DEEPAK N. SUBRAMANI

deepakns@iisc.ac.in | (O): +91-80-2293 2058; (M) +91-8139883769 | cds.iisc.ac.in/faculty/deepakns
Address: Dept. of Computational and Data Sciences, Room No. 321, Indian Institute of Science, Bengaluru 560012

EXPERIENCE

Indian Institute of Science, Bangalore, India	
Assistant Professor Department of Computational and Data Sciences	31 Dec. 2018 – Present
• Leader of QUEST (Quantifying Uncertainty in Engineering, Science and Technology) Lab	
Massachusetts Institute of Technology, Cambridge MA, USA	
Postdoctoral Research Associate Advisor: Prof. Pierre F.J. Lermusiaux	Dec. 2017 – Nov. 2018
• Developed a data-driven AI and IoT tool for efficient and sustainable fishing. • Further developed our PDE-based optimal ship routing system in dynamic and uncertain ocean currents and waves.	
Graduate Research Assistant Advisor: Prof. Pierre F.J. Lermusiaux	Sept. 2012 – Nov. 2017

• Optimal path planning in strong, dynamic and uncertain environments
  o Developed governing planning S-PDEs and efficient numerical schemes for energy-, stochastic time-, and risk-optimal path planning of autonomous vehicles.
  o Completed multiple sea experiments for real-time validation of our path planning system with REMUS 600 AUVs in Buzzard's Bay.
• Uncertainty quantification and probabilistic regional ocean predictions
  o Developed theory, schemes and implemented dynamically orthogonal ocean primitive equations for quantifying and predicting uncertainties in regional oceans.
  o First full-fledged ocean modeling system with probabilistic prediction capability.
• The above uncertainty quantification theory and schemes is accurate and computationally faster (3-4 orders of magnitude) compared to earlier approximate methods.	

SKILLS

Machine Learning; Deep Learning; Artificial Intelligence; Uncertainty Quantification; Numerical Ocean Modeling; Nonlinear Data Assimilation; Nonlinear Optimization.

IN-HOUSE HPC SOFTWARE

Stochastic Path Planner for Marine and Aerial Vehicles: In-house scalable CPU and GPU software for optimal path planning of autonomous marine and aerial vehicles in stochastic dynamic environments.
Probabilistic Regional Ocean Forecasting System: In-house stochastic dynamically orthogonal ocean primitive equation solver for predicting 4-D (3-D in space and 1-D in time) probabilities of dynamic ocean states.

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA

Ph.D. in Mechanical Engineering and Computation   Nov. 2017

Thesis: Probabilistic Regional Ocean Predictions: Stochastic Fields and Optimal Path Planning

Major: Computational Science and Engineering

Minors: Stochastic Systems; Ocean Sciences; Technology and Public Policy;
        Development in Resource Constrained Economies (set of three courses in each)

M.S. in Computation for Design and Optimization   2014

Thesis: Energy Optimal Path-Planning using Dynamically Orthogonal Level-Set Optimization   GPA: 4.8/5

Indian Institute of Technology Madras, Chennai, India

M.Tech and B.Tech in Mechanical Engineering   2012

Masters specialization: Energy Technology   GPA: 9.11/10

Minor: Operations Research

Thesis: Profile Match-up Algorithms for Geophysical Retrievals and Their Application for Data Assimilation

AWARDS

IISc Award for Excellence in Teaching 2022 Indian Institute of Science, Bengaluru	2022
Arcot Ramachandran Young Investigator Award Division of Interdisciplinary Research, IISc Bengaluru	2019 – 2021
Postdoctoral and Graduate Fellowship MIT-Tata Center	2015 – 2018
SNAME Graduate Travel Award in Ocean Engineering Department of Mechanical Engineering, MIT, Cambridge, MA	Dec. 2017
Wunsch Foundation Silent Hoist & Crane Award for Outstanding Research Department of Mechanical Engineering, MIT, Cambridge, MA	May 2017
First Place in Graduate Science De Florez Design Competition, MIT, Cambridge, MA	May 2017
Best Demonstration/Prototype Award Mechanical Engineering Research Exhibition 2016, MIT, Cambridge, MA	Sept. 2016
Esteemed Presenter Award for Best Computational Research Mechanical Engineering Research Exhibition 2015, MIT, Cambridge, MA	Sept. 2015
Best Poster Award Center for Computational Engineering Symposium, MIT, Cambridge, MA	Mar. 2015
Runner-up Poster Award DyDESS 2014 Conference, Cambridge, MA	Nov. 2014
Institute Merit Prize (Highest GPA in Energy Technology) Indian Institute of Technology Madras, India	2012
GE Foundation Award GE Foundation Scholar-Leaders Program (Global)	2009-2011
National Talent Search (NTS) Scholar, India	2005

