C. Carlo Fazioli

Curriculum Vitae

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I am an applied mathematician and software engineering generalist with experience in cloud computing, AI, and DevOps. I am a lifelong learner with far-ranging interests, confident in my ability to rapidly spin up in new environments, as well as deep-dive into the gritty details. In 2021, I made it onto the Advent Of Code global leaderboard!

Current Position

2018 – Present **Software Engineer**, *Group W, Inc*, Vienna VA.

Contributor to nearly all aspects of a 2021 MORS Barchi-prize-winning, multi-year, multimillion-dollar DARPA contract to develop an AI wargaming application deployed to an 11-node, 1,240-CPU cluster. After the award, migrated the application from the privately controlled cluster to MS Azure.

- Cloud-native Architecture:
  - Architected microservices, their interfaces, and their implementations as Kubernetes objects, including all system Deployments, Services, Jobs, PVCs, ConfigMaps, NetworkPolicies, Secrets, RoleBindings, and ServiceAccounts
  - Managed Kubernetes objects in a Helm Chart for flexible deployment to multiple pipeline environments and client systems
  - Defined all cloud infrastructure requirements using Azure ARM Templates, including Virtual Networks, subnets, DNS config, ACR, AKS, RoleDefinitions, and RoleAssignments
  - Configured application reverse proxy with NGINX, and Certbot for automated Let's Encrypt SSL certificate procurement
- Agile Development:
  - Acted as unofficial Agile Team Leader for a team of 10, managing issues, branch/merge strategies, package releases, and CICD pipelines
  - Assembled a robust CICD Pipeline using GitLab Runners deployed as VMs in Azure, as well as on-prem machines, that: de/commissions Azure infrastructure as needed; assures code quality with style guides, unit tests, and integration tests; builds and tags Docker images; installs/updates the application
  - Facilitated uniform development workflows using a custom Docker image and developer utility scripts
- Software Engineering:
  - Designed AI algorithms under a senior mathematician's guidance, using reinforcement learning, feature engineering, TensorFlow neural networks, and Monte Carlo Tree Search
  - Researched data analysis techniques, and implemented a from-scratch K-medoids algorithm to cluster and classify wargame state data
  - Authored application source code in Python, including a REST server with Django, database interfaces with PyMongo, and custom libraries
  - Detailed significant portions of the project in technical documentation in the form of wiki pages, READMEs, code comments, prose documents, and GitLab comment threads, for ingestion by colleagues, client developers, and project leadership
  - Constructed a REST API and SDK to support frontend Vue developers as well as external collaborators, with artifacts that include full technical documentation, abstract base classes, derived class examples, and Jupyter notebooks that illustrate common API use cases.
- System Administration:
  - Controlled application access using Azure Active Directory for users, Vouch Proxy for OAuth2, and security principals for pipeline actions
  - Administrated multiple MongoDB instances (each 10GB-1TB) from the mongo shell, and with PyMongo, including automated backup/restore, manual intervention when necessary, and query design

Education

2006 – 2009 **Ph.D. Mathematics**, *University of Illinois at Chicago*, Chicago IL.

2005 – 2006 **M.S. Mathematics**, *University of Illinois at Chicago*, Chicago IL.

2000 – 2004 **B.S. Mathematics**, *University of San Francisco*, San Francisco CA.

Previous Positions

2016 – 2018 **Econometric Modeler**, *International Monetary Fund*, Washington DC.

Collaborated with IMF economists on global economic model development; researched, designed, and implemented algorithms for use by IMF staff; pursued exploratory research into technology solutions for IMF institutional needs; addressed technical needs of individual IMF staff.

- Researched Monte Carlo techniques to approximate game- theoretical quantities, resulting in substantial runtime improvements
- Authored user software to assist economists in global systemic risk valuations
- Developed working knowledge of AWS, including IAM, VPC, EC2, and S3, for internal pilot program

2013 – 2016 **Assistant Teaching Professor**, *Dept. of Mathematics*, Drexel University, Philadelphia, PA.

Developed course and lab materials; lectured, graded exams, monitored students' use of online resources, assigned final grades; assisted students as needed outside of class or in office hours; directed teaching assistants.

- Linear Algebra (Fall 2013, Winter 2014, Winter 2015, Spring 2016)
- Differential Equations (Winter 2014, Spring 2015, Winter 2016)
- Complex Variables and Vector Analysis (Spring 2014)
- Discrete Math (Summer 2014)
- Multivariable Calculus, Calculus II, Precalculus, Math 101 (multiple quarters)

2011 – 2013 **Postdoctoral Research Associate**, *Dept. of Mathematical Sciences*, New Jersey Inst. of Tech., Newark, NJ.

Researched, designed, and coded novel algorithms for use in fluid dynamics simulations; briefed research supervisor; presented findings to collaborators and conference attendees.

- Surveyed recent research literature
- Communicated and collaborated with supervisors to develop research program
- Drafted, wrote, revised, and debugged new numerical algorithms

2011 – 2012 **Lecturer**, *DMS*, NJIT, Newark, NJ.

Worked with course coordinators to develop course materials; lectured courses, graded exams, monitored students' use of online resources; assisted students as needed outside of class or in office hours.

- Honors Multivariable Calculus (Spring 2012)
- Differential Equations (Fall 2011)

2009 – 2011 **Lecturer**, *Dept. of Math, Stats, and Comp. Sci.*, UIC, Chicago, IL.

