

Presentation type : Poster

Title : Sampling low-fidelity outputs for estimation of high-fidelity density and its tails

Authors' name (affiliation) :

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Statement for SIAM UQ24 Conference Student Travel Award

Research Interest and Experience:

As a statistics student, my research has always been rooted in data. During my master's studies, while analyzing challenging climate data, I began to see the potential of integrating governing physics equations into data analysis. I became curious in how data-driven methods could be enhanced with physical laws, potentially leading to superior model performance, better interpretability and practical relevance.

My research interests have been broadened by internship experiences. Working with Lawrence Livermore National Laboratory team introduced me to the application of reduced-order modeling for accelerating physics simulations. I had opportunity to gain insights into studies utilizing neural operators for dimension reduction like DeepONet and the concept of physics informed neural networks. My subsequent internship at Moloco broadened my technical understanding of neural network models within a real-world tech environment.

Under the guidance of my advisor, Prof. Vladas Pipiras, I am engaged in doctoral research on questions concerning multi-fidelity, reduced-order models and extremal behavior with applications to ship motion and related dynamics. So far, I worked on calibrating certain reduced-order models to higher-fidelity ship motion programs, and sampling of low-fidelity outputs for which to obtain the corresponding higher-fidelity outputs to estimate the density thereof (the subject of my poster). Employing statistical techniques such as importance sampling for surrogate models, Monte Carlo simulations, extreme value theory, and machine learning, my goal is to develop methods that accurately incorporate the inherent physics and can provide reliable insights.

Rationale for Conference Support:

In my interactions with domain experts, I initially faced challenges in explaining the role of statistics in their fields. Upon reflection, I realized that overcoming this was not just about deepening my statistical knowledge. It was rather the continuous engagement and open communication with others that truly allowed me to challenge my own perspectives and grow. Under the mentorship of my academic advisor, I learned more on how statistical perspectives can contribute to interdisciplinary research. Engaging with domain experts taught me about the synergy of collaboration through shared knowledge. These experiences have emphasized to me the value of community and mentorship in both personal and professional growth.

Attending the SIAM UQ24 conference is more than presenting research or acquiring knowledge; it's a platform for intellectual growth and collaboration. The conference offers a unique opportunity to learn from leading researchers, exchange ideas, receive feedback, and familiarize with the latest advancements. The conference aligns with my research interests and career aspirations, offering an invaluable experience to further my understanding and contributions to the field.

¹work done while in UNC Chapel Hill