PHD/MTECH SUPERVISION

1. **Graduated/Submitted**
   a. **MPI and CUDA-based Implementation of High-order Narrow-band Level-set Schemes for Time-optimal Ship Routing** (Chennam Revanth Sri Sesha Sai, 2020 M.Tech)
   b. **Deep Learning of Synoptic Ocean Features from Concurrent Satellite Images** (Raghav Sharma, 2020 M.Tech)
   c. **Digital Twins for Satellite Systems** (Ramkiran Balivada, 2021 M.Tech)
   d. **Deep Sequence Models for Fault Detection** (Sivasangaran, 2022 M.Tech)
   e. **Deep Learning for Satellite Oceanography** (Devyani Lambhate, 2021, M.Tech (Research))
   f. **Polynomial Chaos-Gaussian Mixture Model Filtering: Theory, Schemes and Applications** (Srikanth Avasarala, 2022, M.Tech (Research))
2. **Ongoing Ph.D. Students**
   a. **Optimal Path Planning of Autonomous Marine Vehicles** (PhD, Rohit Chowdhury, Joined 2018)
   b. **Time Series Modeling and Data Assimilation** (PhD, Akanksha Rajak, Joined 2018)
   c. **Ocean Modeling and Data Assimilation** (PhD, P. Abhishek, Joined 2019)
   d. **Machine Learning, Combinatorial Optimization and Environmental Applications** (PhD, Sumanth Boya, Joined 2020)
   e. **AI for Social Good: Applications of ML in Human-Wildlife Conflict** (PhD, P. Anjali, Joined 2020)
   f. **Physics-Informed Neural Networks and Data Assimilation** (PhD, Rishi J, Joined 2022)
   g. **Turbulent simulations with PINNs** (PhD, Azhar, Joined 2022)
   h. **Computer Vision for Satellite Oceanography** (PhD, Apoorva Dinesh Singh, Joined 2022)
   i. **AI for Human Learning and Educational Technology** (PhD, Nicy Scaria, Joined 2022)

SPONSORED RESEARCH

Fast and Scalable Algorithms for On-Board Routing of Autonomous Agents in Stochastic Dynamic Environments – 37 Lakhs
SERB 2022 – 2025 [PI].
MODES: Machine Learning for Ocean Data Assimilation, Estimation and Simulation – 57 Lakhs
Ministry of Earth Sciences 2022 – 2025 [PI].
WAKE-NET: A Fast and Scalable Physics Informed Neural Network for Wind Farm Simulation – 1.92 Crores
Shell India Technology Limited 2022 – 2025 [PI].
INSPIRE Faculty Fellowship – 35 Lakhs
Department of Science and Technology, Govt. of India. Jan 2019-Jan 2024 [PI]
Deep Learning for EV Fault Detection – 11 Lakhs
Altigreen Propulsion Private Limited 2022 – 2024 [PI].
DECOVID: Data-assimilation and Error Correction Of Viral Infectious Diseases Models – 5.5 Lakhs
Department of Science and Technology, SERB MATRICS Covid Special Call July 2020 – July 2021 [PI]
Arcot Ramachandran Young Investigator Award – 6 Lakhs
Indian Institute of Science, Bengaluru. Oct 2019 - Oct 2021 [PI]
Data Assimilation for Ship Routing – 5.56 Lakhs
Maersk Digital Center, Bangalore, India. Jan 2019 - Jul 2020 [PI]
SPADE: Stochastic Parmoon for Analysis, Design and Estimation – 98.4 Lakhs
Ministry of Human Resource Development STARS program. Mar 2020 – Mar 2023 [Co-PI; 50% Role]
Hardware Aware Algorithms in Scientific Computing – 1.6 Crores
UGC-Indo German Partnership 2021-2025 [Co-PI; 25% Role]

