

## FARZAD FARNOUD HASSANZADEH

---

Assistant Professor  
Department of Electrical & Computer Engineering  
Department of Computer Science  
University of Virginia

Office: Thornton Hall E309  
351 McCormick Rd, Charlottesville, VA  
Email: farzad@virginia.edu  
Web: people.virginia.edu/~ffh8x

---

### a. EXPERIENCE

**Assistant Professor** August 2016–present  
Department of Electrical & Computer Engineering  
Department of Computer Science (since 2017)  
University of Virginia

### b. EDUCATION

**California Institute of Technology**, Pasadena, CA 2013–2016  
**Postdoctoral Training** in Electrical Engineering  
Advisor: Prof. Jehoshua Bruck

**University of Illinois at Urbana-Champaign**, Urbana, IL May 2013  
**Ph.D.** in Electrical and Computer Engineering  
Thesis Title: *Distances on Rankings: from Social Choice to Flash Memories*

**University of Illinois at Urbana-Champaign**, Urbana, IL Dec. 2012  
**M.Sc.** in Mathematics

**University of Toronto**, Toronto, ON, Canada Aug. 2008  
**M.Sc.** in Electrical and Computer Engineering  
Thesis Title: *Reliable Broadcast of Safety Messages in Vehicular Ad hoc Networks*

**Sharif University of Technology**, Tehran, Iran July 2006  
**B.Sc.** in Electrical Engineering

### c. AWARDS & HONORS

- ◇ Outstanding Teacher Award, University of Virginia, Electrical and Computer Engineering Department 2018
- ◇ IEEE Data Storage Best Student Paper Award 2014
- ◇ Robert T. Chien Memorial Award, presented by UIUC to one Ph.D. candidate in ECE for *demonstrating excellence in research.* 2013
- ◇ Member of Phi-Kappa-Phi honor society 2009
- ◇ Rogers Graduate Scholar, University of Toronto 2007
- ◇ Granted Admission to Graduate Program of EE Dept. at Sharif University without Entrance Exam (Through Exceptional Talents Admissions Office) 2005
- ◇ Ranked 14 among over 300,000 contestants in Iran's National Universities Entrance Exam and ranked 1 in the Province of Khorasan 2002
- ◇ Silver Medalist in Iran's National Physics Olympiad 2001

## d. PUBLICATIONS

(\*) Submitted or in preparation.

