Ammar Daskin (aka Anmer Daskin), Ph.D.

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Research Interest

Topics:

- Quantum machine learning and big data and time series analysis
- Optimization methods on quantum and classical computers
- Quantum information, entanglement, algorithms, complexity, and circuits
- Adiabatic quantum computation and combinatorial optimization
- Numerical linear algebra and parallel computing
- Quantum bioinformatics

Education

2011 – 2014 **Ph.D., Dept. of Computer Science, Purdue University, West Lafayette, IN, US**.
Dissertation: *Quantum Circuit Design Methods and Applications*
Advisors: Prof. Ananth Grama and Prof. Sabre Kais

2009 – 2011 **M.Sc., Dept. of Computer Science, Purdue University, West Lafayette, IN, US.**

2008 – 2009 **ESL Student, ELS Language Center, New York, NY, US.**
EPI, University of South Carolina, Columbia, SC, US.

2002 – 2007 **B.Sc., Computer Engineering, Erciyes University, Kayseri, Turkiye.**

Employment History

2015 – **Assistant Professor,** Department of Computer Engineering, Istanbul Medeniyet University, Istanbul, Turkey
Also served as department head, from January 2021 - February 2023 and vice department Head from 2018 - 2021.

Summer 2013 **Research Consultant,** The Qatar Environment and Energy Research Institute (QEERI),QATAR.

2011 – 2012 **Research Assistant,** NSF Quantum Information for Quantum Chemistry Center, Purdue University, West Lafayette, Indiana, US.

2011 – 2013 **Teaching Assistant** Dept. of Computer Sciences, Purdue University, West Lafayette, Indiana, US.

Technical Strengths

Programming languages and technologies: Julia (currently experiencing), Rust(currently experiencing), Python (experience in numpy, pandas, scikit-learn, tensorflow, Qiskit), Java, C/C++, Matlab, MPI, OpenMP, SQL, MS Office, VBA, Linux, macOS, Windows.

Research Grants

- Application of Quantum Computation to the Problems in Bioinformatics and Chemistry.30000TL. Tubitak#115E747. (2016-2017)

Professional Activities

Co-organizer: Special Sessions on Quantum Cybernetics and Machine Learning at IEEE SMC 2019 and IEEE SMC 2020
Panellist: TUBITAK
Referee: Scientific Reports, Science Bulletin, IEEE Transactions on Pattern Analysis and Machine Intelligence, IEEE Transactions on Neural Networks and Learning Systems, Quantum Information and Processing, Quantum Machine Intelligence, IEEE Internet Computing, ACM Computing Surveys, IEEE Computer Architecture Letters, IEEE Transactions on Circuits and Systems I, Journal of Experimental and Theoretical Artificial Intelligence, Turkish Journal of Electrical Engineering and Computer Sciences, IEEE Transactions on Control Systems Technology, IEEE SMC Magazine

Memberships

IEEE Computer Society, IEEE SMC Quantum Cybernetics, ACM

Teaching

Links for Example Lecture Notes

- System Programming (in Unix)
- Data Structures and Algorithms

Experience

- **Istanbul Medeniyet University:**
  - BIL 301 Operating Systems *Fall 2020-present*
  - BIL 222 System Programming (in Linux) *Spring 2020-present*
  - BIL491/492 Student Projects
  - BIL 206 Algorithm Analysis and Design *Spring 2022*
  - BIL 366 Data Mining *Fall 2021*
  - BIL 201 Data Structures and Algorithms (in Java, C++, Python) *Fall 2019-2021*
  - MAT 107 Discrete Mathematics, *Spring 2019, 2022*
  - BIL 111 Introduction to Computer Science and Engineering *Fall 2020, 2021*
  - **Computer Programming Courses in C/C++, Python, Java, MATLAB**
    - BIL 121 Procedural Programming (in C, Python), *Fall 2018*
    - FIZ 114 Computer Programming (in MATLAB), *Spring 2018, 2019*
    - CSE101 and BIL101 Computer Programming (in C, Python), *Fall 2016, 2017, 2021*
    - UMHB 519 Computer Programming for Computational Science, *Fall/Spring 2019, 2018, 2017*
    - CSE201/BIL122 Object Oriented Programming (in Java), *Spring 2017, 2021*
  - MY510 and MY610 Advanced Table Applications in Engineering(VBA), *Spring 2016, 2017*
- **Purdue University (Graduate Teaching Assistant):**
  CS-18000 Problem Solving and Object Oriented Programming, *Fall 2011, 2012, Spring 2013*
  CS-38100 Introduction to Algorithms *Fall 2012*

Publications

Preprints

1. Ammar Daskin, A quantum compiler design method by using linear combinations of permutations, arXiv:2404.18226, 2024
   Keywords— quantum compiler, linear combination of permutations, Birkhoff-von Neumann algorithm, bistochastic matrices, quantum block encoding

2. Ammar Daskin, A unifying primary framework for quantum graph neural networks from quantum graph states, 2402.13001, 2024
   Keywords— quantum machine learning, graph neural networks, graph states

