurIPS Workshop*)
- Proposed the first federated clustering algorithm with formal data privacy and lossless performance guarantees compared to centralized clustering
- Developed a proof-of-contribution-based trustworthy design for collaborative AI on blockchain

## **Future IP Networking Research Intern**

Nokia Bell Labs

Murray Hill, NJ, USA

Jun 2021 - Aug 2021

- Implemented a reinforcement learning-based framework for network optimization for hyperconnectivity

## **Graduate Research Assistant**

University of Maryland

College Park, MD, USA

Aug 2016 - Dec 2021

- Designed a timely communication framework for federated learning with performance guarantees
- Introduced age-based coded computation for bias reduction in distributed learning
- Investigated timely information delivery in distributed computing systems with stragglers (*Asilomar Conference - Best Student Paper - Second Place*)
- Proposed scalable transmission schemes for timeliness in large distributed networks and clustered gossip networks (*IEEE SPAWC - Best Student Paper - First Place*)

## **HONORS & AWARDS**

- **CTTC Andrea Goldsmith Young Scholars Award** Apr 2024  
Awarded by the IEEE Communications Society
- **George Harhalakis Outstanding Graduate Student Award** Sep 2021  
Awarded by Institute of Systems Research, University of Maryland
- **Best Student Paper Award - First Place** Sep 2021  
IEEE International Workshop on Signal Processing Advances in Wireless Communications
- **IEEE International Conference on Communications (ICC) Student Grant** May 2021  
Awarded by the US National Science Foundation (NSF)
- **Best Student Paper Award - Second Place** Nov 2020  
54th Asilomar Conference on Signals, Systems, and Computers
- **Future Faculty Program Fellowship, University of Maryland** Jan 2020 - Dec 2021  
Selected to receive a comprehensive training on career-long success in academia
- **Jacob K. Goldhaber Travel Grant, University of Maryland** Dec 2019  
For travels to scholarly, scientific, or professional conferences
- **Best Student Paper Award - Finalist** Nov 2019  
53rd Asilomar Conference on Signals, Systems, and Computers
- **Distinguished Graduate Fellowship, University of Maryland** Aug 2016 - Aug 2017  
Awarded by the Clark School of Engineering for Ph.D. studies
- **Research Excellence Award, Bilkent University** May 2016  
Awarded by the Department of Electrical and Electronics Engineering
- **Bilkent University Undergraduate Fellowship** Sep 2011 - Jan 2016  
Awarded for bachelor's degree studies
- **Ranked 360th in Turkey's National University Entrance Examination** Jul 2011  
Among 1.5 million participants

## **PUBLICATIONS**

For a more up-to-date list here is a link to my Google Scholar page.

### **Book Chapters:**

1. Z. Batool, **B. Buyukates**, R. Nourmohammadi, and K. Zhang, *Privacy Enhancing Technologies for Federated Learning*, in *Federated Learning Systems: Towards Privacy-Preserving Distributed Artificial Intelligence*, 2nd Edition, M. H. Rehman and M. M. Gaber, Eds., Springer Nature, to appear, 2024.
2. M. Bastopcu, **B. Buyukates**, and S. Ulukus, *Age of Information in Source Coding*, in *Age of Information: Foundations and Applications*, N. Pappas, M. A. Abd-Elmagid, B. Zhou, W. Saad, H. S. Dhillon, Eds., Cambridge Univ. Press, 2023.