### Journal Publications

20. (\*) H. Lou, F. Farnoud, M. Schwartz, and J. Bruck, “Evolution of  $k$ -mer Frequencies and Entropy in Duplication and Substitution Mutation Systems,” In preparation.
19. (\*) R. Gabrys, F. Farnoud, “Reconciling Similar Sets of Data,” *Submitted to IEEE Trans. Communications*, Available: <https://arxiv.org/abs/1809.04702>, Sep. 2018.
18. (\*) O. Elishco, F. Farnoud, M. Schwartz, and J. Bruck, “The Capacity of Some Pólya String Models,” *Submitted to IEEE Trans. Information Theory*, Available: <https://arxiv.org/abs/1808.06062>, Aug. 2018.
17. (\*) F. Farnoud, M. Schwartz, and J. Bruck, “Estimation of Duplication History under a Stochastic Model for Tandem Repeats,” *Submitted to BMC Bioinformatics*, Available: <http://www.people.virginia.edu/~ffh8x/d/p/smttd.pdf>, Jul. 2018.
16. N. Alon, J. Bruck, F. Farnoud, and S. Jain, “Duplication Distance to the Root for Binary Sequences,” *IEEE Trans. Information Theory*, vol. 63, Dec. 2017.
15. F. Farnoud, O. Milenkovic, G. J. Puleo, and L. Su, “Computing Similarity Distances Between Rankings,” *Discrete Applied Mathematics*, vol. 232., Dec. 2017.
14. S. Jain, F. Farnoud, and J. Bruck, “Capacity and Expressiveness of Genomic Tandem Duplication” *IEEE Trans. Information Theory*, vol. 63, Oct. 2017.
13. S. Jain, F. Farnoud, M. Schwartz, and J. Bruck, “Duplication-Correcting Codes for Data Storage in the DNA of Living Organisms,” *IEEE Trans. Information Theory*, vol. 63, Aug. 2017.
12. F. Farnoud, E. Yaakobi, and J. Bruck, “Approximate Sorting of Data Streams with Limited Storage,” *J. Combinatorial Optimization*, 32(4), Nov. 2016.
11. F. Farnoud, M. Schwartz, and J. Bruck, “The Capacity of String-Duplication Systems,” *IEEE Trans. Information Theory*, vol. 62, Feb. 2016.
10. F. Farnoud, M. Schwartz, and J. Bruck, “Bounds for Permutation Rate-Distortion,” *IEEE Trans. Information Theory*, vol. 62, Feb. 2016.
9. R. Gabrys, E. Yaakobi, F. Farnoud, F. Sala, J. Bruck, and L. Dolecek, “Codes Correcting Erasures and Deletions for Rank Modulation,” *IEEE Trans. Information Theory*, vol. 62, Jan. 2016.
8. M. Kim, X. Zhang, J.G. Ligo, F. Farnoud, V.V. Veeravalli, and O. Milenkovic, “MetaCRAM: An Integrated Pipeline for Metagenomic Data Processing and Compression,” *BMC Bioinformatics*, Feb. 2016.
7. M. Kim, F. Farnoud, and O. Milenkovic, “HyDRA: Gene Prioritization via Hybrid Distance-Score Rank Aggregation,” *Bioinformatics*, 31(7):1034–1043, 2015.
6. F. Farnoud, and O. Milenkovic, “An Axiomatic Approach to Constructing Distances for Rank Comparison and Aggregation,” *IEEE Trans. Information Theory*, vol. 60, Oct. 2014.
5. F. Farnoud and O. Milenkovic, “Multipermutation Codes in the Ulam Metric for Nonvolatile Memories,” *IEEE J. Selected Areas in Communications*, vol. 32, May 2014, **IEEE Data Storage Best Student Paper Award for 2014**.
4. F. Farnoud, V. Skachek, and O. Milenkovic, “Error-Correction in Flash Memories via Codes in the Ulam Metric,” *IEEE Trans. Information Theory*, vol. 59, May 2013.
3. F. Farnoud and O. Milenkovic, “Sorting of Permutations by Cost-Constrained Transpositions,” *IEEE Trans. Information Theory*, vol. 58, Jan. 2012.

2. S.M.S.T. Yazdi, S.A. Savari, G. Kramer, K. Carlson, and F. Farnoud, "On the Multimessage Capacity Region for Undirected Ring Networks," *IEEE Trans. Information Theory*, vol. 56, Apr. 2010.
1. F. Farnoud, M. Ibrahimi, and J. Salehi, "A Packet-Based Photonic Label Switching Router for a Multirate All-Optical CDMA-Based GMPLS Switch," *IEEE J. Selected Topics in Quantum Electronics*, vol. 13, May 2007.