Worked with course coordinators to develop course materials; lectured courses, graded exams, monitored students' use of online resources; assisted students as needed outside of class or in office hours. Directed teaching assistants in designing and administering discussion sections and quizzes.

- Linear Algebra course coordinator (Spring 2011)
- Differential Equations (Spring 2011)
- Linear Algebra (Fall 2010, Spring 2010, Fall 2009)
- Multivariable Calculus (Fall 2010, Fall 2009)

2007 – 2009 **Graduate Student Lecturer**, *MSCS*, UIC, Chicago, IL.

Lectured courses; wrote and graded exams; assissted students as needed during office hours and scheduled meetings; assigned final grades.

- Linear Algebra (Spring 2008)
- Multivariable Calculus (Spring 2009, Fall 2007)

2005 – 2009 **Teaching Assistant**, *MSCS*, UIC, Chicago, IL.

Led discussion sections; created and graded quizzes; assisted students as needed in office hours and department tutoring center.

- Calculus II (Fall 2008, Summer 2008, Spring 2005)
- Calculus I (Spring 2008, Spring 2007, Fall 2006, Spring 2006, Fall 2005)
- Linear Algebra (Summer 2007)
- Calculus I Emerging Scholars Program (Spring 2007, Fall 2006)
- Differential Equations (Summer 2006)

2002 **Supplemental Instruction Tutor**, *Dept. of Mathematics*, USF, San Francisco, CA.

Attended lectures and took notes for undergraduate courses; hosted drop-in peer tutoring sessions.

- Introduction to Statistics (Fall 2002)
- Calculus I (Spring 2002)

Publications

M. Booty, C. Fazioli, M. Siegel. "A New Algorithm for Efficient Computation of Moving Fluid Interfaces." (in progress)

C. Fazioli, D. Nicholls. "Stable Computations of Variations of Dirichlet-Neumann Operators." *Journal of Computational Physics*, Volume 229, Number 3, 906-920 (2010)

C. Fazioli, D. Nicholls. "Parametric Analyticity of Functional Variations of Dirichlet-Neumann Operators." *Differential and Integral Equations*, Volume 21, Number 5-6, 541-574 (2008)

Invited Talks

2014 *Overlapping Patches for Dynamic Surface Problems*, Conference on Hamiltonian PDE, The Fields Institute for Research in Mathematical Sciences, University of Toronto, Toronto, Ontario, Canada

2012 *Overlapping Patches for Dynamic Surface Problems*, Applied Math Seminar, Department of Mathematics, Drexel University, Philadelphia PA

2009 *Functional Variations of the Dirichlet-Neumann Operator*, IMACS Conference, University of Georgia, Athens GA

2009 *Functional Variations of the Dirichlet-Neumann Operator*, AMS Sectionals Meeting, University of Illinois at Urbana-Champaign, Urbana-Champaign IL

Conferences Attended

2020 Rigetti Advantage 2020, Sacramento CA

2019 IBM Q Summit, Yorktown Heights NY

2018 D-Wave Systems Qubits 2018, Knoxville TN

2017 D-Wave Systems Qubits 2017, National Harbor MD

2014 Joint Mathematics Meetings, Baltimore MD

2014 Conference on Hamiltonian PDE, Toronto, Ontario, Canada

2012 Frontiers in Applied and Computational Mathematics, Newark NJ

2011 Joint Mathematics Meetings, New Orleans LA

2009 IMACS Conference, Athens GA

2009 AMS Sectionals, Urbana-Champaign IL

2009 Joint Mathematics Meetings, Washington DC

2005 3-Manifolds and Knot Theory Conference, Austin TX

2005 Algebraic Geometry, Symplectic Geometry and Theoretical Physics: A Conference Celebrating the Contributions of Women Researchers, Philadelpha PA

Service

2019 – 2020 Computer Science Intern Team Mentor, Group W and George Mason University, Vienna VA

2018 – 2019 Quantum Computing Intern Individual Mentor, Group W, Vienna VA

Summer 2015 'Students Tackling Advanced Research' Faculty Mentor, Drexel University, Philadelphia PA

2014 – 2015 Teaching Innovations Committee Head, Drexel University, Philadelphia PA

2008 – 2009 Faculty Partner, UIC, Chicago IL

Spring 2005 Associate Organizer, Bay Area Math Meet, USF, San Francisco CA

Spring 2004 Student Volunteer, BAMM, USF, San Francisco CA

Hobbies and Interests

- Solving the NYT crossword puzzle daily: My longest streak is 252 days!
- Cycling: I spent 6 weeks traveling 1,400+ miles by bicycle in 2013.
- Mindfullness: frequent meditator and yoga practicioner.
- Cloud computing: professional experience with MS Azure and AWS; personal website hosted on GCP.
- Science fiction lit/TV/movies: I'm a fan of classics like Phil K. Dick, contemporaries like Neal Stephenson and Rian Hughes, and the '80s and '90s campiness of Paul Verhoeven.
- Coding competitions: I am Advent of Code supporter, proudly listed on the global leaderboard! Also enjoy participating in entry-level CTFs.
- Quantum computing: Occasional conference attendee, and collaborator of Dr. Denny Dahl (D-Wave Systems, Cold Quanta).
- Bug bountying and cybersecurity: Avid listener of Risky Biz and Darknet Diaries podcasts.
- MCU and embedded systems: Arduino and AVR chip tinkerer, currently working on a sleep monitor to induce lucid dreaming.