### Journal Papers:

1. A. Sheshmani, Y. You, **B. Buyukates**, A. Ziashahabi, and A. S. Avestimehr, *Renormalization Group Flow, Optimal Transport and Diffusion-based Generative Model*, *Physical Review E*, to appear, June 2024. Available on ArXiv: 2402.17090.
2. **B. Buyukates**, J. So, H. Mahdavifar, and A. S. Avestimehr, *LightVeriFL: A Lightweight and Verifiable Secure Aggregation for Federated Learning*, *IEEE Journal on Selected Areas in Information Theory*, (5):285-301, April 2024.
3. **B. Buyukates**, E. Ozfatura, S. Ulukus, and D. Gunduz, *Gradient Coding with Dynamic Clustering for Straggler-Tolerant Distributed Learning*, *IEEE Transactions on Communications*, 71(6):3317-3332, June 2023.
4. **B. Buyukates**, M. Bastopcu, and S. Ulukus, *Version Age of Information in Clustered Gossip Networks*, *IEEE Journal on Selected Areas in Information Theory*, 3(1):85-97, March 2022.
5. M. Bastopcu, **B. Buyukates**, and S. Ulukus, *Selective Encoding Policies for Maximizing Information Freshness*, *IEEE Transactions on Communications*, 69(9):5714-5726, September 2021.
6. **B. Buyukates**, A. Soysal, and S. Ulukus, *Scaling Laws for Age of Information in Wireless Networks*, *IEEE Transactions on Wireless Communications*, 20(4):2413-2427, April 2021.
7. **B. Buyukates** and S. Ulukus, *Timely Distributed Computation with Stragglers*, *IEEE Transactions on Communications*, 68(9):5273-5282, September 2020.
8. **B. Buyukates**, A. Soysal, and S. Ulukus, *Age of Information in Multihop Multicast Networks*, *Journal of Communications and Networks*, special issue on Age of Information, 21(3):256-267, June 2019.

### Peer-Reviewed Conference Papers:

1. M. Yang, **B. Buyukates**, I. Jarin, A. S. Avestimehr, A. Markopoulou, *Maverick-Aware Shapley Valuation for Client Selection in Federated Learning*, submitted.
2. Y. F. Bakman, D. N. Yaldiz, **B. Buyukates**, C. Tao, D. Dimitriadis, A. S. Avestimehr, *Do Not Design, Learn: A Trainable Scoring Function for Uncertainty Estimation in Generative LLMs*, submitted. Available on ArXiv: 2406.11278.
3. S. Han, W. Wu, **B. Buyukates**, W. Jin, Y. Yao, Q. Zhang, A. S. Avestimehr, C. He, *Kick Bad Guys Out! Zero-Knowledge-Proof-Based Anomaly Detection in Federated Learning*, submitted. Available on ArXiv: 2310.04055.
4. S. Li, S. Hou, **B. Buyukates**, and A. S. Avestimehr, *Secure Federated Clustering*, submitted. Available on ArXiv: 2205.15564.
5. Y. F. Bakman, D. N. Yaldiz, **B. Buyukates**, C. Tao, D. Dimitriadis, A. S. Avestimehr, *MARS: Meaning-Aware Response Scoring for Uncertainty Estimation in Generative LLMs*, 62nd Annual Meeting of the Association for Computational Linguistics (ACL 2024), Bangkok, Thailand, August 2024.
6. S. Han, **B. Buyukates**, Z. Hu, H. Jin, W. Jin, L. Sun, X. Wang, W. Wu, C. Xie, Y. Yao, K. Zhang, Q. Zhang, Y. Zhang, A. S. Avestimehr, C. He, *FedSecurity: A Benchmark for*

