Dananjaya (Dan) Liyanage

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Research Interests and Vision

- **Research interests:** nuclear physics, scientific computation, relativistic fluid dynamics, data science and Bayesian statistics.
- **I enjoy** studying ultra-relativistic collisions of nuclei at the Relativistic Heavy Ion Collider and the Large Hadron Collider using scientific computing, machine learning and advanced statistical methods. I specially enjoy collaborating with experts from diverse fields, such as computer science, physics, and statistics.
- **Vision:** To understand quark-gluon plasma and the "Little Bangs" made in relativistic heavy-ion collisions.

Education

Ph.D. in Computational Nuclear Physics   Aug 2017 – Aug 2023

- **The Ohio State University, USA.** *Thesis: "[Multifaceted Study of Ultrarelativistic Heavy Ion Collisions](#)". Advisor: Prof. Ulrich Heinz.*

M.Sc. in Computational Nuclear Physics   Aug 2017 – Aug 2019

- **The Ohio State University, USA.** *Concentration: Advanced Bayesian Statistical Methods for Relativistic Heavy Ion Collisions.*

B.Sc. (Eng.) in Electrical and Electronics Engineering (EEE)   Oct 2011 – Oct 2015

- **University of Peradeniya (UoP), Sri Lanka.** *Research: Development of a Complete Robotic System for Reconnaissance. Graduated with First Class Honors*

Secondary Education

- **Kingswood College, Kandy, Sri Lanka.** *Subject Stream: Physical Sciences – Combined Mathematics. Rank: 3rd out of ~30,000 students in Advanced Level Examination*

Experience

Machine Learning Scientist   Aug 2023 – Present

- **Global Analytics and Data Science, PayPal.**
  Applying advanced machine learning methods to solve business problems related to PayPal Digital Wallet app. Conduct experimentation and deep dives to analyze large sets of consumer data to understand customer behavior and pain points. Provide timely recommendations and analytical insights to decision makers.

Machine Learning Scientist (Internship)   June 2022 – July 2023

- **Consumer Machine Learning, PayPal.**
  Use Causal Inference techniques to model the effect of incentives and reward programs to retain PayPal consumers.

Graduate Research Assistant   Jan 2019 – Aug 2023

- **Department of Physics, The Ohio State University.**
  Conducted research within two multi-institutional collaborations. *Supervisor:* Prof. Ulrich Heinz. *Research Areas:*
  (1) [BAND](#) Collaboration: Developed two advanced statistical software packages, "[Taweret](#)" and "[QGP Bayes](#)", for the BAND cyberinfrastructure [framework](#).
  (2) [JETSCAPE](#) Collaboration: Develop machine learning tools to reduce computational cost associated with heavy-ion collision simulations.
  (3) Study relativistic heavy ion collisions with the viscous anisotropic hydrodynamic (VAH) model and advanced statistical software tools.

Graduate Teaching Assistant   Aug 2017 – Aug 2020
- **Department of Physics, The Ohio State University.**
  Conducted weekly problem-solving sessions, lab classes. Duties also included grading assessments, exams and conducting office hours.

Instructor   Nov 2015 – July 2017
- **Department of Engineering Mathematics, Faculty of Engineering, University of Peradeniya (UoP).**
  Conducted teaching, evaluating, mentoring and lab classes for engineering undergraduates from all fields of specializations.

Electrical Engineer (Internship)   Oct 2014 – Jan 2015
- **Ceylon Electricity Board, Sri Lanka.**
  Rotation program to understand how national electricity power system work from generation to all the way to distribution.

Telecommunication Engineer (Internship)   Oct 2013 – Jan 2014
- **Dialog Axiata PLC, Networks Operation Center, Sri Lanka.**
  Database development project to expedite troubleshooting issues in the microwave communication network.

