AHMED ATTIA, PH.D.

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EDUCATION

Virginia Polytechnic Institute and State University (Virginia-Tech)   2012–2016
Ph.D. in computer science   *Blacksburg, VA, USA*

- *Area of Concentration*: uncertainty quantification and data assimilation.

- *Dissertation Title*: Advanced Sampling Methods for Solving Large-Scale Inverse Problems.

- *Advisor*: Prof. Dr. Adrian Sandu (`http://people.cs.vt.edu/asandu/`)

Mansoura University   2005–2008
Master of mathematics, statistics and computer science   *Mansoura, DK, Egypt*

- *Master Thesis Title*: Data Mining Algorithms Using Artificial Neural Networks.

Mansoura University   1999–2004
Bachelor of mathematics, statistics and computer science   *Mansoura, DK, Egypt*

- *Area of Concentration*: statistics and computer science.

- *Graduation Project*: Pharmaceutical Database Management System using VBA and MS Access.

WORK EXPERIENCE

Mathematics and Computer Science Division, Argonne National Laboratory 07/2019–Present
Assistant Computational Mathematician   *Lemont, IL, USA*

- *Responsibilities*: develop scalable computational algorithms and software tools for large-scale problems with applications to energy problems.

Mathematics and Computer Science Division, Argonne National Laboratory 08/2017–07/2019
Postdoctoral Appointee   *Lemont, IL, USA*

- *Responsibilities*: developed scalable computational algorithms and software tools for large-scale problems with applications to energy problems.

Statistics and Applied Mathematical Science Institute (SAMSI)   08/2016–07/2017
Postdoctoral Research Fellow   *Research Triangle Park, Durham, NC, USA*

- *Responsibilities*: developed efficient algorithms for experimental design and sensor placement.

Mathematics Department, North Carolina State University (NCSU)   08/2016–07/2017
Postdoctoral Research Fellow   *Raleigh, NC, USA*

- *Responsibilities*: developed efficient algorithms for experimental design and sensor placement.

Computer Science Department, Virginia-Tech   Fall 2015–Spring 2016
Teaching Assistant   *Blacksburg, VA, USA*

- *Responsibilities*: Assisted with teaching and grading several courses including "numerical methods" and "data and algorithm analysis."

Mathematics and Computer Science Division, Argonne National Laboratory 06/2015–08/2015
Summer Intern   *Lemont, IL, USA*

- *Project*: **DAPack**: an extensible data assimilation testing suite
- *Supervisor*: Dr. Emil Constantinescu (`http://www.mcs.anl.gov/~emconsta/`)

Mathematics and Computer Science Division, Argonne National Laboratory 06/2014–08/2014
Summer Intern   *Lemont, IL, USA*

- *Project*: Optimization methods for importance sampling.
- *Supervisor*: Dr. Mihai Anitescu (`http://www.mcs.anl.gov/~anitescu/`)

Mathematics Department, Faculty of Science, Mansoura University   2008–2011
Assistant Lecturer   *Mansoura, DK, Egypt*

- *Responsibilities*: Assisted with teaching and grading several courses for both undergraduate and graduate students in math, statistics, and computer science majors.

Mathematics Department, Faculty of Science, Mansoura University   2004–2008
Demonstrator   *Mansoura, DK, Egypt*

- *Responsibilities*: Assisted with teaching and grading several courses for both undergraduate and graduate students in math, statistics, and computer science majors.

CURRENT RESEARCH INTERESTS

- Inverse Problems
- Data Assimilation
- Uncertainty Quantification
- Optimal Design of Experiments
- PDE-Constrained Optimization
- Robust Optimization
- Probabilistic Machine Learning
- Parallel Programming and High-Performance Computing

PUBLICATIONS

Refereed Journal Articles

1. **Attia, Ahmed**, Daniel Adrian Maldonado. "Centralized calibration of power system dynamic models using variational data assimilation." (2023).

2. **Attia, Ahmed**, Sven Leyffer, and Todd Munson. "Robust A-optimal experimental design for Bayesian inverse problems." arXiv preprint arXiv:2305.03855 (2023).

3. **Attia, Ahmed**, and Shady E. Ahmed. "PyOED: an extensible suite for data assimilation and model-constrained optimal design of experiments." arXiv preprint arXiv:2301.08336 (2023).