## Conference Publications

32. H. Lou, M. Schwartz, F. Farnoud, "Evolution of N-gram frequencies under duplication and substitution mutations," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, pp. 2246–2250, Vail, Colorado, June 2018.
31. R. Gabrys, F. Farnoud, "Noise and Uncertainty in String-Duplication Systems," In *Proc. 55th Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, Monticello, IL, Oct. 2017.
30. S. Jain, F. Farnoud, M. Schwartz, and J. Bruck, "Noise and Uncertainty in String-Duplication Systems," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Aachen, Germany, June 2017.
29. N. Alon, J. Bruck, F. Farnoud, and S. Jain, "On the Duplication Distance of Binary Strings," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Barcelona, Spain, July 2016.
28. S. Jain, F. Farnoud, M. Schwartz, and J. Bruck, "Duplication-Correcting Codes for Data Storage in the DNA of Living Organisms," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Barcelona, Spain, July 2016.
27. O. Elishco, F. Farnoud, M. Schwartz, and J. Bruck, "The Capacity of Some Polya String Models," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Barcelona, Spain, July 2016.
26. F. Farnoud, M. Schwartz, and J. Bruck, "A Stochastic Model for Genomic Interspersed Duplication," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Hong Kong, China, June 2015.
25. S. Jain, F. Farnoud, and J. Bruck, "Capacity and Expressiveness of Genomic Tandem Duplication," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Hong Kong, China, June 2015.
24. R. Gabrys, and F. Farnoud, "Reconciling Similar Sets of Data," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Hong Kong, China, June 2015.
23. F. Farnoud, E. Yaakobi, and J. Bruck, "Approximate Sorting of Data Streams with Limited Storage," In *Proc. Computing and Combinatorics Conf. (COCOON)*, Atlanta, GA, Aug. 2014.
22. F. Farnoud, M. Schwartz, and J. Bruck, "The Capacity of String-Duplication Systems," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Honolulu, HI, June 2014.
21. F. Farnoud, M. Schwartz, and J. Bruck, "Bounds for Permutation Rate-Distortion," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Honolulu, HI, June 2014.
20. F. Farnoud and O. Milenkovic, "Multipermutation Codes in the Ulam Metric," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Honolulu, HI, June 2014.
19. L. Su, F. Farnoud, and O. Milenkovic, "Similarity Distances between Permutations," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Honolulu, HI, June 2014.
18. R. Gabrys, E. Yaakobi, F. Farnoud, F. Sala, J. Bruck, and L. Dolecek, "Single-Deletion-Correcting Codes over Permutations," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Honolulu, HI, June 2014.
17. R. Gabrys, E. Yaakobi, F. Farnoud, and J. Bruck, "Codes Correcting Erasures and Deletions for Rank Modulation," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Honolulu, HI, June 2014.
16. M. Kim, F. Raisali, F. Farnoud, and O. Milenkovic, "Gene Prioritization via Weighted Kendall Rank Aggregation," In *Proc. IEEE Int. Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP)*, Dec. 2013.

15. M. Kim, J.G. Ligo, A. Emad, F. Farnoud, O. Milenkovic, and V.V. Veeravalli, "MetaPar: Metagenomic Sequence Assembly via Iterative Reclassification," In *Proc. IEEE Global Conf. Signal and Information Processing (GlobalSIP)*, Dec. 2013.
14. F. Farnoud, O. Milenkovic, "Aggregating Rankings with Positional Constraints," In *Proc. IEEE Information Theory Workshop (ITW)*, Seville, Spain, Sep. 2013.
13. F. Farnoud, E. Yaakobi, O. Milenkovic, and J. Bruck, "Building Consensus via Iterative Voting," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Istanbul, Turkey, Jul. 2013.
12. F. Raisali, F. Farnoud, and O. Milenkovic, "Weighted Rank Aggregation via Relaxed Integer Programming," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Istanbul, Turkey, Jul. 2013.
11. B. Touri, F. Farnoud, A. Nedich, and O. Milenkovic, "A General Framework for Distributed Vote Aggregation," In *Proc. American Control Conf.*, Washington, DC, Jun. 2013.
10. F. Farnoud, N.P. Santhanam, and O. Milenkovic, "Alternating Markov Chains for Distribution Estimation in the Presence of Errors," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Boston, MA, Jul. 2012.
9. F. Farnoud, V. Skachek, and O. Milenkovic, "Rank Modulation for Translocation Error Correction," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Boston, MA, Jul. 2012.
8. F. Farnoud, B. Touri, and O. Milenkovic, "Nonuniform Vote Aggregation Algorithms," In *Proc. IEEE Int. Conf. Signal Processing and Communications (SPCOM)*, Bangalore, India, Jul. 2012.
7. F. Farnoud and O. Milenkovic, "Decomposing Permutations via Cost-Constrained Transpositions," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Saint Petersburg, Russia, Jul./Aug. 2011.
6. F. Farnoud, C.-Y. Chen, O. Milenkovic, and N. Kashyap, "A Graphical Model for Computing the Minimum Cost Transposition Distance," In *Proc. IEEE Information Theory Workshop (ITW)*, Dublin, Ireland, Aug./Sep. 2010.
5. F. Farnoud, O. Milenkovic, and N. Santhanam, "Small-Sample Distribution Estimation over Sticky Channels," In *Proc. IEEE Int. Symp. Information Theory (ISIT)*, Jun./Jul. 2009.
4. F. Farnoud and S. Valaee, "Reliable Broadcast of Safety Messages in Vehicular Ad Hoc Networks," In *Proc. IEEE INFOCOM*, Rio de Janeiro, Brazil, Apr. 2009.
3. F. Farnoud and S. Valaee, "Repetition-Based Broadcast in Vehicular Ad Hoc Networks in Rician Channel with Capture," In *Proc. IEEE INFOCOM Workshops*, Phoenix, AZ, Apr. 2008.
2. F. Farnoud, B. Hassanabadi, and S. Valaee, "Message Broadcast Using Optical Orthogonal Codes in Vehicular Communication Systems," In *Proc. ACM Int. Workshop on Wireless Networking for Intelligent Transportation Systems*, Vancouver, BC, Aug. 2007.
1. S. Yazdi, S. Savari, F. Farnoud, and G. Kramer, "A Multimessage Capacity Region for Undirected Ring Networks," In *Proc. IEEE Int. Symp. Information Theory*, Nice, France, June 2007.

