ASKE-E Simulation Design Working Group

December 4th, 2020

Goals of the Working Group

Demonstrate proofs of concept for the simulation portion of the pipeline.

Demonstrate complex visions of simulation design.

Challenge Problems for the Working Group

- Given a model, how do we do advanced and complicated operations?
  - What does complex experimental design look like for a model?
  - How do we identify models in a structural model space to generate and execute?
  - How do we validate models?
  - How do we compare to model executions?
- Challenging Models
  - Multi-scale models

Challenge Problems for the Working Group

Prior to generating code we need:

- A model or models to execute
- An experimental design over these models
- An architecture/solution method to target for generation.

Challenge Problems for the Working Group

The Feedback Loop of “Learning from Simulation”

- We simulate a model to:
  - Learn about the model (diagnostic)
  - Learn about reality (prognostic)

- Diagnostic models
  - Knowledge needs to feedback to the model. Augment models with the new knowledge.
- Prognostic models
  - Knowledge needs to feedback to the domain modeler and knowledge base.

Challenge Problems for the Working Group

- Trickier Stuff
  - What are the current bottlenecks in the R&D process?
  - How do we fix them?

- Clearly define representations.
  - Share concrete examples.
- Trade code more often.
- Trade example representations more often.
- Trade example problems more often.

Distributed world will make integration tricky.

- At least two meetings before January
- Weekly in January
- Check and see if the pace is appropriate after this.

Emphasis on hands-on sharing and testing.

- Todo: Eric to create spreadsheet to for everyone to share all their information.
- Master repo with a wiki to point to other repos, and where joint issues can be posted.
- https://github.com/DARPA-ASKE/info-and-links
- Todo: Eric create github from scratch

Todos

Each group to work on design docs for:

- What information they need to perform their complex operation
  - What is the input provided?
  - What are the “knobs” defining the experiment
  - What is returned?

GTRI: “Spatializing” Models (Given an ODE, what is the PDE that represents the spatial process).

Galois: Model Validation/Repair Operations, Parameter Space Search (Companion to Spatializing/Structural Transforms)

Pitt: Simulation class automatically populated by aPRAM. Currently no way to say to the simulation, on Day 42, I want to change all the parameters.

- Bringing in exogenous influences
- Approximating synthetic populations

3-5 Slides - Summarizing integration and design.

Think about this all end-to-end. Talk about the high level integration and design. Need to quickly think about generalization.

What does it mean, fundamentally, to get diagnostic or prognostic information out of a model?