4. **Attia, Ahmed**, and Emil Constantinescu. "Optimal experimental design for inverse problems in the presence of observation correlations." SIAM Journal on Scientific Computing 44, no. 4 (2022): A2808-A2842.

5. **Attia, Ahmed**, Sven Leyffer, and Todd S. Munson. "Stochastic learning approach for binary optimization: Application to Bayesian optimal design of experiments." SIAM Journal on Scientific Computing 44, no. 2 (2022): B395-B427.

6. **Attia, Ahmed**, and Adrian Sandu. "DATeS: a highly extensible data assimilation testing suite v1. 0." Geoscientific Model Development 12, no. 2 (2019): 629-649.

7. **Attia, Ahmed**, Alen Alexanderian, and Arvind K. Saibaba. "Goal-oriented optimal design of experiments for large-scale Bayesian linear inverse problems." Inverse Problems 34, no. 9 (2018): 095009.

8. **Attia, Ahmed**, Azam Moosavi, and Adrian Sandu. "Cluster sampling filters for non-Gaussian data assimilation." Atmosphere 9, no. 6 (2018): 213.

9. **Attia, Ahmed**, Răzvan Ştefănescu, and Adrian Sandu. "The reduced-order hybrid Monte Carlo sampling smoother." International Journal for Numerical Methods in Fluids 83, no. 1 (2017): 28-51.

10. **Attia, Ahmed**, Vishwas Rao, and Adrian Sandu. "A hybrid Monte Carlo sampling smoother for four-dimensional data assimilation." International Journal for Numerical Methods in Fluids 83, no. 1 (2017): 90-112.

11. **Ahmed, Attia**, and Sandu Adrian. "A hybrid Monte Carlo sampling filter for non-Gaussian data assimilation." AIMS Geosciences 3, no. 1 (2015): 41-78.

Publications in Refereed Conference Proceedings

1. Minseok Ryu, Ahmed Attia, Arthur Barnes, Russell Bent, Sven Leyffer, and Adam Mate. "Heuristic Algorithms for Placing Geomagnetically Induced Currents Blocking Devices." Submitted to the 23rd Power Systems Computation Conference (PSCC 2024).

2. Moosavi, Azam, **Ahmed Attia**, and Adrian Sandu. "Tuning covariance localization using machine learning." In International Conference on Computational Science, pp. 199-212. Springer, Cham, 2019.

3. **Attia, Ahmed**, Vishwas Rao, and Adrian Sandu. "A sampling approach for four dimensional data assimilation." In International Conference on Dynamic Data-Driven Environmental Systems Science, pp. 215-226. Springer, Cham, 2014.

Technical Reports and White Papers

1. Ramanathan, Arvind, Carlo Graziani, Charlie Catlett, **Ahmed Attia**, Ben Blaiszik, Marieme Ngom, Romit Maulik, Aaron Packman, Niall Mangan, Ahmed Abokifa, Anuj Taiwari, and Marcelo Garcia. "Models, Forecasts, and Uncertainty in the Wastewater Epidemic Surveillance Era." DARPA, 2022.

2. **Attia, Ahmed** and Emil Constantinescu. AI for Automated Acquisition and Weighting of Simulation, Observational, and Experimental Data." AI@DOE Roundtable, 2021.

3. **Ahmed Attia**, Ray Bair, Ramesh Balakrishnan, Prasanna Balaprakash, Anouar Benali, Franck Cappello, Kyle Chard, Mathew Cherukara, Ian Cloët, Emil Constantinescu, Mark Dewing, Sheng Di, Anshu Dubey, Jun Fang, Ian Foster, Rinku Gupta, Carlo Graziani, Iulian Grindeanu, Salman Habib, Kevin Harms, Steven Henke, Paul Hovland, Robert Jacob, Michael Kruse, Jeffrey Larson, Sven Leyffer, Nevin Liber, Zhengchun Liu, Ye Luo, Vijay Mahadevan, Todd Munson, Sri Hari Krishna Narayanan, Raymond Osborn, Michael Papka, Scott Parker, Hannah Parraga, Ken Raffenetti, Katherine Riley, Paul Romano, Rob Ross, Nicholas Schwarz, Emily Shemon, Patrick Shriwise, Rick Stevens, Rajeev Thakur, Richard Tran Mills, Thomas Uram, Alvaro Vazquez-Mayagoitia, Logan Ward, Stefan Wild,

Tim Williams, Justin Wozniak, Xingfu Wu, Xingqiu Yuan, Hong Zhang, and Junchao Zhang. "RFI Response: Stewardship of Software for Scientific and High-Performance Computing." DOE-ASCR, Stewardship of Software for Scientific and High-Performance Computing, 2021.