PROFESSIONAL ACTIVITY

- Topic Editor, Geoscientific Model Development, European Geosciences Union
- Expert Panel Member for Data Science at VIT-AP Recruitment
- Board of Studies Member, Periyar University Mathematics Department
- Expert panel member on mathematical modeling of infectious disease spread – podcasts, news discussion, conferences.
- More than 30 Invited lectures delivered at universities, colleges, and industry labs.
- Participant at the NASA JPL-Caltech Climate Summer School 2017
- Received the Kaufman Teaching Certificate in June 2015.
- Reviewer for Robotics and Autonomous Systems, International Journal of Control, Automation and Systems, IEEE Journal of Cybernetics, IEEE International Conference on Robotics and Automation, Journal of Computational and Nonlinear Dynamics, Dynamic Data-Driven Environmental System Sciences Conference, International Journal of Thermal Sciences, The Sea, Current Science, Sadhana, Remote Sensing of the Environment, IEEE TGRS.

PUBLICATIONS

Google Scholar Profile: https://scholar.google.com/citations?user=d-V0TTwAAAAJ&hl=en
As on 24 Aug 2023 – Number of Citations: 761, h-index: 17, i10-index: 18
[Since Joining IISc, Bangalore]
Papers in Peer-Reviewed International Journals

1. Abhishek Pasula, D. N. Subramani (2023). Cause and impact of Andaman Sea's salinity variability: A modeling study, **Deep Sea Research Part II: Topical Studies in Oceanography**, Volume 209, 105291, ISSN 0967-0645, https://doi.org/10.1016/j.dsr2.2023.105291.
   [Impact Factor – 2.88. Paper with student Abhishek]
   [Identified the contribution of Summer Monsoon Current in Andaman Sea's salinity variability. Completed particle trajectory analysis and EOF analysis.]

2. R. Chowdhury and D. N. Subramani (2022). *Optimal Path Planning of Autonomous Marine Vehicles in Stochastic Dynamic Ocean Flows using a GPU-Accelerated Algorithm.* **IEEE Journal of Oceanic Engineering** doi: 10.1109/JOE.2022.3152514
   [Impact Factor – 3.88. Paper with student Rohit]
   [A fast GPU-implemented algorithm for path planning giving 1000x speed-up compared to serial code.]

3. Chowdhury, R., Navsalkar, A. and D. Subramani (2022). GPU-Accelerated Multi-Objective Optimal Planning in Stochastic Dynamic Environments. **Journal of Marine Science and Engineering**, 10(4), p.533.
   [Impact Factor – 2.9. Paper with student Rohit and summer intern Atharva.]
   [A fast GPU-implemented algorithm for path planning giving 1000x speed-up compared to serial code.]

4. R. Gadi, P. N. Vinayachandran, D. N. Subramani (2021). *Data-Driven Feature Modeling of Southwest Monsoon Current*. **Ocean Modelling**. Vol 168, 101912 https://doi.org/10.1016/j.ocemod.2021.101912
   [Impact Factor – 3.686. Paper with research associate Ratnakar. Collaborators provided the data.]
   [First application of the FORMS methodology in the Indian Ocean resulting in a significant improvement in representation of observed features in simulation.]

5. S. Avasarala and D. N. Subramani (2021). *A non-Gaussian Bayesian Filter for Sequential Data Assimilation with non-intrusive Polynomial Chaos Expansion*. **International Journal for Numerical Methods in Engineering.** 122(23), 7156-7181**. https://doi.org/10.1002/nme.6827**
   [Impact Factor – 3.9. Paper with student Srikanth.]
   [A non-intrusive non-Gaussian algorithm that is expected to increase adoption of powerful GMM filtering for a variety of scientific applications.]

6. D. Lambhate, R. Sharma, J. Clark, A. Gangopadhyay and D. Subramani (2021). *W-Net: A Deep Network for Simultaneous Identification of Gulf Stream and Rings from Concurrent Satellite Images of Sea Surface Temperature and Height*. **IEEE Transactions on Geoscience and Remote Sensing**. DOI: 10.1109/TGRS.2021.3096202
   [Impact Factor – 5.6. Paper with students Devyani and Raghav. Collaborators provided the data.]
   [First application of deep learning for Gulf Stream and Rings detection. Novel architecture and physical interpretation of deep layers provided.]