Awards and Honors

- **Advanced Achievement,** IBM Fall Quantum Computing Challenge.   2022
- **Honorable mention,** *Edward F. Hayes Advanced Research Forum, OSU, USA.*   2021
- **Hazel Brown Outstanding Teaching Award,** *The Ohio State University, OH, USA* 2020,2021
- **Best Data Science Project,** *Erdós Institute, Columbus, OH, USA.*   2019
- **Prof. W.P. Jayasekara Prize,** *For the Best Final Year Engineering Research Project (FYRP) in EEE, UoP.*   2015
- **Prof. E.F. Bartholomeusz Prize,** *For the Best FYRP in terms of Engineering Mathematics, UoP.*   2015
- **Bronze Medal – International Physics Olympiad,** *Bangkok, Thailand.*   2011
- **Honorable mention – Asian Physics Olympiad,** *Tel-Aviv, Israel.*   2011
- **Gold Medal – National Physics Olympiad,** *Sri Lanka*   2011
- **Mahapola Merit-based State Scholarship,** *Government of Sri Lanka*   2010

Teaching Experience

JETSCAPE Online Summer School   July 2021
- Conducted a session on how to use Bayesian parameter techniques to infer simulation model parameters using experimental data. Participants (Ph.D. candidates and postdoctoral researchers) were able to run the code in cloud platform during the session to get hands on practical experience.

Physics 1201: E&M, Optics, Modern Physics, *The Ohio State University*   Fall-2017,2020, Sum-2019
- Teaching assistant to algebra-based introduction to electricity and magnetism, simple optics, overview of modern physics including special relativity and quantum mechanics.

Physics 1250: Mechanics, Work and Energy, Thermal Physics, *The Ohio State University*   Fall-2017,2020, Sum-2019
- Teaching assistant to calculus-based introduction to classical physics: Newton's laws, work and energy, fluids, thermodynamics; for students in physical sciences, mathematics, and engineering.

Physics 1251: E&M, Waves, Optics, Modern Physics, *The Ohio State University*   Fall-2017,2020, Sum-2019
- Teaching assistant to calculus-based introduction to electricity and magnetism, waves, simple optics, and quantum mechanics; for students in physical sciences, mathematics, engineering.

Mathematics GP116: Linear Algebra, *University of Peradeniya*   2017
- Temporary instructor to the introduction of central ideas of linear algebra: vector spaces, linear transformations, orthogonality, eigenvalues, eigenvectors and canonical forms and the applications of these ideas in science and engineering.

Mathematics EM211: Ordinary Differential Equations, *University of Peradeniya*   2017
- Temporary instructor to the introduction of analytical solving techniques of linear ordinary differential equations.

Mathematics 213: Probability and Statistics, *University of Peradeniya* 2016
- Temporary instructor to introduction of basic concepts of probability and inferential statistics: probability distributions, sampling distributions, estimation and confidence intervals and test of hypothesis for engineering students.

Mathematics 212: Calculus II, *University of Peradeniya* 2015
- Temporary instructor to introduction to calculus of functions of several variables: vector values functions and the use of integral theorems in any orthogonal curvilinear coordinates.

Mentoring Experience

Undergraduate Research Mentor 2022,2023
- Mentored *Cullen Gantenberg* on their undergraduate honors thesis research "[Analysis of Anisotropic Flow in Ultrarelativistic Heavy Ion Collisions](#)" at *The Ohio State University, Columbus, OH, USA.*

Data Science Project Mentor May 2021,2022
- Mentored over twenty Ph.D. candidates and postdoctoral researchers on their final data science projects in the *Erdós data science bootcamp, Columbus, OH, USA.*

Assessment Experience

- *Project Judge*: Erdós data science bootcamp (Award for the best data science project) Spring 2023
- *Judge*: Ohio State Science Fair (Award for the best science project by high school students) 2019

Service and Outreach

- *Graduate Student Representative*: Climate and diversity committee, Department of Physics, OSU 2020/2021
- *Volunteer (Course Instructor):* "[Nenathambara](#) - *Transforming Lives Through Technology Education*" 2021-Present
- *Volunteer (Course Instructor):* [*"Arunella"*](#) *– For a Better Future*" 2011-2015
- *Chairperson*: IEEE student branch of University of Peradeniya 2015
- *Vice President*: Rotaract Club of University of Peradeniya 2015