4. **Attia, Aahmed** and Emil Constantinescu. "An Optimal Experimental Design Framework for Adaptive Inflation and Covariance Localization for Ensemble Filters." ArXiv preprint arXiv: 1806.10655, 2019.

5. Moosavi, Azam, **Ahmed Attia**, and Adrian Sandu. "A Machine Learning Approach to Adaptive Covariance Localization." ArXiv preprint arXiv:1801.00548, 2018.

PRESENTATIONS AND WORKSHOPS

Invited Talks in Minisymposia

1. Aug 20–25, 2023: International Congress on Industerial and Applied Mathematics (ICIAM-2023). Waseda University, Tokyo, Japan. Robust Optimal Experimental Design for Bayesian Inverse Problems: A general approach for Robust Binary Optimization.

2. May 9, 2023: International Conference on Design of Experiments (ICODOE-2022). FedEx Institute of Technology, University of Memphis. Robust Optimal Experimental Design for Bayesian Inverse Problems.

3. March 2, 2023: SIAM Conference on Computational Science and Engineering (SIAM-CSE-23). RAI Congress Centre, Amsterdam, The Netherlands. Robust Optimal Experimental Design for Bayesian Inverse Problems.

4. April 14, 2022: SIAM Conference on Uncertainty Quantification (UQ22). Stochastic Learning Approach to Binary Optimization for Optimal Design of Experiments.

5. April 12, 2022: SIAM Conference on Uncertainty Quantification (UQ22). A New Stochastic Learning Approach for Binary Optimization: Application to Bayesian OED.

6. July 19, 2021: SIAM Annual Meeting (SIAM-AN-21). Virtual. Stochastic Learning Approach for Model-Constrained Optimal Design of Experiment.

7. January 11, 2021: (*Rescheduled due to COVID-19 from July 2020*): Eccomas Congress 2020 & 14th WCCM Joint Congress. Paris, July 19–24, 2020. An Optimal Experimental Design Framework for Sensor Placement and Acquisition of Highly Correlated Data.

8. April 17, 2018: SIAM Conference on Uncertainty Quantification (SIAM-UQ-18). Goal-Oriented Optimal Design of Experiments for Bayesian Inverse Problems.

Other Talks

1. September 12, 2023: SciDAC Principal Investigators (PI) Meeting, Rockville, MD, USA. Scalable Approaches and Software Tools for Optimal Design of Experiments.

2. September 12, 2023: SciDAC Principal Investigators (PI) Meeting, Rockville, MD, USA. A Recipe for Transforming High-Productivity DSL Code into High-Performance Code for Exascale Systems

3. Jan 24, 2023: FASTMath Seminar Series. Virtual. Optimal Experimental Design for Bayesian Inversion.

4. June 1, 2022: Bayesian Analysis of Nuclear Physics (BAND) seminar series, Ohio University. Optimal Experimental Design for Bayesian Inversion.

5. November 11, 2021: FASTMath Machine Learning Webinars. Virtual. Innovative ML/AI Perspectives for UQ, DA, and OED.

6. November 1, 2021: MACSER Review. Virtual. Optimal Experimental Design for Sensor Placement and Acquisition of Highly Correlated Data.

7. March 5, 2021: SIAM Conference on Computational Science and Engineering (SIAM-CSE-21). Virtual. Optimal Experimental Design for Sensor Placement and Acquisition of Highly Correlated Data.

8. March 17, 2021: Argonne National Laboratory, LANS Seminar Series. New Efficient Approaches for Model-Constrained Optimal Design of Experiments.

