Karlsruhe Institute of Technology

Autonomous Learning Robots Lab

Grounding Graph Network Simulators using Physical Sensor Observations

ICLR 2023 Poster

Jonas Linkerhägner, Niklas Freymuth, Paul Maria Scheikl, Franziska Mathis-Ullrich and Gerhard Neumann | April 5, 2023

Why *learned* Physics Simulation?

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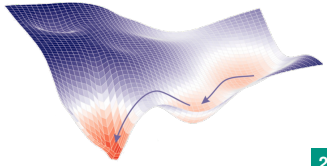
[1] https://www.hrcloud.com/blog/10-ways-to-improve-team-efficiency-and-productivity (April 2, 2023)
[2] http://primo.ai/index.php?title=Gradient_Descent_Optimization_%26_Challenges (April 2, 2023)
[3] https://www.youtube.com/watch?v=1yT0hxplVBg (April 2, 2023)

Why *learned* Physics Simulation?

1


2

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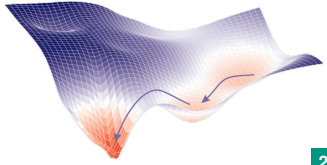
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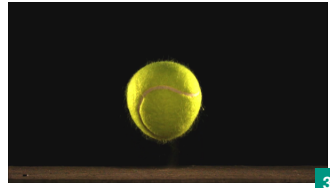
3

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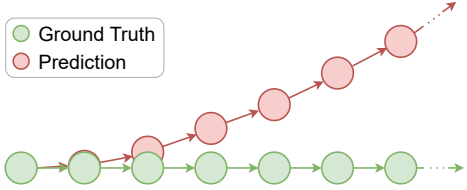
Current Limitations



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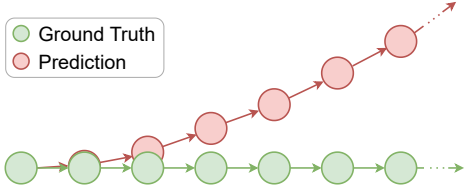
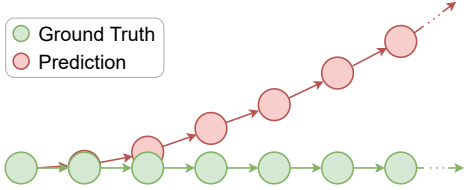


- Accumulation of error

Current Limitations



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- Cannot include partial initial states or observations

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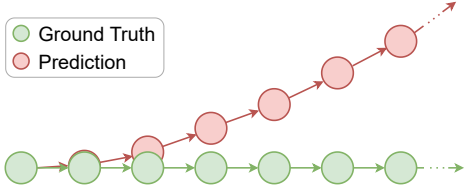

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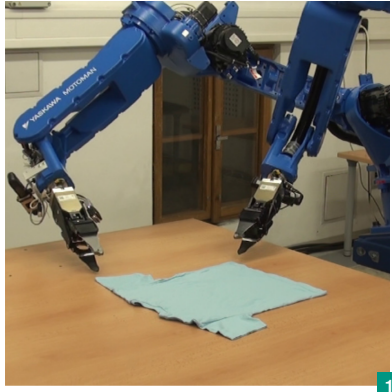
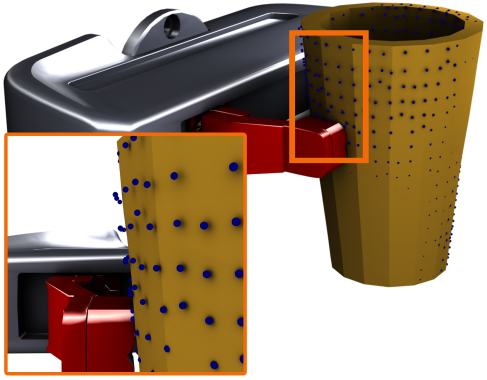
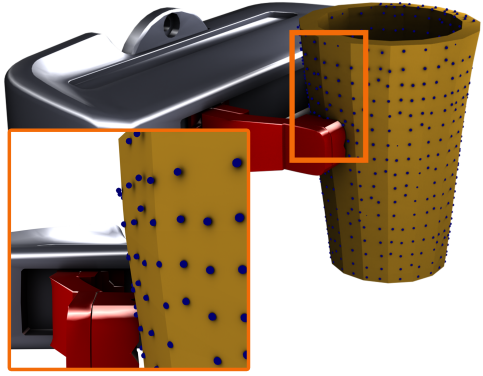