- Attacks and Defenses in Federated Learning and Federated LLMs*, ACM SIGKDD Conference on Knowledge Discovery and Data Mining (KDD), Barcelona, Spain, August 2024.
7. A. Ziashahabi, **B. Buyukates**, A. Sheshmani, Y. You, A. S. Avestimehr, *Frequency Domain Diffusion Model with Scale-Dependent Noise Schedule*, IEEE International Symposium on Information Theory, Athens, Greece, July 2024.
  8. Y. F. Bakman, D. N. Yaldiz, **B. Buyukates**, C. Tao, D. Dimitriadis, A. S. Avestimehr, *Predicting Uncertainty of Generative LLMs with MARS: Meaning-Aware Response Scoring*, IEEE International Symposium on Information Theory, Athens, Greece, July 2024.
  9. **B. Buyukates\***, C.He\*, S. Han, Z. Fang, Y. Zhang, J. Long, A. Farahanchi, and A. S. Avestimehr, *Proof-of-Contribution-Based Design for Collaborative Machine Learning on Blockchain*, IEEE International Conference on Decentralized Applications and Infrastructures, Athens, Greece, July 2023. **(Oral presentation)** \*: equal contribution.
  10. M. Bastopcu, **B. Buyukates**, and S. Ulukus, *Gossiping with Binary Freshness Metric*, IEEE Global Communications Conference, Madrid, Spain, December 2021.
  11. **B. Buyukates**, M. Bastopcu, and S. Ulukus, *Age of Gossip in Networks with Community Structure*, IEEE International Workshop on Signal Processing Advances in Wireless Communications, Lucca, Italy, September 2021. **(Best Student Paper Award Winner)**
  12. **B. Buyukates**, E. Ozfatura, S. Ulukus, and D. Gunduz, *Gradient Coding with Dynamic Clustering for Straggler Mitigation*, IEEE International Conference on Communications, Montreal, Canada, June 2021.
  13. **B. Buyukates** and S. Ulukus, *Timely Communication in Federated Learning*, IEEE INFOCOM Workshop on Age of Information, May 2021.
  14. E. Ozfatura, **B. Buyukates**, D. Gunduz, and S. Ulukus, *Age-Based Coded Computation for Bias Reduction in Distributed Learning*, IEEE Global Communications Conference, Taipei, Taiwan, December 2020.
  15. **B. Buyukates** and S. Ulukus, *Timely Updates in Distributed Computation Systems with Stragglers*, 54th Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, November 2020. **(Best Student Paper Award Second Place)**
  16. **B. Buyukates**, M. Bastopcu, and S. Ulukus, *Optimal Selective Encoding for Timely Updates with Empty Symbol*, IEEE International Symposium on Information Theory, Los Angeles, CA, June 2020.
  17. **B. Buyukates** and S. Ulukus, *Age of Information with Gilbert-Elliot Servers and Samplers*, Conference on Information Sciences and Systems, Princeton, NJ, March 2020.
  18. M. Bastopcu, **B. Buyukates**, and S. Ulukus, *Optimal Selective Encoding for Timely Updates*, Conference on Information Sciences and Systems, Princeton, NJ, March 2020.
  19. **B. Buyukates**, A. Soysal, and S. Ulukus, *Age of Information Scaling in Large Networks with Hierarchical Cooperation*, IEEE Global Communications Conference, Waikoloa, HI, December 2019.
  20. **B. Buyukates**, A. Soysal, and S. Ulukus, *Age of Information in Multicast Networks with Multiple Update Streams*, 53rd Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, November 2019. **(Best Student Paper Award Finalist)**
  21. **B. Buyukates**, A. Soysal, and S. Ulukus, *Age of Information Scaling in Large Networks*, IEEE International Conference on Communications, Shanghai, China, May 2019.
  22. **B. Buyukates**, A. Soysal, and S. Ulukus, *Age of Information in Two-Hop Multicast Networks*, 52nd Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, October 2018.

23. **B. Buyukates**, D. Sarica, and E. U. Saritas, *Self Calibration for Relaxation- and System-Induced Delays in X-space MPI*, 6th International Workshop on Magnetic Particle Imaging, Lubeck, Germany, March 2016.

#### Peer-Reviewed Workshop Papers:

1. M. Yang, I. Jarin, **B. Buyukates**, A. S. Avestimehr, A. Markopoulou, *Maverick-Aware Shapley Valuation for Client Selection in Federated Learning*, ISIT 2024 Workshop on Information-Theoretic Methods for Trustworthy Machine Learning (IT-TML), Athens, Greece, July 2024.
2. Y. F. Bakman, D. N. Yaldiz, **B. Buyukates**, C. Tao, D. Dimitriadis, A. S. Avestimehr, *MARS: Meaning-Aware Response Scoring for Uncertainty Estimation in Generative LLMs*, ICLR 2024 Workshop on Secure and Trustworthy Large Language Models, Vienna, Austria, May 2024.
3. **B. Buyukates**, J. So, H. Mahdavifar, and A. S. Avestimehr, *LightVeriFL: Lightweight and Verifiable Secure Federated Learning*, International Workshop on Federated Learning: Recent Advances and New Challenges in Conjunction with NeurIPS 2022 (FL-NeurIPS'22), New Orleans, LA, December 2022. (**Oral presentation**)

#### Doctoral Dissertation:

1. **B. Buyukates**, *Age of Information in Large Networks, Distributed Computation and Learning*, Department of Electrical and Computer Engineering, University of Maryland, December 2021.

