Semantic Program Analysis for Scientific Model Augmentation

Dr. James Fairbanks
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10:00 – 11:00 am
Harvill Building, Room 460
Located at 1103 E 2nd St.

Abstract:
Traditionally, computational models are implemented by translating conceptual models of natural phenomena into mathematical models on a chalkboard and then implementing those models in high level code that is then compiled into executable instructions to run on a machine. Small changes to the model can lead to large and complex changes of the implementing software. Modeling frameworks attempt to solve this problem by creating embedded Domain Specific Languages for describing models. Dr. Fairbanks will discuss a novel approach to modeling frameworks, SemanticModels.jl, which represents models at a semantic level and allows novel models to be expressed in terms of transformations on existing models. Code implementing the novel models is generated, compiled, and executed in an interactive modeling environment.

We will discuss how knowledge graphs, category theory, abstract algebra, and program analysis can help analyze software implementing scientific models. This analysis leads to practical tools for helping scientists develop novel models.

Biography
Dr. James Fairbanks is a research engineer at the Georgia Tech Research Institute where he has worked on applied research problems since 2016. His research interests include scientific and mathematical computing and data science. Prior to joining GTR, he studied numerical, statistical, and streaming algorithms for the analysis of large, complex graphs at Georgia Tech.
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