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Team Details:

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Project Title:

Harnessing Machine Learning for Physics: A Synergistic Approach with PINNs and KANs in Solving Complex PDEs

Possible Dataset and Source:

- Synthetic datasets generated from known partial differential equations (PDEs) with added noise.
- Benchmark datasets from computational mechanics or physics.

Uniqueness of Topic:

This project aims to develop an adaptive framework within the Kolmogorov-Arnold-Informed Neural Network (KINN) that dynamically adjusts its architecture or training process based on the level and type of noise present in the data.

Traditional Physics-Informed Neural Networks (PINNs) assume minimal Gaussian noise, which limits their applicability in real-world scenarios where data often contains various forms of noise. By understanding and addressing these noise characteristics, we can enhance the robustness and accuracy of PINNs in solving complex PDEs.

This adaptive approach seeks to improve model performance, stability, and generalization in noisy environments.

Our Learning Goal:

To gain a deeper understanding of adaptive frameworks in neural networks, specifically focusing on noise handling techniques, and to apply this knowledge to improve KINN's performance in solving PDEs.

(Extra) Why We Think This Project is Important:

1. **Real-World Data Challenges**: Adaptive frameworks ensure KINN effectively handles noisy data from physical phenomena.
2. **Model Stability**: Noise handling techniques enhance KINN's stability during training, improving generalization.
3. **Performance Optimization**: Dynamic adjustments to noise characteristics allow KINN to achieve faster convergence and accuracy.

Reference Papers:

1	KINN: A physics-informed deep learning framework for solving forward and inverse problems	https://arxiv.org/abs/2406.11045
2	KAN-ODEs: Kolmogorov–Arnold network ordinary differential equations for learning dynamical systems	https://www.sciencedirect.com/science/article/abs/pii/S0045782524006522
3	Physics-informed Neural Networks with Unknown Measurement Noise	https://arxiv.org/abs/2211.15498

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