9. March 24, 2020 (*Cancelled due to COVID-19*): SIAM Conference on Uncertainty Quantification (SIAM-UQ-20). Garching Campus of Technical University of Munich (TUM) — Garching near Munich, Germany. A New Shur-Product Formulation of Optimal Design of Experiments for Bayesian Inverse Problems.

10. June 12, 2019: Machine Learning and Data Assimilation for Dynamical Systems (MLDADS). The International Conference on Computational Science (ICCS), Faro, Portugal. Tuning Covariance Localization Using Machine Learning.

11. March 4, 2019: SIAM Conference on Computational Science & Engineering (CSE19), Spokane, WA, USA. An Optimal Experimental Design Framework for Adaptive Inflation and Covariance Localization for Ensemble Filter.

12. February 25, 2019: SIAM Conference on Computational Science & Engineering (CSE19), Spokane, WA, USA. A Learning-Based Approach for Data Assimilation.

13. January 29, 2019: ASCR Applied Mathematics Principal Investigators Meeting, Rockville, MD, USA. DLiDA: Extremely High-Resolution Data Assimilation.

14. October 31, 2018: Argonne National Laboratory, Lemont, IL, USA. Large-Scale Data Fusion for Improved Model Simulation and Predictability.

15. September 14, 2018: SIAM Conference on Mathematics for Planet Earth (SIAM-MPE-18). A Framework for Adaptive Inflation and Covariance Localization for Ensemble Filters.

16. May 19, 2017: SAMSI/NCSU Undergraduate Workshop; NC State University, Raleigh, NC, USA. *NWP-Project Proposal:* Data Assimilation for Numerical Weather Prediction.

17. May 19, 2017: SAMSI/NCSU Undergraduate Workshop; NC State University, Raleigh, NC, USA. Data Assimilation for Numerical Weather Prediction and Introduction to using DATeS.

18. May 16, 2017: SAMSI/NCSU Undergraduate Workshop; NC State University, Raleigh, NC, USA. An Introduction to Python for Scientists: Hands-On Tutorial.

19. May 1, 2017: OPT-Program Transition Workshop. SAMSI: Statistical and Applied Mathematical Science Institute; Durham, NC, USA. Goal-Oriented Optimal Design of Experiments for Bayesian Linear Inverse Problems.

20. April 27 , 2017: SAMSI: Statistical and Applied Mathematical Science Institute; Durham, NC, USA. Goal-Oriented Optimal Experimental Design.

21. March 23, 2017: Workshop on Uncertainty Quantification and Data-Driven Modeling; Austin, TX, USA. Cluster Sampling Algorithms for Non-Gaussian Data Assimilation.

22. March 8, 2017: SAMSI: Statistical and Applied Mathematical Science Institute; Durham, NC, USA. A Family of Clustering Sampling Smoothers for 4D Non-Gaussian Data Assimilation.

23. March 1, 2017: SIAM Conference on Computational Science & Engineering (CSE17), Atlanta, GA, USA. Cluster Sampling Filters for Non-Gaussian Data Assimilation.

24. December 6, 2016: Argonne National Laboratory, IL, USA. Advanced Sampling Methods for Solving Large-Scale Inverse Problems.

25. November 16, 2016: SAMSI: Statistical and Applied Mathematical Science Institute; Durham, NC, USA. Goal-Oriented Optimal Experimental Design: GO-OED for PDE-Based Bayesian Linear Inverse Problems.

26. June 4, 2015: Workshop on Sensitivity Analysis and Data Assimilation in Meteorology and Oceanography, Roanoke, WV, USA, Adjoint Workshop 2015. Efficient Sampling Algorithms for Non-Gaussian Data Assimilation.

27. August 7, 2015: Argonne Students Symposium (SASSy), Argonne National Laboratory, Lemont, IL, USA. DAPACK: A Python Package for Sequential Data Assimilation.

28. March 17, 2015: SIAM Conference on Computational Science and Engineering, Salt Lake City, UT, USA, SIAM CSE 2015. Efficient Sampling Algorithms for Non-Gaussian Data Assimilation.

29. November 6, 2014: Dynamic Data-driven Environmental Systems Science conference, Massachusetts Institute of Technology, Cambridge, MA, DyDESS 2014. A Sampling Approach for Four Dimensional Data Assimilation.