Invited Talks and Presentations

- **Bayesian calibration of viscous anisotropic hydrodynamic simulations of heavy-ion collisions.** 2023
  Talk, Workshop on Information and Statistics in Nuclear Experiment and Theory (ISNET), Washington University, St. Louis, MO.
- **Bayesian Parameter Estimation with Viscous Anisotropic Hydrodynamics Modeling.** 2022
  Invited talk, Fifteenth Workshop on Particle Correlations and Femtoscopy, FRIB, Michigan State University, MI.
- **Bayesian Parameter Estimation of Relativistic Heavy Ion Collisions Simulation with VAH Modeling.** 2022
  Talk, 2022 Fall Meeting of the APS Division of Nuclear Physics, New Orleans, Louisiana.
- **Transfer Learning for Emulation of Hydrodynamic Simulations.** 2021
  Invited talk, Virtual Seminar for the University of Tennessee nuclear physics group.
- **Bayesian Parameter Estimation for Relativistic Heavy Ion Collisions.** 2021
  Talk at the workshop at JETSCAPE summer school.
- **Predictions for 0-5% centrality O-O collisions at 7 TeV.** 2021
  Talk, Online Workshop on Opportunities in O-O and p-O collisions at the LHC, CERN.
- **Transfer Learning Emulation.** 2021
  Talk, Workshop on Information and Statistics in Nuclear Experiment and Theory (ISNET), FRIB, Michigan State University, MI.
- **Transfer Learning for Emulation of Hydrodynamic Simulations.** 2021
  Talk (virtual), 2021 Fall Meeting of the APS Division of Nuclear Physics.

Publications ([iNSPIRE](), [Google Scholar]())

Peer-Reviewed Journal Publications

1. D.P Liyanage, Y. ji, D. Everett, M. Heffernan, U. Heinz, S. Mak, J.-F. Paquet. Efficient emulation of relativistic heavy ion collisions with transfer learning. *Phys. Rev. C*, volume 105, page 034910. American Physical Society, Mar 2022. [[PRC]()]

2. D.P. Liyanage, D. Everett, C. Chattopadhyay, and U. Heinz. Prehydrodynamic evolution and its impact on quark-gluon plasma signatures. *Phys. Rev. C*, volume 105, page 064908. American Physical Society, Jun 2022. [[PRC]()]

3. D.P. Liyanage, Ö. Sürer, M. Plumlee, S. Wild, and U. Heinz. Bayesian calibration of viscous an-isotropic hydrodynamic simulations of heavy-ion collisions. *arXiv e-prints,* page 2302.14184, 2023. Accepted for publication in *Phys. Rev. C.* [[arXiv]()]

4. D.P. Liyanage, U. Heinz. Bayesian model mixing for relativistic heavy-ion collisions. [In preparation]

5. K. Ingles, D.P. Liyanage, A. Semposki, and J. Yannotty. Taweret: Bayesian model mixing package. [In preparation]

6. W.R.C.B.S. Welikala, D.P. Liyanage, A.H.A.D. Abeysekara, M.P.B Ekanayake, G.M.R.I Godaliyadda, and Janaka V. Wijayakulasooriya. Control Strategy for Navigation of a Reconnaissance Robotic System. *Control and Intelligent Systems*, 44(3), 2016. [[ACTA Press]()]

Peer-Reviewed Conference Publications

1. W.R.C.B.S. Welikala, D.P. Liyanage, A.H.A.D. Abeysekara, M.P.B. Eakanayake, G.M.R.I. Godaliyadda, and J.V. Wijayakulasooriya. Versatile Non-Linear Control Strategy for Reconnaissance Robotic System. In *Proc. of 10th IEEE Intl. Conf. on Industrial and Information Systems*, pages 332–337, 2015. [[IEEExplore]()]