1

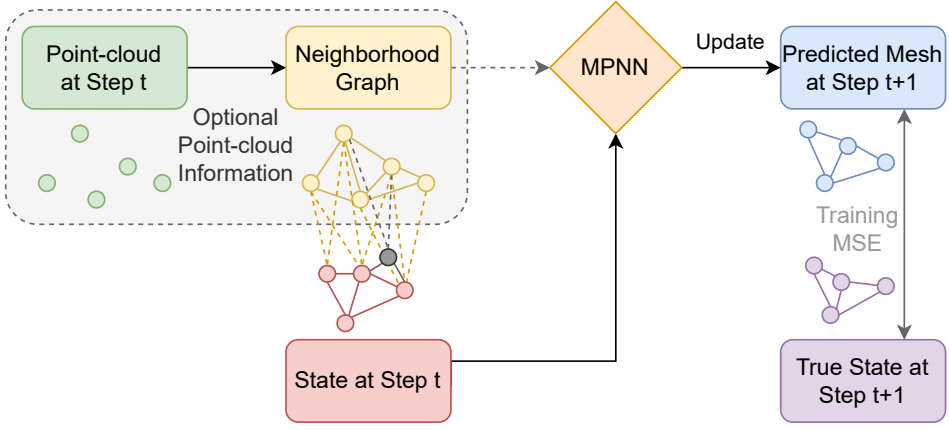
[1] Sanchez et al. IJRR 2018 - Robotic manipulation and sensing of deformable objects in domestic and industrial applications: a survey

Grounding Graph Network Simulators (GGNS)





Grounding Graph Network Simulators - Schematic



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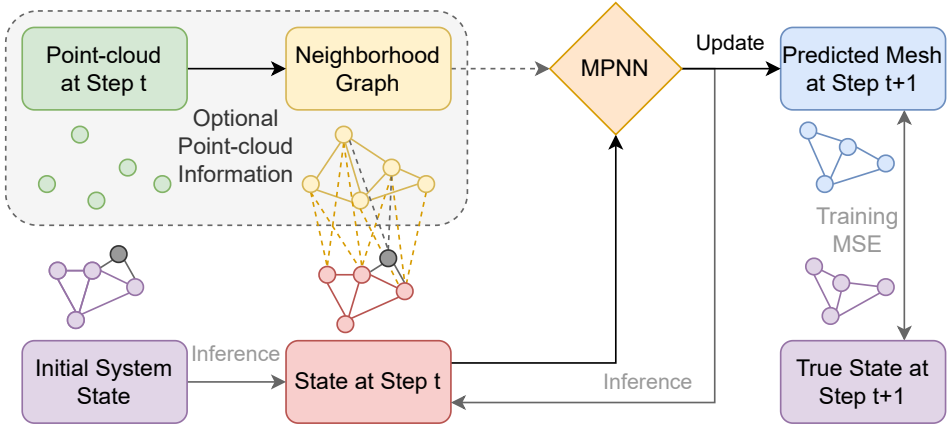
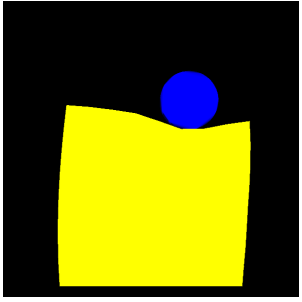
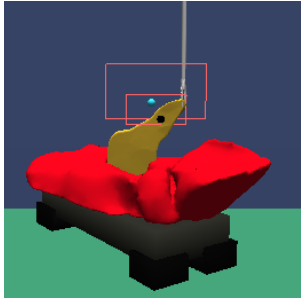


Datasets[1]

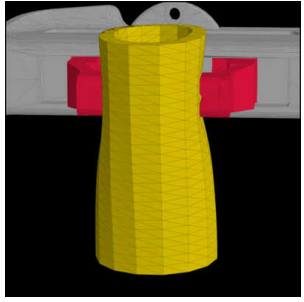
Deformable Plate



Tissue Manipulation



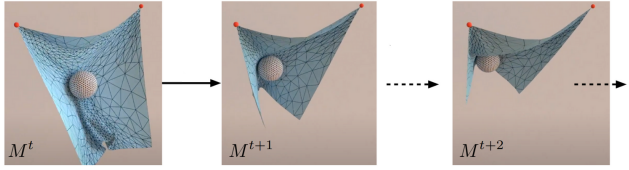
Cavity Grasping



[1] Faure et al. 2012 - SOFA: A Multi-Model Framework for Interactive Physical Simulation.