30. August 6, 2014: Argonne Students Symposium (SASSy), Argonne National Laboratory, Lemont, IL. Derivative-Based Solution of the Constrained Optimization Problem(s) with DeMarco's Model.

31. October 13, 2014 University of Maryland-Virginia Tech Data Assimilation Day, University of Maryland, College Park. UMD and Virginia-Tech meeting, 2014. A Sampling Filter for Non-Gaussian Data Assimilation.

DOE Workshops

1. Jan 6–7, 2021: RASC 2; Randomized Algorithms for Scientific Computing Workshop, Part 2, virtual.

2. Dec 2, 2020: RASC; Randomized Algorithms for Scientific Computing Workshop, virtual.

3. Sep 17–19, 2019: The DOE National Laboratory Applied Math Visioning Workshop on uncertainty quantification and multi-scale modeling, the Marriott Albuquerque, Albuquerque, New Mexico.

NSF Workshops

1. April 6–7, 2017: National Science Foundation (NSF), Arlington, VA. Examination of Data Assimilation Algorithms, Observations, and Applications in the Context of Next-Generation Computing.

Other Workshop Participation

1. Oct 5–7, 2021: ALCF Annual Simulation, Data, and Learning Workshop. Argonne Leadership Computing Facility, Argonne, IL. Virtual.

2. December 10–11, 2018: Argonne National Laboratory, IL, USA. Argonne Quantum Computing Tutorial.

3. October 2–4, 2018: ALCF Simulation, Data, Learning Workshop, Argonne National Laboratory, USA.

4. September 24–25, 2018: Argonne National Laboratory, IL, USA. Advanced Statistical Methods Meet Machine Learning Workshop.

5. January 16–18, 2018: Building 240, Argonne, TCS1416, S. Cass Ave., Lemont, IL. Deep Learning at Argonne National Laboratory.

6. June 7–9, 2017; American Institute of Mathematics, AIM. San Jose, CA. Workshop on Careers in Academia.

7. February 2017: E&O: Undergraduate Workshop. SAMSI: Statistical and Applied Mathematical Science Institute.

8. February 2017: Workshop on the Interface of Statistics and Optimization (WISO), Duke University, Durham, NC.

9. August/September 2016: Opening Workshop of the Program on Optimization. SAMSI: Statistical and Applied Mathematical Science Institute.

10. August 8–12, 2016: SAMSI Optimization Summer School, The Hamner Conference Center in Research Triangle Park, NC.

11. April 2014: SIAM Conference on Uncertainty Quantification, SIAM UQ 2014, Savannah, GA.

12. October 2013: Sixth International Symposium on Data Assimilation, University of Maryland, College Park, NC, WMO 2013.

AWARDS AND TRAVEL GRANTS

1. NSF and AIM Travel Grant to participate in the workshop "Careers in Academia," American Institute of Mathematic, AIM, San Jose, CA, June 2017.

2. NSF Travel Grant to participate in the workshop "An Examination of Data Assimilation Algorithms, Observations, and Applications in the Context of Next-Generation Computing," National Science Foundation, Arlington, VA, April 2017.

3. ICES Travel Grant to participate in "Workshop on Uncertainty Quantification and Data-Driven Modeling", Austin, Texas, March 2017.

4. VT-MENA graduate award, 2012–2016. **VT-MENA** is a partnership between Virginia-Tech, VT, USA, and the Academic Institutions of the Ministry of Higher Education (MoHE), in Egypt.

FUNDING

Pending

1. DOE-BES-ASCR (DE-FOA-0003003). *Title:* Hybrid Physics-and-Data-Based Modeling of MultiScale Processes in Complex Reactions. *Role:* Co-PI. *PIs:* Michael Burke (Columbia University); Ahmed Attia (ANL); Ian Foster (ANL); Stephen Klippenstein (ANL). *Topic:* Relevant Energy Earthshots: Industrial Heat, Long Duration Storage. *Status:* Proposal Submitted.

Current

1. DOE-ASCR-NP. *Title:* Femtoscale Imaging of Nuclei using Exascale Platforms. *Role:* Senior Personnel. *Budget:* $13,750,000 total; (Oct 1, 2022–Sep 30, 2027). *PIs:* Ian Clöet (ANL); Jianwei Qiu (Jefferson Lab); Wu-chun Feng (Virginia Tech).