3. Ammar Daskin, Federated learning with distributed fixed design quantum chips and quantum channels, arXiv:2401.13421, 2024
   Keywords— Federated learning, distributed quantum computing, machine learning, programmable chips

4. Ammar Daskin, A Simple Quantum Blockmodeling with Qubits and Permutations, arXiv:2311.07726, 2023
   Keywords— Blockmodeling, quantum optimization, qubit encoding, permutation matrices, Barbell graph

5. Ammar Daskin, On the explainability of quantum neural networks based on variational quantum circuits, arXiv:2301.05549, 2023
   Keywords— Quantum neural networks, explainability, interpretability, ridge functions

6. Ammar Daskin, Quantum implementation of circulant matrices and its use in quantum string processing, arXiv preprint arXiv:2206.09364, 2022
   Keywords— quantum machine learning, quantum algorithms, bioinformatics, circulant matrix, suffix trees, Burrows-Wheeler Transform, string processing

7. Ammar Daskin, A walk through of time series analysis on quantum computers, arXiv preprint arXiv:2205.00986, 2022
   Keywords— quantum machine learning, quantum optimization, forecasting models, autoregressive models, time series analysis

8. Ammar Daskin, A Quantum Approach to Subset-Sum and Similar Problems, arXiv preprint arXiv:1707.08730, 2017
   Keywords— quantum algorithms, combinatorial optimization, NP-hard problems, subset-sum problem, 0-1 knapsack problem, quantum Arthur-Merlin games

Journal Articles

9. A Daskin, R Gupta, S Kais Dimension reduction and redundancy removal through successive Schmidt decompositions, Appl. Sci. 2023, 13(5), 3172; https://doi.org/10.3390/app13053172
   Keywords— quantum machine learning, quantum algorithms, tensor decomposition, data mapping, dimension reduction

10. Ammar Daskin, Combinatorial optimization through variational quantum power method, Quantum Inf Process 20, 336 (2021). `https://doi.org/10.1007/s11128-021-03283-x`, arXiv:2007.01004
    Keywords— quantum optimization, combinatorial optimization, power iteration, variational eigenvalue solver

11. Ammar Daskin, The quantum version of the shifted power method and its application in quadratic binary optimization, Turk J Elec Eng and Comp Sci, 2020, `https://doi.org/10.3906/elk-1910-99`, arXiv:1809.01378
    Keywords— quantum optimization, power iteration, matrix computation, variational circuits

12. Ammar Daskin, Quantum Spectral Clustering through a Biased Phase Estimation Algorithm, TWMS J. App. Eng. Math. V.10, N.1, 2020, pp. 24-33, arXiv:1703.05568
    Keywords— quantum machine learning, clustering, phase estimation, quantum amplitude amplification, principal components

13. Ammar Daskin, Teng Bian, Rongxin Xia, Sabre Kais, Context aware quantum simulation of a matrix stored in quantum memory, Quantum Information Processing,18:357, 2019. https://doi.org/10.1007/s11128-019-2469-1

Keywords— quantum circuit design, quantum RAM, context aware circuits, fixed design circuits

14. Teng Bian, Daniel Murphy, Rongxin Xia, Ammar Daskin, Sabre Kais, Quantum computing methods for electronic states of the water molecule, Molecular Physics, 2019. https://doi.org/10.1080/00268976.2019.1580392
Keywords— quantum circuit design, quantum phase estimation, simulation of Water molecule with different approaches

15. Ammar Daskin, Sabre Kais, A Generalized Circuit for the Hamiltonian Dynamics Through the Truncated Series, Quantum Information and Processing, 17:328, 2018. https://doi.org/10.1007/s11128-018-2099-z2018

Keywords— quantum circuit design, non-unitary matrices, writing a matrix as a sum of unitaries, Taylor series

16. Ammar Daskin, A Quantum Implementation Model for Artificial Neural Networks, Quanta, 7:718, 2018. http://dx.doi.org/10.12743/quanta.v7i1.65
Keywords— quantum machine learning, Widrow-Hoff learning rule, quantum amplitude amplification, phase estimation, principal components

17. Ammar Daskin, Sabre Kais, Direct Application of the Phase Estimation Algorithm to Find the Eigenvalues of the Hamiltonians, Chemical Physics, Volume 514, Pages 87-94, 2018. https://doi.org/10.1016/j.chemphys.2018.01.002
Keywords— quantum circuit design, phase estimation, non-unitary matrices, sum of unitaries, polar form, plane rotations

18. Ammar Daskin, Sabre Kais, An Ancilla Based Quantum Simulation Framework for Non-Unitary Matrices, Quantum Information and Processing, vol.16, no.1, pp.33-43, 2017. http://dx.doi.org/10.1007/s11128-016-1452-3

Keywords— quantum circuit design, phase estimation, non-unitary matrices, sum of unitaries, square root of a matrix, cosine-sine decomposition