7. S. Ganesan and D. N. Subramani (2020). *Spatio-temporal predictive modeling framework for infectious disease spread*. **Scientific Reports**. 11, 6741 (2021). DOI: 10.1038/s41598-021-86084-7
   [Impact Factor – 5.134. Sci. Rep. is a respected interdisciplinary journal with wide readership. Paper is ranked #1 by AltMetrics among papers of similar age in Sci. Rep.]
   [A novel population balance PDE for predicting the spatio temporal spread of infectious diseases with a focus on Covid-19 in India]

8. G. Mannarini, D. N. Subramani, P. F. J. Lermusiaux and N. Pinardi (2019). *Graph-Search and Differential Equations for Time-Optimal Vessel Route Planning in Dynamic Ocean Waves* in **IEEE Transactions on Intelligent Transportation Systems**. DOI: 10.1109/TITS.2019.2935614.

[Impact Factor – 5.744. IEEE TITS is a top journal for research on intelligent transportation systems.]
[This collaborative work with groups in Italy, USA and India (me from IISc) show the first direct comparison of our data-driven PDE-based methodologies for routing marine traffic and graph search methods, clearly showing the former's advantage.]

9. Subramani, D.N. and P.F.J. Lermusiaux (2019). *Risk Optimal Path Planning in Stochastic Dynamic Environments.* **Computer Methods in Applied Mechanics and Engineering**. Volume 353, 15 August 2019, Pages 391-415.
[Impact Factor - 5.02. CMAME is a top journal in the field of data-driven computational methods for engineering applications.]
[Combined decision theory and data-driven stochastic planning methods for learning paths for autonomous agents that minimize risk of being sub-optimal in uncertain dynamic environments]

Arxiv Papers

1. Ganesan, S., Subramani, D., Anandh, T., Ghose, D. and Babu, G., 2021. Ensemble Forecast of COVID-19 for Vulnerability Assessment and Policy Interventions. MedRxiv Pre-print DOI: 10.1101/2021.08.31.21262943
[Early warning of Covid Wave 3 impact in Karnataka and science-based policy recommendations.]

Papers in Peer-Reviewed International Conferences (with Proceedings)

1. Chowdhury, R., Murugan, R., and Subramani, D. (2023). Intelligent Onboard Routing in Stochastic Dynamic Environments using Transformers. In Proceedings of the 2023 **International Conference on Autonomous Agents and Multiagent Systems** (pp. 1688-1696). [AAMAS - Core A* Conference]
[Work completed with my Ph.D. student Rohit Chowdhury, and summer intern Murugan.]
[Developed a decision transformer that learns on-board routing goals through expert trajectories from level set equations.]

2. A. Pasula and D. N. Subramani (2022). 4D-Var Data Assimilation of Sea Surface Temperature in a Regional Model of the Andaman Sea. OCEANS 2022, Hampton Roads, Hampton Roads, VA, USA, 2022, pp. 1-6, doi: 10.1109/OCEANS47191.2022.9977119.
[Work completed with my Ph.D. student Abhishek.]
[Improved ROMS simulation with 4D var data assimilation with Sea Surface Temperaturem.]

3. P. Anjali and D. N. Subramani (2021). Inter and Intra-Annual Spatio-Temporal Variability of Habitat Suitability for Asian Elephants in India: A Random Forest Model-based Analysis, 2021 IEEE International India Geoscience and Remote Sensing Symposium (InGARSS), Ahmedabad, India, 2021, pp. 467-470, doi: 10.1109/InGARSS51564.2021.9792132.
[InGARSS is a respected geoscience conference in India conducted by the IEEE GRSS, India Chapter. Paper won second place in the student presentation category.]
[Developed a Random Forest algorithm for species distribution modelling of Asian Elephants in India].

4. Chowdhury, R. and D. N. Subramani (2020). Physics-Driven Machine Learning for Time-Optimal Path Planning in Stochastic Dynamic Flows. In: Darema F., Blasch E., Ravela S., Aved A. (eds) Dynamic Data Driven Application Systems. DDDAS 2020. Lecture Notes in Computer Science, vol 12312. Springer, Cham. https://doi.org/10.1007/978-3-030-61725-7_34
[DDDAS is the topmost conference in the field of data driven application systems conducted at MIT. Work completed with my Ph.D. student Rohit Chowdhury.]
[Developed a novel reinforcement learning algorithm that learns from a distribution of pre-planned time-optimal paths, and updates policy onboard by data assimilation.]

5. Lambhate, D. and D. N. Subramani (2020). *Super Resolution of Sea Surface Temperature Satellite Images*. In: IEEE/MTS Oceans '20 Gulfcoast. Oct 2020.
[Popular conference for any application related to oceans. Work completed with student Devyani]
[Developed a novel Bayesian deep learning algorithm for super-resolution of SST.]

