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Title: Mass balance of physics-informed and physics-constrained machine learning

Author(s): Ahmmmed, Bulbul
Karra, Satish
Mudunuru, Maruti K.

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Mass balance of physics-informed and physics-constrained machine learning

Bulbul Ahmmmed, Satish Karra

Computational Earth Science Group

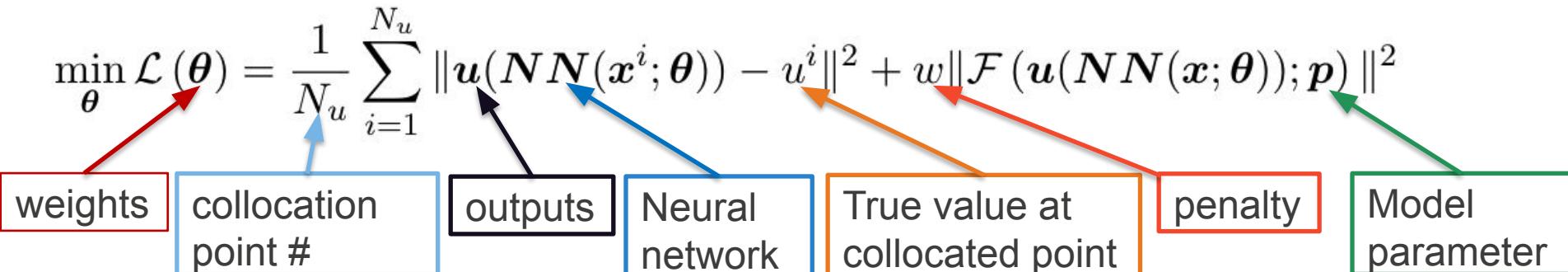
Los Alamos National Laboratory, Los Alamos, NM 87545

Email: ahmmmedb@lanl.gov

Maruti K. Mudunuru

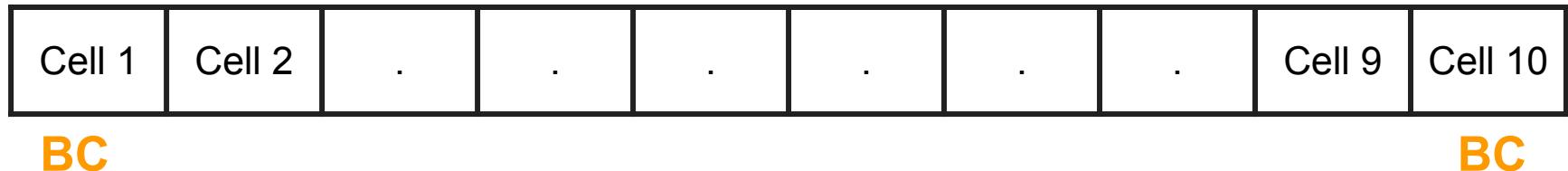
Pacific Northwest National Laboratory, Richland, WA 99352

Background: Physics-informed neural networks (PINN)

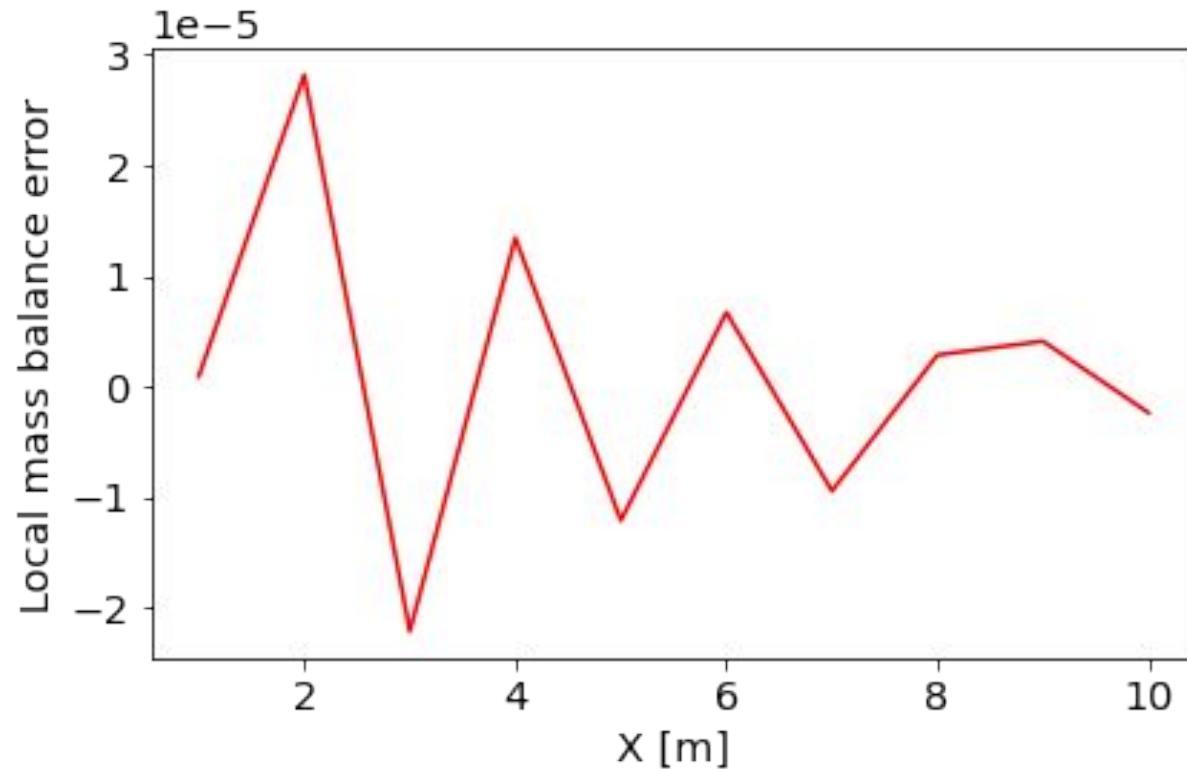


- Physics code is solved at collocation points
- Then comparison between real and simulated points is calculated
- Optimization problems become stiff
- Training takes a lot of wall clock time even for a simple problem
- Does not always satisfy mass balance and other mathematical properties of physics code?
- **Our goal is to compute the mass balance in Darcy flow equation for a porous media**
- **Also, find when and when not to use PINN**

Steady-state Darcy flow model



Results: Flux



Conclusions

- Mass is not fully conserved
- However, it gives us a good range for parameter search space
- The parameter range can be used in physics model to fine tune the model

Thanks!

Question?