#### TEACHING EXPERIENCE

##### Graduate Teaching Assistant

College Park, MD, USA

University of Maryland

Fall 2019, Signal and System Theory (ENEE 322),

Spring 2019, Information Theory (ENEE 627),

Fall 2018, Convex Optimization (ENEE 662),

Spring 2018, Digital Circuits and Systems Laboratory (ENEE 245).

#### HIGHER EDUCATION COURSES IN TEACHING & LEARNING

As a a fellow of the Future Faculty Program of the University of Maryland, I received rigorous training on how to be a successful academic both as a researcher and educator.

##### • Future Faculty Program Seminar I - Spring 2020

- Emphasis on technical writing and effective presentations
- Discussions on research diversification and ethics

##### • Future Faculty Program Seminar II - Fall 2020

- Effective teaching and communication; principles of education and learning
- Emphasis on developing a course; promoting active learning and critical thinking

##### • Future Faculty Program Seminar III - Spring 2021

- Developing a successful research program and establishing/maintaining a research group
- Finding funding opportunities and mentoring graduate students

#### MENTORING & ADVISING

- Yavuz Faruk Bakman (PhD Student, USC), Duygu Nur Yaldiz (PhD Student, USC)
  - *Uncertainty Estimation in Large Language Models (LLMs)*

- Erum Mushtaq (PhD Student, USC)
  - *Uncertainty Estimation in Vision Language Models (VLMs)*
- Emir Ceyani (PhD Student, USC), Sara Babakniya (PhD Student, USC)
  - *Uncertainty-Aware Continual Learning for LLMs*
- Mengwei Yang (PhD Student, UC Irvine), Ismat Jarin (PhD Student, UC Irvine)
  - *Fair and Responsible Client Valuation in Federated Learning*
- Amir Ziashahabi (PhD Student, USC)
  - *Fourier-Space Diffusion Model*
- Shanshan Han (PhD Student, UC Irvine)
  - *Verifiable Outlier Detection and Removal in Federated Learning and Federated LLMs*
- Sizai Hou (PhD Student, HKUST)
  - *Secure Clustering and Personalization for Federated Learning*
- Jinhyun So (PhD Student. Now Assistant Professor at DGIST)
  - *Verifiable Secure Aggregation in Federated Learning*

## **SELECTED INVITED TALKS & CONFERENCE PRESENTATIONS**

- “Foundations of Trustworthy Collaborative Machine Learning”
  - IEEE Communication Theory Workshop 2024, Canada, May 2024
  - Seminar, University of Delaware, DE, Feb 2024
  - Seminar, École de technologie supérieure (ÉTS), Canada, Feb 2024
  - ELLIIT Distinguished Lecture, Linköping University, Sweden, Oct 2023
  - Seminar, KTH Royal Institute of Technology, Sweden, Oct 2023
  - Seminar, University of Birmingham, UK, Oct 2023
- “Proof-of-Contribution-Based Design for Collaborative Machine Learning on Blockchain”
  - ProperData 3rd Annual Symposium, Sep 2023
  - IEEE International Conference on Decentralized Applications and Infrastructures, Jul 2023
  - Private AI Collaborative Research Institute Spring Workshop, Apr 2023
  - ProperData Institute, Apr 2023
  - Crypto Economics Security Conference, Nov 2022
- “LightVeriFL: Lightweight and Verifiable Secure Federated Learning”
  - Information Theory and Applications Workshop, Feb 2023
  - NeurIPS Workshop on Federated Learning, Dec 2022
- “Reinforcement Learning-Based Network Optimization for Hyper Connectivity”
  - Nokia Bell Labs, Aug 2021
- “Gradient Coding with Dynamic Clustering for Straggler Mitigation”
  - IEEE ICC, Jun 2021
- “Timely Communication in Federated Learning”
  - IEEE INFOCOM Workshop on Age of Information, May 2021