6. A. Gupta, P. J. Haley, D. N. Subramani and P. F. J. Lermusiaux (2019), "Fish Modeling and Bayesian Learning for the Lakshadweep Islands," *OCEANS 2019 MTS/IEEE SEATTLE*, 2019, pp. 1-10, doi: 10.23919/OCEANS40490.2019.8962892.
[Popular conference for any application related to oceans.]
[Developed a fish modelling system using machine learning and dynamical ocean forecasts.]

7. Ali, W.H., M.H. Mirhi, A. Gupta, C.S. Kulkarni, C. Foucart, M.M. Doshi, D.N. Subramani, C. Mirabito, P.J. Haley, Jr., and P.F.J. Lermusiaux, (2019). *SeaVizKit: Interactive Maps for Ocean Visualization*. In: OCEANS '19 MTS/IEEE Seattle, 27-31 October 2019, doi:10.23919/OCEANS40490.2019.8962794
[Popular conference for any application related to oceans.]
[Developed a web based visualization toolkit for ocean state forecasts.]

Papers Presented in Important Conferences (with no Proceedings; Peer-Review only of Abstract)

1. P Abhishek, D Subramani (2024) AI-based correction of CMIP6 ocean projections. AGU Ocean Sciences Meeting 2024 at New Orleans, USA

2. P Patel, PN Vinayachandran, D Subramani (2024) Variations of Eddy Characteristics Along the East Coast of India. AGU Ocean Sciences Meeting 2024 at New Orleans, USA

3. P Abhishek, D Subramani (2022) Inter-Annual Variability of Monsoon and Post-Monsoon Salinity in Andaman Sea, AGU Ocean Sciences Meeting 2022 at Hawaii, USA (Held completely online)

4. D Subramani, R Sharma, A Gangopadhyay (2020) Deep Learning for Detecting Gulf Stream and Eddies from Satellite Images, AGU Ocean Sciences Meeting 2020 at San Diego USA. (Presented orally in person)

5. P Abhishek, R Gadi, D Subramani (2020) Bayesian Estimation and Data Assimilation for Probabilistic Regional Forecasts in the northern Indian Ocean, AGU Ocean Sciences Meeting 2020 at San Diego USA. (Presented orally in person)

Patents

1. Lermusiaux, Pierre, Deepak Narayanan Subramani, Chinmay Kulkarni, and Patrick Haley. "Route determination in dynamic and uncertain environments." U.S. Patent 11,435,199, issued September 6, 2022.

[Before joining IISc Bangalore - 31 Dec 2018]

Papers in Peer-Reviewed International Journals

10. Subramani, D.N., Q.J. Wei and P.F.J. Lermusiaux (2018). *Stochastic Time Optimal Path Planning in Uncertain, Strong, and Dynamic Flows.* **Computer Methods in Applied Mechanics and Engineering**. 333, pp 218-237. doi: 10.1016/j.cma.2018.01.004
[Impact Factor - 5.02. CMAME is a top journal in the field of data-driven computational methods for engineering applications.]
[Developed data-driven time-optimal planning algorithm for robot motion in uncertain dynamic environments.]

11. Lermusiaux, P.F.J., D.N. Subramani, J. Lin, C.S. Kulkarni, A. Gupta, A. Dutt, T. Lolla, P.J. Haley Jr., W.H. Ali, C. Mirabito, and S. Jana (2017). *A Future for Intelligent Autonomous Ocean Observing Systems.* **The Sea Vol. 17: The Science of Ocean Prediction**, Special Issue of J. Marine Res., 75, 765–813.
[Impact Factor - NA. The Sea is a prestigious and classic monograph with invited review papers recently revived. Co-authors are members of group led by Prof. Lermusiaux at MIT.]
[My contribution is a review of data-driven optimal planning methods for intelligent marine robots and a description of real-time demonstration with REMUS 600 AUVs]

12. Subramani, D. N., P. J. Haley, Jr., and P. F. J. Lermusiaux (2017). Energy-optimal path planning in the coastal ocean, **Journal of Geophysical Research: Oceans**, 122, 3981–4003, doi:10.1002/ 2016JC012231

[Impact Factor – 2.71. JGR: Oceans is a flagship journal by the American Geophysical Union for research related to applications in oceanography.]
[Demonstrated realistic simulations of data-driven energy-optimal planning of autonomous gliders.]