## e. Graduate Students

### Doctoral Students:

- ◇ Hao Lou, Graduate Research Assistant, ECE, UVA, Joined Aug. 2017, Expected graduation: Spring 2022.
- ◇ Tao Jin, Graduate Research Assistant, CS, UVA, Joined Jan. 2018, Expected graduation: Fall 2022.
- ◇ Yuanyuan Tang, Graduate Research Assistant, ECE, UVA, Joined Aug. 2018, Expected graduation: Fall 2021.

## f. Undergraduate Students

- ◇ Nikhil Bhaip, Undergraduate Research Assistant, UVA, 2017–present
- ◇ Eric McCord-Snook, Undergraduate Research Assistant, UVA, 2017–present
- ◇ Yiming Wang, Undergraduate Research Assistant, UVA, Spring 2017–present
- ◇ Daniel Fontenot, Undergraduate Capstone Project, UVA, Spring 2018

## g. External Research Grants

- ◇ Organization: National Science Foundation. Award number: 1755773. Period of support: 3/15/2018–2/29/2020. Role: PI; Title: *CRII: CIF: Model-based Compression of Biological Sequences*. Amount: \$175,000 (Sole PI).
- ◇ Organization: National Science Foundation. Award number: 1816409; Period of support: 10/1/2018–9/30/2021. Role: PI. Title: *CIF: NSF-BSF: Small: Collaborative Research: Characterization and Mitigation of Noise in a Live DNA Storage Channel*. Amount: \$312,749 (Share: \$284,272);

In addition, I have received as PI *two SEAS Research Innovation Awards* (Total: 3 semesters of GRA support and 1.5 months of salary) and a *UVA Global Infectious Diseases Institute Award* (\$70,000).

## h. Invited Talks

20. *On the entropy of biological sequences*  
52nd Asilomar Conference on Signals, Systems and Computers, Pacific Grove, CA, Oct. 2018 (Scheduled).
19. *Evolution of k-mer frequencies in stochastic mutation systems*  
Information Theory and Applications Workshop (ITA), San Diego, CA, Feb. 2018.
18. *Duplication-Correcting Codes for Data Storage in DNA of Living Organisms*  
Allerton Conf. on Communications Control and Computing, Allerton Retreat Center, Monticello, IL, Sep. 29, 2016.
17. *Estimation of Mutation Rates in DNA Tandem Repeat Regions*  
ECE, University of Virginia, Charlottesville, VA, Sep. 9, 2016.
16. *Stochastic and Information-theoretic Approaches to Analysis of Biological Data*
  - ◇ ECE, University of Virginia, Charlottesville, VA, May 2016
  - ◇ EE, University of Hawaii at Manoa, Honolulu, HI, Apr. 2016
  - ◇ EECS, University of Michigan, Ann Arbor, MI, Mar. 2016.
  - ◇ EE, University of Southern California, Los Angeles, CA, Mar. 2016.
  - ◇ ECEE, Arizona State University, Tempe, AZ, Mar. 2016.
15. *On Estimation of DNA Repeat Mutation Rates*  
Information Theory and Applications Workshop (ITA), San Diego, CA, Feb. 2016.
14. *Stochastic Models for DNA Tandem Duplication*  
Molecular Programming Project Workshop, University of Washington, WA, Jan. 2016.
13. *Diversity of biologically-inspired duplication systems*  
Information Theory and Applications Workshop (ITA), San Diego, CA, Feb. 2015.
12. *Biological Diversity through Duplication: Combinatorial and Stochastic Models*
  - ◇ SEAS, Harvard University, Cambridge, MA, Jan. 23, 2015.