2. DOE-OE-ASCR. *Title:* Space Weather Mitigation Planning. *Role:* Senior Personnel. *Budget:* $700,000 total; (Aug, 2022–Feb, 2024).

3. DOE SciDAC Institute. *Title:* Frameworks, Algorithms and Scalable Technologies for Mathematics (FASTMath). *Lead Institution:* Lawrence Berkeley National Laboratory. *Role:* Participant. *Budget:* $5.75M/year (Sep 1, 2020–Sep 1, 2025). *PIs:* Esmond Ng (LBNL); Todd Munson (ANL); Ulrike Yang (LLNL); Rick Archibald (ORNL); Karen Devine (SNL); Youssef Marzouk (MIT); Mark Shephard (RPI); Daniel Reynolds (SMU); Ken Jansen (UCB); Roger Ghanem (USC).

4. DOE-ASCR *Title:* X-ray & Neutron Scientific Center for Optimization, Prediction, & Experimentation (XSCOPE) *Role:* Co-PI. *Budget:* $1M/year (Sep 1, 2023 –Sep 1, 2028) *PIs:* Ahmed Attia (ANL) Tekin Bicer (ANL) Franck Cappello (ANL) Mathew Cherukara (ANL) Zichao Di (ANL) Ian Foster (ANL) Rajkumar Kettimuthu (ANL) Antonino Miceli (ANL) Nicholas Schwarz (ANL) Frank J. Alexander (BNL) Stuart Campbell (BNL) Sven Leyffer (ANL) Prasanna Balaprakash (ORNL) Richard Archibald

(ORNL) Juan M. Restrepo (ORNL) Jonathan Taylor (ORNL) Guannan Zhang (ORNL) Ryan Coffee (SLAC) Jana Thayer (SLAC) *FOA:* LAB 23-3030. *Status:* Funded.

Past

1. Argonne LDRD. *Title:* The Use of Metabarcoding to Characterize Ecosystem Health Status. *Role:* Co-PI. *Budget:* $70K total; (June 1–Sep 30, 2020). *PIs:* Mark Grippo (ANL); Ahmed Attia (ANL); Sarah Owens (ANL); Leroy Walston (ANL).

2. Argonne LDRD. *Title:* Goal-Oriented Optimal Experimental Design Framework for Sensor Placement and Acquisition of Highly-Correlated Data. *Role:* Lead PI. *Budget:* $25K/year; (Oct 1, 2018–Sep 30, 2019). *PIs:* Ahmed Attia (ANL); Emil Constantinescu (ANL).

3. Argonne LDRD. *Title:* Statistical Multi-Scale Methods for Parameterization of Complex Physics-Based Models. *Role:* Co-PI. *Budget:* $25K/year; (Oct 1, 2018–Sep 30, 2019). *PIs:* Ahmed Attia (ANL); July Bessac (ANL); Emil Constantinescu (ANL).

SOFTWARE PROJECTS

Major Software Projects

1. **PyOED**: Extensible toolkit for data assimilation and optimal design of experiments.
   - *Download and Documentation*: `https://gitlab.com/ahmedattia/pyoed`
   - *Role*: group leader and main developer.

2. **DLiDA**: Doppler lidar data assimilation. A PETSc-based package for ensemble-based data assimilation of high-resolution wind measurements into a large-scale atmospheric model.
   - *Documentation*: `https://www.mcs.anl.gov/~attia/DLiDA/`
   - *Role*: main developer.

3. **DATeS**: Advanced data assimilation testing suite, written mainly in Python but it gives the freedom to combine pieces written in different languages such as models written in Fortran or filters written in C.
   - *Download and Documentation*: `https://bitbucket.org/a_attia/dates/`
   - *Paper*: `https://doi.org/10.5194/gmd-12-629-2019`
   - *Role*: group leader and main developer.

Other Software Projects

1. **DOERL**: Design of experiments using reinforcement learning.
   - *Download and Documentation*: `https://gitlab.com/ahmedattia/doerl`
   - *Role*: designer and main developer.