2. A.H.A.D. Abeysekara, D.P. Liyanage, W.R.C.B.S. Welikala, G.M.R.I. Godaliyadda, M.P.B. Eakanayake, and J.V. Wijayakulasooriya. Depth Map Generation for a Reconnaissance Robot via Sensor Fusion. In *Proc. of 10th IEEE Intl. Conf. on Industrial and Information Systems*, pages 320–325, 2015. [[IEEExplore]()]

3. W.R.C.B.S. Welikala, A.H.A.D. Abeysekara, D.P. Liyanage, M.P.B. Ekanayake, G.M.R.I. Godaliyadda, and J.V. Wijayakulasooriya. Multi Sensor Fusion for Position and Indoor Navigation. In *Institute of Engineers Sri Lanka* (IESL) Transactions, pages 445–453, 2015.

4. D.P. Liyanage, W.R.C.B.S. Welikala, G.M.R.I. Godaliyadda, M.P.B. Ekanayake, and J.V. Wijayakulasooriya. Accurate Depth Map from Stereo Web Camera Setup. In *Proc. of Peradeniya Univ. Intl. Research Sessions*, page 91, 2015. [[iPURSE Proc.]()]

Peer-Reviewed Collaboration Publications

1. W. Fan, G. Vujanovic, S.A. Bass, A. Angerami, R. Arora, D.P. Liyanage *et al*. [JETSCAPE Coll.] A new metric improving Bayesian calibration of a multistage approach studying hadron and inclusive jet suppression. *arXiv e-prints,* page 2307.09641, 2023. [[arXiv]()]

2. G. Vujanovic, A. Angerami, R. Arora, S.A. Bass, S. Cao, D.P. Liyanage *et al*. [JETSCAPE Coll.] Multiscale evolution of heavy flavor in the QGP. *arXiv e-prints,* page 2307.09640, 2023. [[arXiv]()]

3. Y. Tachibana, A. Kumar, A. Majumder, A. Angerami, D.P. Liyanage *et al*. [JETSCAPE Coll.] Hard jet substructure in a multi-stage approach. *arXiv e-prints,* page 2301.02485, 2023. [[arXiv]()]

4. W. Fan, G. Vujanovic, S.A. Bass, A. Majumder, D.P. Liyanage *et al*. [JETSCAPE Coll.] Multiscale evolution of charmed particles in a nuclear medium. *Phys. Rev. C,* volume 107, page 054901. American Physical Society, May 2023. [[PRC]()]

5. A. Kumar, Y. Tachibana, C. Sirimanna, G. Vujanovic, S. Cao, D.P. Liyanage *et al.* [JETSCAPE Coll.] Inclusive jet and hadron suppression in a multistage approach. *Phys. Rev. C,* volume 107, page 034911. American Physical Society, March 2023. [[PRC]()]

6. D. Everett, D. Oliinychenko, M. Luzum, J.-F. Paquet, D.P. Liyanage *et al.* [JETSCAPE Coll.] Role of bulk viscosity in deuteron production in ultrarelativistic nuclear collisions. *Phys. Rev. C,* volume 106, page 064901. American Physical Society, December 2022. [[PRC]()]

7. D. Everett, W. Ke, J.-F. Paquet, G. Vujanovic, S.A Bass, D.P. Liyanage *et al.* [JETSCAPE Coll.] Multisystem Bayesian constraints on the transport coefficients of QCD matter. *Phys. Rev. C,* volume 103, page 054904. American Physical Society, May 2021. [[PRC]()]

8. D. Everett, W. Ke, J.-F. Paquet, G. Vujanovic, S.A Bass, D.P. Liyanage *et al.* [JETSCAPE Coll.] Phenomenological constraints on the transport properties of QCD matter with data-driven model averaging. *Phys. Rev. Lett.,* volume 126, page 242301. American Physical Society, June 2021. [[PRL]()]

REFERENCES

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