

PROJECT SUMMARY

Overview:

Computational scientists need to learn how to take advantage of the rapidly evolving cyberinfrastructure eco-system to maximize scientific discovery: explanation, prediction, and optimization. This is important for both simulation-driven and data-driven computational science. Computational scientists should begin learning in their pre-university studies and continue through their doctoral studies. Key ideas to be learned include how to compute multi-lingually while connecting different software libraries, how to compute in diverse hardware environments, how to compute as an interdisciplinary team, and how to ensure that computational results can be reproduced.

This will project will develop curricular, co-curricular, and extra-curricular elements to teach students from computer science, mathematical science, and the natural sciences how to be productive computational scientists using the most advanced developments in cyberinfrastructure. Learning will take place through newly developed courses designed for multiple majors, special summer courses, tutorials, course projects arising from industry and government labs, internships, and projects that broaden the graduate theses. Students at earlier stages of the learning process will be mentored by those who are further along.

Intellectual Merit:

Tomorrow's computational scientists must be broad. They cannot afford to exist in a silo of one language, one hardware environment, and one application area. They should know at least two of each. Learning a second language, computing environment, or application will make it easier when they need to learn a third. Computational scientists must understand what the application domain deems significant to compute, the computational error of algorithms, valid inference based on models fitted to training data, and how to compute efficiently. This learning happens best over an extended period of time and via multiple modes of learning. Learning opportunities must accommodate students from different majors with different deficiencies.

This project, led by the Center for Interdisciplinary Scientific Computation and involving PIs and external advisors from multiple disciplines, will coordinate the resources inside and outside our Illinois Tech to ensure that future computational scientists have the required breadth of education and experience to utilize advanced cyberinfrastructure in a responsible way. This will be done without lengthening the time for degree completion by replacing non-crucial term-time activity and enhancing summer activity.

Broader Impacts:

Computational scientists being trained by our new program will cross-pollinate their disciplines with the good computational practices that they learn from other disciplines. These computational scientists will be better prepared to contribute immediately to large research projects. The partnerships that we establish with industry and government research labs will be mutually beneficial. Students who do not pursue careers in computational science will still benefit from the increased opportunities to learn computational thinking and practice. The reach of this program will extend beyond our own students but to underrepresented minority students in Chicagoland and college students at institutions where research opportunities are less. Our renovation of the Illinois Tech's computational science education will be sustained beyond the end of this project. The lessons that we learn will be shared with others via conferences in multiple disciplines and in the online resources that we develop.