- ◇ ECE, University of Houston, Houston, TX, Jan. 28, 2015.
- 11. *Biological Diversity through Duplication*  
Molecular Programming Project Workshop, San Francisco, CA, Jan. 2015.
- 10. *On the Capacity of String-Duplication Systems and Genomic Duplication*  
Asilomar Conf. on Signals, Systems, and Computers, Pacific Grove, CA, Nov. 2014.
- 9. *Approximate Sorting for Streams and Preference Rankings with Limited Storage*  
Allerton Conf. on Communications, Control, & Computing, Monticello, IL, Oct. 2014.
- 8. *Sorting Big Data with Small Memory*  
Information Theory and Applications Workshop (ITA), San Diego, CA, Feb. 2014.
- 7. *Approximate Sorting of Data Streams with Limited Storage*
  - ◇ Conf. in Information Sciences & Systems (CISS), Princeton University, NJ, Mar. 2014
  - ◇ Comm. Seminars, CSL, University of Illinois at Urbana-Champaign, IL, May 2014.
- 6. *Fewer Axioms for a More Flexible Distance between Rankings*  
NIPS Workshop on Social Choice: Theory and Practice, Lake Tahoe, NV, Dec. 2012.
- 5. *A Constrained Distance-based Approach to Social Choice*  
Psychology Department, University of Illinois at Urbana-Champaign, IL, Nov. 2012.
- 4. *Rank Modulation Codes for Translocation Errors*
  - ◇ EE, Caltech, Pasadena, CA, Apr. 2012.
  - ◇ EE, UCLA, Los Angeles, CA, Apr. 2012.
- 3. *A Novel Distance Measure for Rank Aggregation*  
CommNetS Seminars, USC, CA, Apr. 2012
- 2. *Novel Measures for Rank Aggregation*  
Information Theory and Applications Workshop (ITA), San Diego, CA, Feb. 2012.
- 1. *Sorting of Permutations by Cost-Constrained Transposition*  
AFOSR Complex Networks Review, Arlington, VA, Dec. 2010.

## **i. Professional Service**

### **Conference Organization**

- ◇ Asilomar Conf. on Signals, Systems, and Computers 2014, Co-organizer and chair of the session “Bioinformatics and DNA Computing”
- ◇ Allerton 2014, Co-organizer and chair of the session “Topics in Machine Learning”
- ◇ Allerton 2013, Co-organizer and chair of the session “Information Aggregation Over Social Networks”
- ◇ CISS 2014, Co-organizer of the session “Ordinal and Social Science Data Processing”

### **Journal and Conference Reviewer**

- ◇ Transactions on Algorithms, 2018
- ◇ IEEE Transactions on Communications 2017
- ◇ Gene 2017

- ◇ IEEE Transactions on Information Theory 2012, 2014, 2015, 2016, 2017, 2018
- ◇ IEEE Transactions on Emerging Topics in Computing 2016
- ◇ IEEE Transactions on Molecular, Biological, and Multi-Scale Communications 2015
- ◇ Journal of Mathematical Psychology 2015
- ◇ IEEE Trans. Emerging Topics in Computing, special issue on Approximate & Stochastic Computing Circuits, Systems and Algorithms 2015
- ◇ Journal of Combinatorial Optimization 2014
- ◇ IEEE Transactions on Vehicular Technology 2013
- ◇ IEEE Communication Letters 2011, 2018
- ◇ IEEE Conferences: ISIT'18, ISIT'17, ISIT'16, ITW'15, ISIT'14, ISIT'13, ITW'13, ISIT'12, ISIT'11, ISIT'09, ICC'09, CCNC'09, ICC'08, LCN'07, Globecom'07

### **Review Panels**

- Jeffress Trust Awards Program in Interdisciplinary Research, Richmond, Virginia, Spring 2018
- Jeffress Trust Awards Program in Interdisciplinary Research, Richmond, Virginia, Spring 2017