13. Sun, W., P. Tsiotras, T. Lolla, <u>D.N. Subramani</u>, and P.F.J. Lermusiaux (2017). *Multiple-Pursuit/One-Evader Pursuit Evasion Game in in Dynamical Flow Fields.* **Journal of Guidance, Control, and Dynamics**. doi: 10.2514/1.G002125.
[Impact Factor – 2.061. JGCD is a flagship journal by the AIAA for research related to control theory in aerospace applications. Co-authors are experts in pursuit evasion games with application to autonomous vehicles.]
[My contribution is towards developing the idea of using level-set equations for devising a stopping criterion for pursuit evasion games in dynamical flow fields.]

14. Lermusiaux, P.F.J., P.J. Haley Jr., S. Jana, A. Gupta, C.S. Kulkarni, C. Mirabito, W.H. Ali, <u>D.N. Subramani</u>, A. Dutt, J. Lin, A. Y. Shcherbina, C. M. Lee, A. Gangopadhyay (2017). *Optimal Planning and Sampling Predictions for Autonomous and Lagrangian Platforms and Sensors in the Northern Arabian Sea* **Oceanography** 30(2), 172-185.
[Impact Factor – 3.883. Oceanography is a popular journal by The Oceanography Society that published invited review articles. Co-authors are members of group led by Prof. Lermusiaux at MIT.]
[My contribution is towards providing data-driven reachability front predictions for gliders deployed in a real-time sea exercise in the Northern Arabian Sea.]

15. <u>Subramani, D.N.</u> and P.F.J. Lermusiaux (2016). *Energy Optimal Path Planning by Stochastic Dynamically Orthogonal Level-Set Optimization*. **Ocean Modelling**, 100, pp 57-77.
[Impact Factor - 3.503. OM is the most respected venue for data-driven computational modelling in the ocean domain.]
[First ever stochastic optimization technique for exact data-driven energy-optimal path planning of marine robots.]

16. <u>Subramani, D.</u>, Chandrasekar, R., Ramanujam, K.S. and C. Balaji (2014). *A new ensemble-based data assimilation algorithm to improve track prediction of tropical cyclones.* **Natural Hazards,** 71, pp 659-682.
[Impact Factor – 3.102. Natural Hazards is a popular venue for data-driven predictions of environmental hazards.]
[Developed a Bayesian inference algorithm for data-driven prediction of tropical cyclones.]

17. S. Ramanujam, C. Radhakrishnan, <u>D. Subramani</u> and C. Balaji (2012). *On the Effect of Non-Raining Parameters in Retrieval of Surface Rain Rate Using TRMM PR and TMI Measurements*. **IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing**, 5(3), pp. 735-743.
[Impact Factor – 3.784. IEEE JSTARS is within the top 10 journals for remote sensing and computational methods in earth sciences. First author was a research scholar at IIT Madras.]
[My contribution was in developing a Bayesian retrieval algorithm from a precipitation radar. Co-authors had developed a retrieval algorithm from Microwave Imager that needed information from radar data for correct inference, which I completed.]

Papers in Peer-Reviewed International Conferences (with Proceedings)

8. <u>Subramani, D.N.</u>, T. Lolla, P.J. Haley and P.F.J Lermusiaux (2015). *A stochastic optimization method for energy-based path planning*. In: Ravela, S., Sandu, A. (Eds.), Vol. 8964 Lecture Notes in Computer Science, Springer, pp. 347-358.
[The papers presented at the Dynamic Data Driven Environmental System Science Conference 2014 was published in LNCS.]
[Introduced the use of stochastic optimization for data-driven energy-optimal planning in dynamic environments.]

9. <u>Subramani, D. N.</u>, P. F. J. Lermusiaux, P.J. Haley, Jr., C. Mirabito, S. Jana, C. S. Kulkarni, A. Girard, D. Wickman, J. Edwards, J. Smith (2017). *Time-Optimal Path Planning: Real-Time Sea Exercises*. In: Oceans

'17 MTS/IEEE Aberdeen, 19-22 June 2017, DOI: 10.1109/OCEANSE.2017.8084776.
[Popular conference for any application related to oceans.]
[First demonstration of real-time applicability of data-driven time-optimal planning with REMUS 600 AUVs in real-time.]