2. **DAPack(PY-DA*)**: Extensible Python package for data assimilation.
   - *Download and Documentation*: `https://www.mcs.anl.gov/~emconsta/DAPackSite/index.html`
   - *Role*: main developer.

3. **Carbonara**: A package for using machine and deep learning algorithms for soil carbon prediction in the U.S.
   - *Download*: `https://gitlab.com/jbessac/soil_carbon_modeling_2020`
   - *Role*: designer and main developer.

4. **PyNASPI**: Python-based package for predicting failures in power grids.

- *Download*: `https://gitlab.com/emconsta/naspi-argonnauts-2021`
- *Role:* designer and main developer

5. **PyMLeDNA**: A prototypical framework (in Python and R) that provides selective regressors and classifiers to carry out the training and prediction process of environmental DNA data following several scenarios.

   - *Download*: `https://bitbucket.org/a_attia/ml_edna_2020/`
   - *Role:* designer and main developer.

PROFESSIONAL SERVICES

Meetings and Logistics

1. Co-chaired asessions of the SASSy Summer Students Argonne National Laboratory (ANL), Lemont, IL, USA, Auguest, 04 and August 11, 2023.

2. Served as a career panelist to "the SIAM Student Chapter Visit" to Argonne National Laboratory (ANL), Lemont, IL, USA, March 24, 2023.

3. Led an affinity group on "Inverse Problems and Data Assimilation" at SIAM Conference on Computational Science and Engineering (CSE23), RAI Congress Centre, Amsterdam, The Netherlands, Febrary 26–March 5, 2023.

4. Organized mini-symposium on "Optimal Experimental Design and Robust Optimization for Large-Scale Inverse Problems" at SIAM Conference on Computational Science and Engineering (CSE23), RAI Congress Centre, Amsterdam, The Netherlands, Febrary 26–March 5, 2023.

5. Coorganized FASTMath SciDAC Institute Monthly Seminar Series, 2021–2022

6. Organized mini-symposium on "Recent Advances in Optimal Experimental Design for Large-Scale Inverse Problems" at SIAM Conference on Computational Science and Engineering (CSE21), March 1–March 5, Fort Worth, TX, 2021.

7. Organized mini-symposium on "Computational Methods for Data Assimilation and Uncertainty Quantification" at SIAM Conference on Computational Science and Engineering (CSE19), Spokane WA, February 25–March 1, 2019.

8. Organized mini-symposium on "Subgrid Variability Modeling and Stochastic Parameterization for Multiscale Uncertainty Quantification" at SIAM Conference on Uncertainty Quantification (UQ20), Garching Campus of the Technical University of Munich (TUM), Garching, Germany, March 24–27, 2020. *Cancelled due to the coronavirus pandemic.*

9. Organized mini-symposium on "Recent Advances and Challenges in Optimal Experimental Design for Large-Scale Inverse Problems" at SIAM Conference on Uncertainty Quantification (UQ20), Garching Campus of the Technical University of Munich (TUM), Garching, Germany, March 24–27, 2020. *Cancelled due to the coronavirus pandemic.*

10. Organized mini-symposium on "Recent advances in computational methods for data assimilation" at SIAM Conference on Mathematics of Planet Earth (MPE18), Sept 12–15, Philadelphia, PA, 2018.

11. Co-organized the "E&O: Undergraduate Workshop", Statistical and Applied Mathematical Science Institute (SAMSI), Durham, NC, USA.

12. Co-organized the "OPT-Program Transition Workshop", Statistical and Applied Mathematical Science Institute (SAMSI), Durham, NC, USA.

Projects and Competitions

1. IEEE-NASPI Oscillation Source Location Contest. Team: Emil Constantinescu, Ahmed Attia, Adrian Maldonado, Vishwas Rao. June 2021.

2. NWP-Project; Data Assimilation for Numerical Weather Prediction, as a group leader. SAMSI/NCSU Undergraduate Workshop. July 2017.

