

Advanced Computing Training Program

Final Report

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The two-month period (between April and May 2019) of training under the Advanced Computing Training Program at the University of Texas at Austin was spent under the mentoring of Prof. Tan Bui-Thanh from the Department of Aerospace Engineering and Engineering Mechanics and Institute for Computational Engineering and Sciences (ICES).

Prof. Bui-Thanh's research is mainly focused on large-scale high-dimensional Bayesian inverse problems. These methods are applied to several domains such as geophysics, geosciences and medical imaging. As these methods do require large computational infrastructures and HPC, an important topic of his research is also the development of model-order reduction techniques without impacting the inference of the posterior distributions.

The two-month training program was developed after finding a common ground between Prof. Bui-Thanh's research lines and my personal skills and experience on geostatistics, geophysical inverse problems and subsurface modelling and characterization. We developed and applied randomized methods for large-scale seismic inverse problems in models with number cells in the order of 10^6 . These methods were implemented and applied in synthetic application examples to assess its performance and quality of the prediction.

From my personal point of view, this training period allowed me to acquire and deepen my knowledge on Bayesian inverse problem and stochastic methods to approximate the posterior distribution of the inverse solution, along with model-order reduction techniques. During this period, I was also able to attend some seminars held at ICES by PhD students and post-doc researchers of this institution. These seminars covered interesting topics related to seismic inversion.

The expertise acquired at ICES allowed me to get in touch with the most recent research trends in the topics explored during the visiting period. This experience will definitely contaminate the research lines of my PhD students in future. To strengthen the collaboration between my research group and Prof. Bui-Thanh's group, we will be exploring joint research funding opportunities, namely through the calls under the UTAustin|Portugal program, which will allow

exchanges students and fund visits between both groups. This topic was deeply discussed and a series of research topics identified.

I also had the opportunity to assist the final deployment stage of the current state-of-art cluster, Frontera, at the Texas Advanced Computing Center. This new computational infrastructure represents a landmark in HPC and scientific visualization for American and worldwide academic institutions. A key contact made during the duration of the program was Mr. Barbosa, a researcher from the Texas Advanced Computing Center. This contact allowed me to know other research fields within the Texas Advanced Computing Center, such as scientific visualization. In the near future I wish to explore opportunities with his group as well.

The Advanced Computing Training Program represents a unique opportunity to get in touch and being exposed to leading edge high performance computing and scientific visualization tools available in worldwide recognized institutions such as the Texas Advanced Computing Center and ICES. The program will definitely have an impact on my future research directions.