## SKILLS

- **Programming:** MATLAB, Python, C,  $\LaTeX$
- **Frameworks:** PyTorch, TensorFlow, Message Passing Interface (MPI)
- **Others:** Linux, Github, Jupyter Notebook
- **Languages:** Turkish (Native), English (Fluent), French (Beginner)

## SERVICE

### Organizing Committee Member

- IEEE International Conference on Decentralized Applications and Infrastructures (DAPPS) 2024
  - Publicity Chair
- ACM/IFIP International Middleware Conference 2024
  - Publicity Co-Chair

### Technical Committee Member

- IEEE INFOCOM - Age and Semantics of Information (ASoI) Workshop 2024
- IEEE INFOCOM - Age of Information (AoI) Workshop 2023

### Session Chair

- IEEE DAPPS 2023 - Cryptographic Techniques and Security for Decentralized Systems

### Technical Reviewer (journals):

- IEEE/ACM Transactions on Networking, IEEE Transactions on Communications, IEEE Transactions on Wireless Communications, IEEE Communications Letters, IEEE Access, IEEE Journal on Selected Areas in Communications (JSAC), IEEE JSAC Series on Machine Learning for Communications and Networks, IEEE Internet of Things Journal, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Information Forensics & Security, IEEE Journal on Selected Areas in Information Theory, IEEE Network Magazine, Journal of Parallel and Distributed Computing, Journal of Communications and Networks, Computer Networks and Communications, China Communications, IEEE Transactions on Vehicular Technology, MDPI Mathematics, MDPI Electronics, IEEE Transactions on Automatic Control, IEEE Transactions on Signal Processing

### Technical Reviewer (conferences):

- ICLR 2024 Workshop on Secure and Trustworthy Large Language Models, NeurIPS 2023 & 2024 Datasets and Benchmarks, IEEE Global Communications Conference (GLOBECOM), IEEE Information Theory Workshop (ITW), IEEE International Symposium on Information Theory (ISIT), IEEE International Conference on Communications (ICC), IEEE International Conference on Computer Communications (INFOCOM), IEEE International Workshop on Signal Processing Advances in Wireless Communications (SPAWC)

## AFFILIATIONS

Member of IEEE

Member of IEEE Communications Society

## SELECTED COURSEWORK

Machine Learning, Convex Optimization, Digital Communications, Multi-user Communications, Real Analysis I & II, Information Theory, System Theory, Random Processes in Communication and Control, Estimation and Detection Theory, Nonlinear Control Systems, Optimal Control

## OUTREACH

Mentor at Bilkent University Alumni Student Mentoring Program  
Reviewer for USC Student Recognition Awards, Mar 2023  
Judge for USC ECE 12th Annual Research Festival, Oct 2022  
Judge for Stuart-Hobson Middle School, Washington D.C. Science Fair, Feb 2021  
Committee Member in Bilkent University IEEE & Women in Engineering (WiE) Student Branches

## REFERENCES

- **Salman Avestimehr**

Dean's Professor +1 213-740-7326  
Department of Electrical and Computer Engineering & Computer Science avestime@usc.edu  
University of Southern California

- **Sennur Ulukus**

Distinguished University Professor and Chair +1 301-405-4909  
Anthony Ephremides Professor in Information Sciences and Systems ulukus@umd.edu  
Department of Electrical and Computer Engineering  
University of Maryland, College Park

- **Deniz Gunduz**

Professor in Information Processing +44 (0)20-7594-6218  
Department of Electrical and Electronic Engineering d.gunduz@imperial.ac.uk  
Imperial College London

- **Alkan Soysal**

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Department of Electrical and Computer Engineering soysal@vt.edu  
Virginia Polytechnic Institute and State University (Virginia Tech)

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