Minisymposia Co-organizer

1. SIAM-CSE 2019, 2021

2. SIAM-UQ 2020

3. SIAM-MPE 2018

Editorial Board

1. Assocaite editor of Frontier: Numerical Analysis and Scientific Computation (since 2023)

Reviewer of papers for journals

1. SIAM Review

2. SIAM/ASA Journal on Uncertainty Quantification

3. SIAM Journal on Scientific Computing

4. Monthly Weather Review

5. Journal of Applied Meteorology and Climatology

6. Journal of Computational Design and Engineering

7. International Journal for Numerical Methods in Fluids

8. Computational Geosciences

9. Geoscientific Model Development

10. Applied Mathematical Modelling

11. Ocean Modelling

12. F1000 Open Research Europe

13. Statistical Analysis and Data Mining

14. Sensors

15. IOP Measurement Science and Technology

16. MDPI Mathematics

TEACHING EXPERIENCE

SAMSI/NCSU   May 14–19, 2017
Undergraduate Workshop   *Raleigh, NC, USA*

1. An Introduction to Data Assimilation and DATeS, the Data Assimilation Testing Suite.

SAMSI   February 2017
E&O Undergraduate Workshop   *Raleigh, NC, USA*

1. Introduction to Python for Scientists, Inverse Problems, and Data Assimilation: Hands-On Tutorial.

Virginia-Tech 2015–2016
Teaching Assistant *Blacksburg, VA, USA*

1. Numerical methods

2. Data and algorithm analysis

Faculty of Science; Mansoura University 2008–2012
Assistant Lecturer *Mansoura, DK, Egypt*

1. Introduction to Statistics (undergraduate)

2. Statistics (graduate)

3. Numerical Analysis

4. Operational Research and Optimization

5. Calculus

6. Stochastic Processes

7. Introduction to Computer Science

8. Introduction to Programming

9. Computer Science; Advanced Programming

10. Digital Image Processing

11. Functional Analysis

Faculty of Science; Mansoura University 2004–2011
Demonstrator *Mansoura, DK, Egypt*

1. Introduction to Statistics (undergraduate)

2. Numerical Analysis

3. Calculus

4. Introduction to Computer Science

5. Introduction to Programming

Misc 2003–2011
Private tutor *Egypt*

1. Business Mathematics

2. Mathematics of Investment

3. Insurance and its Mathematics

4. Advanced Statistical Mathematics

5. Applied Statistics and Operations Research

6. Probability and Statistics for Finance

7. Introduction to Computer for Business Studies

8. Computer Business Applications

SKILLS, ABILITIES, MANAGEMENT AND EXPERIENCE

Leadership

1. 2020–Present: Leading a group developing "PyOED": an extensible toolkit for inverse problems, data assimilation, and model-constrained optimal design of experiments.

2. 2015–2018: Leading a group developing "DATeS": an extensible package for experimental data assimilation.

3. May 15–19, 2017: Mentor undergraduate team project on a project Data Assimilation for Numerical Weather Prediction

Student Mentorship

1. Abhijit Chowdhary (North Carolina State University). ANL Given's Associate; May-July 2023.

2. Shady Ahmed (Oklahoma State University). ANL Given's Associate; May-July 2021.

INTEREST STATEMENT

My research work is generally in the area of computational science and engineering. The overall goal of my research is to develop robust and highly scalable computational algorithms and software tools for solving large-to-extreme scale inverse problems and optimal design of experiments. Specifically, I am interested in creating novel methodologies for performing data assimilation (DA) and uncertainty quantification (UQ) with highly nonlinear models and in the presence of non-Gaussian probabilistic uncertainties. I am also interested in developing efficient and robust goal-oriented algorithmic approaches for sensor placement, optimal data acquisition, and optimal experimental design (OED). I have developed a new family of ensemble-based sampling algorithms, based on the Hamiltonian Monte Carlo sampling strategy, to avoid the shortcomings of the current state-of-the-art algorithms. Among other OED developments, I have developed a novel reinforcement (machine learning) stochastic framework for solving otherwise computational infeasible mixed integer programs for OED. Additionally, I have extended this work, in a recent project, to design optimal data acquisition schemes that are robust to misspecification of the uncertainty model Currently, I am developing a novel mathematical UQ framework for complex-valued simulations such as coherent-diffraction imaging. I am also developing new robust stochastic learning approaches for solving binary OED optimization problems suitable, for example, for optimally designing sequential data acquisition schemes prevalent in many applications such as drone and satellite trajectory planning.