

Phase-Field Fracture with Physics-Informed Neural Networks

Task

Implement a 2D phase-field fracture framework using physics-informed neural networks. Test your implementation and the method with benchmark cases from literature and assess its viability.

- Get familiar with Neural Networks and common frameworks.
- Understand Physics-Informed Neural Networks [1].
- Implement a physics-informed framework to solve the 2D linear elastic problems [2].
- Extend the framework for phase-field fracture [3,4].
- Test your implementation with benchmark cases from literature.

[1] Raissi, M., Perdikaris, P., & Karniadakis, G. E. (2019). *Physics-informed neural networks: A deep learning framework for solving forward and inverse problems involving nonlinear partial differential equations*. *Journal of Computational Physics*

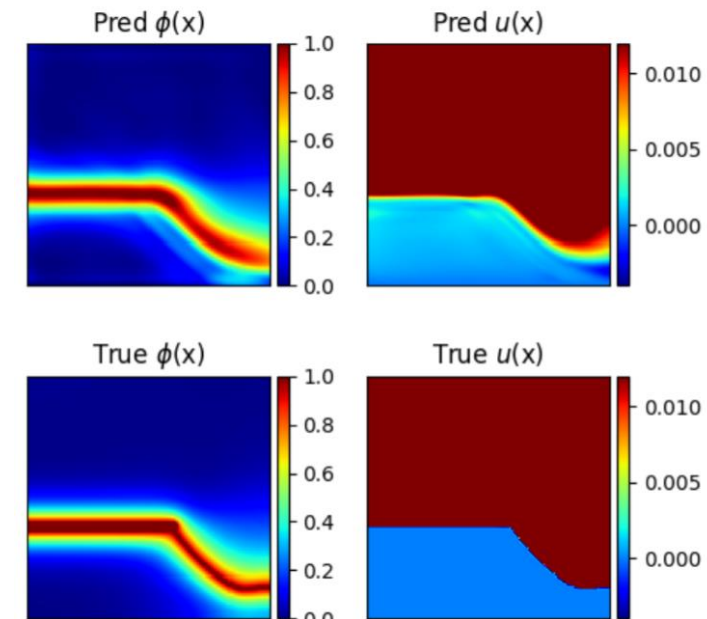
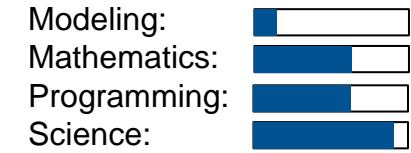
[2] Kollmannsberger, S., D'Angella, D., Jokeit, M., & Herrmann, L. (2021). *Deep Learning in Computational Mechanics: An Introductory Course*. *Studies in Computational Intelligence*

[3] Goswami, S., Anitescu, C., Chakraborty, S., & Rabczuk, T. (2020). *Transfer learning enhanced physics informed neural network for phase-field modeling of fracture*. *Theoretical and Applied Fracture Mechanics*

[4] Goswami, S., Yin, M., Yu, Y., & Karniadakis, G. (2021). *A physics-informed variational DeepONet for predicting the crack path in brittle materials*. *arXiv preprint*

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Project Characteristics



Prediction of a shear crack [4]