19. Anmer Daskin, Obtaining A Linear Combination of the Principal Components of a Matrix on Quantum Computers, Quantum Information and Processing, Volume 15, Issue 10, pp 4013–4027, 2016. http://dx.doi.org/10.1007/s11128-016-1388-7
Keywords— quantum machine learning, quantum phase estimation, quantum amplitude amplification, principal component analysis

20. Anmer Daskin, Quantum Eigenvalue Estimation for Irreducible Non-negative Matrices, International Journal of Quantum Information, Volume 14, Issue 01, 2016. http://dx.doi.org/10.1142/S0219749916500052
Keywords— quantum phase estimation, nonnegative matrices, eigenvalues, phase estimation without state preparation

21. Katherine L. Brown, Anmer Daskin, Sabre Kais, Jonathan P. Dowling, Reducing the number of ancilla qubits and the gate count required for creating large controlled operations, Quantum Information and Processing, Volume 14, Issue 3, pp 891-899, 2015. http://dx.doi.org/10.1007/s11128-014-0900-1
Keywords— quantum circuit design, toffoli gates

22. Anmer Daskin, Ananth Grama, Sabre Kais, Quantum Random State Generation with Predefined Entanglement, 2014 Journal of Quantum Information, Vol. 12, No.5, 2014. http://dx.doi.org/10.1142/S0219749914500300

Keywords— quantum state preparation, entanglement, parameterized circuits, Schmidt decomposition

23. Anmer Daskin, Ananth Grama, Sabre Kais, Multiple Network Alignment on Quantum Computers, Quantum Information and Processing, Volume 13, Issue 12, pp 2653-2666, 2014. http://dx.doi.org/10.1007/s11128-014-0818-7
Keywords— quantum bioinformatics, quantum phase estimation, protein-protein interaction networks

24. Anmer Daskin, Ananth Grama, and Sabre Kais, A universal quantum circuit scheme for finding complex eigenvalues, Quantum Information Processing, Volume 13, Issue 2, pp 333-353, 2014, http://dx.doi.org/10.

1007/s11128-013-0654-1
Keywords— quantum circuit design, non-unitary matrices, phase estimation, complex eigenvalues

25. Anmer Daskin, Ananth Grama, George Killios, and Sabre Kais, Universal Programmable Quantum Circuit Schemes to Emulate an Operator, J. Chem. Phys. 137, 234112, 2012. http://dx.doi.org/10.1063/1.4772185
Keywords— quantum circuit design in linear time, parameterized quantum circuits, sum of unitaries, Schmidt decomposition

26. Yudong Cao, Anmer Daskin, Steven Frankel, Sabre Kais, Quantum Circuit Design for Solving Linear Systems of Equations, Mol. Phys., 110, no. 15-16: 1675-1680, 2012. http://dx.doi.org/10.1080/00268976.2012.668289
Keywords— quantum circuit design, HHL algorithm, quantum phase estimation, matrix inverse

27. Anmer Daskin and Sabre Kais, Decomposition of Unitary Matrices for Finding Quantum Circuits: Application to Molecular Hamiltonians, J. Chem. Phys. 134, 144112, 2011. http://dx.doi.org/10.1063/1.3575402
Keywords— global optimization, quantum circuit design, quantum gates, quantum Hamiltonians, Hydrogen molecule, Water molecule

28. Anmer Daskin and Sabre Kais, Group Leaders Optimization Algorithm, Mol. Phys., 109(5):761-772, 2011. http://dx.doi.org/10.1080/00268976.2011.552444
Keywords— global optimization, Lennard-Jones potential, circuit optimization

Conference Publications

29. Ammar Daskin, A Simple Quantum Neural Net with a Periodic Activation Function, The 2018 IEEE International Conference on Systems, Man, and Cybernetics (SMC2018), Miyazaki, Japan. https://doi.org/10.1109/SMC.2018.00491
Keywords— quantum machine learning, quantum neural networks, periodic activation function, pattern recognition

30. Ammar Daskin , Quantum IsoRank: Efficient Alignment of Multiple Protein-Protein Interaction Networks, International Conference on Computer Science and Engineering (UBMK 2016), TEKIRDAG, TURKIYE, 20-23 Ekim 2016, pp.81-88 (arXiv:1506.05905)
Keywords— quantum bioinformatics, quantum state tomography, protein-protein interaction networks

Conference Abstracts

31. Anmer Daskin, Quantum Circuit Implementations of the Direct Sum of Unitary Matrices, International Conference on Quantum Science and Applications, May 25-27, 2016, Eskisehir, Turkey

32. Anmer Daskin and Sabre Kais, Decomposition of Unitary Matrices for Finding Quantum Circuits, 241st ACS National Meeting & Exposition, The Division of Physical Chemistry, March 30, 2011, Anaheim, California, USA

33. Anmer Daskin, Finding Quantum Circuit Designs for the Simulation of Quantum Chemistry, 5th Annual Computational Science and Engineering Student Conference, 2013, Purdue University, W. Lafayette, USA