10. Mirabito, C., D.N. Subramani, T. Lolla, P.J. Haley, Jr., A. Jain, P.F.J. Lermusiaux, C. Li, D.K.P. Yue, Y. Liu, F.S. Hover, N. Pulsone, J. Edwards, K.E. Railey, and G. Shaw, (2017). *Autonomy for Surface Ship Interception*. In: Oceans '17 MTS/IEEE Aberdeen, 19-22 June 2017, DOI: 10.1109/OCEANSE.2017.8084817.
[Co-authors are experts in acoustics for naval applications.]
[Results and software of data-driven time-optimal planning of autonomous agents used to demonstrate a ship interception application.]

11. Sun, W., P. Tsiotras, T. Lolla, D. N. Subramani, and P. F. J. Lermusiaux, (2017). *Pursuit-Evasion Games in Dynamic Flow Fields via Reachability Set Analysis.* 2017 American Control Conference. Seattle, WA, 2017, pp. 4595-4600. doi: 10.23919/ACC.2017.7963664
[ACC is a flagship international conference on science and engineering of control systems. Co-authors are experts in pursuit evasion games with application to autonomous vehicles.]
[My contribution is towards developing the idea of using level-set equations for devising a stopping criterion for pursuit evasion games in dynamical flow fields.]

12. Edwards, J., J. Smith, A. Girard, D. Wickman, P.F.J. Lermusiaux, D.N. Subramani, P.J. Haley, Jr., C. Mirabito, C.S. Kulkarni, and, S. Jana, (2017). *Data-driven Learning and Modeling of AUV Operational Characteristics for Optimal Path Planning*. In: Oceans '17 MTS/IEEE Aberdeen, 19-22 June 2017, DOI: 10.1109/OCEANSE.2017.8084779
[Popular conference for any application related to oceans. Co-authors own and operated the AUV.]
[Developed data-driven models for predicting AUV speed from data collected by co-authors who operated the AUV.]

13. Ferris, D.L., D.N. Subramani, C.S. Kulkarni, P.F.J. Lermusiaux (2018). *Time-Optimal Multi-Waypoint Mission Planning in Dynamic Environments*. In: MTS/IEEE Oceans '18 Charleston, pp 1-8. doi: 10.1109/OCEANS.2018.8604683
[Popular conference for any application related to oceans. First author was a Master's student under Prof. Lermusiaux, who worked with my help for his thesis while I was a post-doc.]
[Demonstrated a solution to the optimal tours to be taken by AUVs to visit multiple targets in a dynamic environment. The setup resembles a dynamic traveling salesman problem.]

14. Dutt, A., D.N. Subramani, C.S. Kulkarni, P.F.J. Lermusiaux (2018). *Clustering of Massive Ensemble of Vehicle Trajectories in Strong, Dynamic and Uncertain Ocean Flows*. In: MTS/IEEE Oceans '18 Charleston, pp 1-8. doi: 10.1109/OCEANS.2018.8604683
[Popular conference for any application related to oceans. First author was a Master's student under Prof. Lermusiaux, who worked with my help while I was a post-doc.]
[First demonstration of unsupervised clustering algorithms on massive ensembles of optimal paths taken by AUVs, with a goal to learn optimal paths from data.]

Papers Presented in Important Conferences (with no Proceedings; Peer-Review only of Abstract)

6. Subramani, D. N., & Lermusiaux, P. F. (2018, February). Probabilistic Risk-Optimal Path Planning and Sampling in Uncertain Environments. In 2018 Ocean Sciences Meeting. AGU.

7. Subramani, D. N., Haley Jr, P., & Lermusiaux, P. F. (2017, December). Stochastic Ocean Predictions with Dynamically-Orthogonal Primitive Equations. In AGU Fall Meeting Abstracts (Vol. 2017, pp. NG34A-02).

8. Subramani, D. N., Haley Jr, P. J., & Lermusiaux, P. F. (2016, December). Probabilistic Predictions of Regional Ocean Dynamics. In AGU Fall Meeting Abstracts (Vol. 2016, pp. A41G-0145).

9. D.N. Subramani, P. Haley Jr. and P.F.J. Lermusiaux (2016, April) Probabilistic Regional Ocean Predictions. SIAM Uncertainty Quantification Meeting. SIAM

10. Subramani, D. N., Haley Jr, P. J., & Lermusiaux, P. F. (2016, February). Energy Optimal Path Planning: Integrating Coastal Ocean Modelling with Optimal Control. American Geophysical Union Ocean Science Meeting, 2016, PO12A-07.