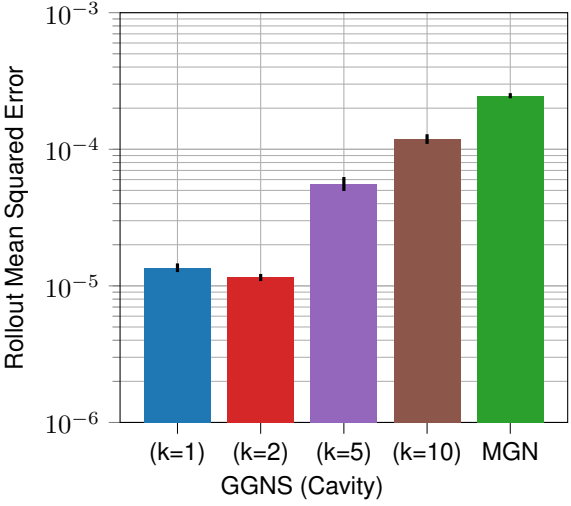
Baseline

MeshGraphNet (MGN)[1]



[1] Pfaff et al. ICLR 2021 - Learning Mesh-Based Simulation with Graph Networks

Quantitative Results



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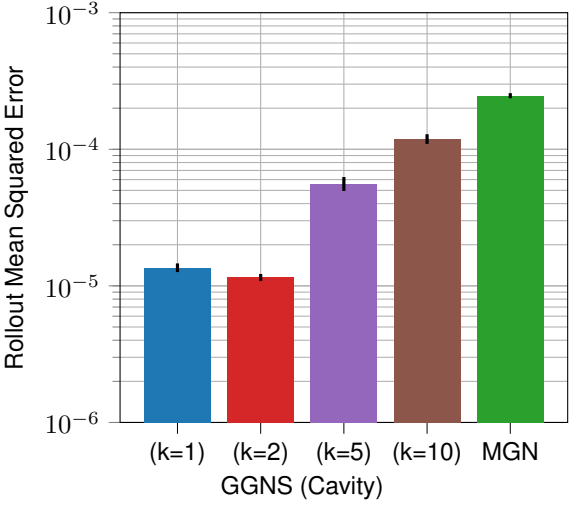
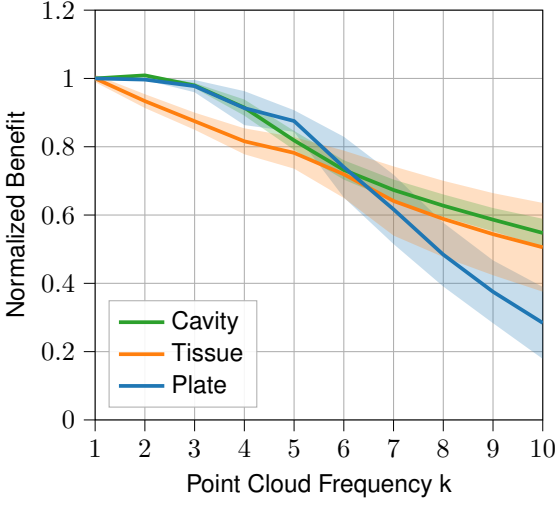
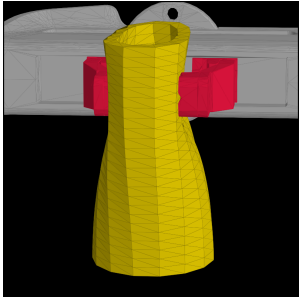


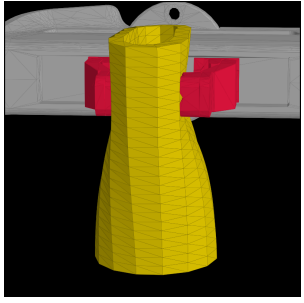


Qualitative Results

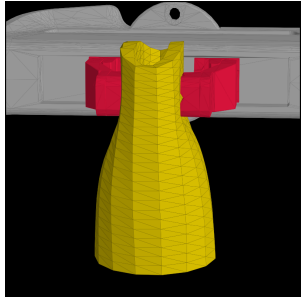
Ours (k=10)



Ground Truth



MGN



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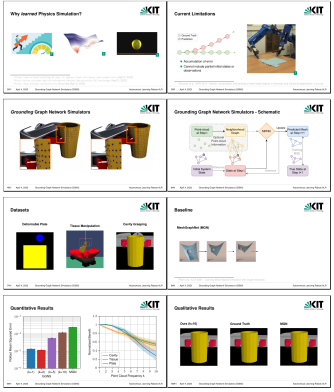

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- Openreview: `https://openreview.net/forum?id=jsZsEd8VEY`
- GitHub: `https://github.com/jlinki/ggns`
- arXiv: `https://arxiv.org/abs/2302.11864`
- Lab: `https://alr.anthropomatik.kit.edu/`
- Contact: `jonas.linkerhaegner@alumni.kit.edu`