Yushan Han
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Professional Summary

I'm currently a Physics Engineer at Epic Games developing the Chaos Flesh project in Unreal Engine that supports physically and biomechanically correct human soft tissue simulations. I obtained my PhD in Applied Mathematics at UCLA, under the guidance of Prof. Joseph Teran. My primary research focus lies at the intersection of physics-based simulation and machine learning, with a special emphasis on the simulation of human soft tissues. My recent work includes:
- a comprehensive neural network model for efficient musculoskeletal-driven skin deformation of animated characters
- a dynamic mode capture paradigm for augmenting secondary effects (e.g. inertia) on top of our quasistatic network
- a robust meshing algorithm for generating volumetric hexahedron meshes from self-intersecting surfaces
- position-based nonlinear Gauss-Seidel approach for quasistatic simulation as training data.
- fast ML levelset for cloth simulations.
Additionally, I'm a research intern at Epic Games, where I am actively involved in the development of Chaos Flesh within the Unreal Engine framework.

Education

- **Ph.D. in Applied Mathematics** - University of California, Los Angeles, June 2024
  - Research interest: physics-based simulation, numerical solver for PDEs, machine learning, inverse dynamics
  - Relevant courses: applied ODEs and PDEs, advanced numerical analysis, fluid mechanics, machine learning
- **B.S. in Mathematics** - University of California, Irvine, September 2015 – June 2019
  - Mathematical finance concentration, minor in statistics, honor in Mathematics, GPA: 3.77
  - Relevant courses: C++, python, statistical methods, financial derivatives, probability, economics, linear algebra

Work Experience

- **Physics Engineer** - Epic Games, July 2024 – Present
  - Working on the Chaos Flesh project in Unreal Engine for physics-based soft body/human soft tissue simulations.
- **Research Intern** - Epic Games, June 2021 – July 2024
  - Devised a novel neural network pipeline for real-time (1000X faster than simulation) character rig corrections for improving metaverse realism on human muscle contractions/interactions, volume preservation, and collisions.
  - Implemented multi-layer FEM human soft tissue simulation and biomechanics-based muscle activation solvers.
  - Proposed a novel muscle contraction constitutive model and decoupled passive/active networks for skin deformations.

  - Developed an analytic real-time spring model for adding secondary dynamics, e.g., inertia.
  - Implemented game engine physics solvers (to be released under Chaos Flesh framework, Unreal Engine 5.5).
- **Graduate Teaching Assistant** - UCLA, January 2021 – Present
  - Teaching assistant for Numerical Analysis, Algorithms, Mathematical Imaging, and Machine Learning.
- **Graduate Research Intern** - Lawrence Berkeley National Lab, June 2020 – September 2020
  - Incorporated conditional random field models in CNNs for rock tomography image segmentation.
  - Improved unsupervised segmentation results qualitatively and reduced hollow regions obtained by traditional CNNs by 90%.

Skills & Abilities

- Proficient in C++, Python, MATLAB, Houdini, Maya, Unreal Engine.

Publications

- **Y. Han**, Y. Chen, C. Ong, J. Chen, J. Hicks, and J. Teran. 2024. A Neural Network Model for Efficient Musculoskeletal-Driven Skin Deformation. *ACM Trans. Graph.*
- Y. Chen, **Y. Han**, J. Chen, Z. Zhang, and J. Teran. 2024. Position-Based Nonlinear Gauss-Seidel for Quasistatic Hyperelasticity. *ACM Trans. Graph.*
- Y. Chen, **Y. Han**, J. Chen, S. Ma, R. Fedkiw, and J. Teran, "Primal Extended Position Based Dynamics for Hyperelasticity," in *Proceedings of the ACM SIGGRAPH Conference on Motion, Interaction and Games*, 2023. DOI: 10.1145/3623264.3624437.
- S. Gagniere, **Y. Han**, Y. Chen, D. Hyde, A. Marquez-Razon, J. Teran, and R. Fedkiw, "A Robust Grid-Based Meshing Algorithm for Embedding Self-Intersecting Surfaces," *Computer Graphics Forum*, 2023. DOI: 10.1111/cgf.14986.
- A. Marquez Razon, Y. Chen, **Y. Han**, S. Gagniere, M. Tupek, and J. Teran, "A Linear and Angular Momentum Conserving Hybrid Particle/Grid Iteration for Volumetric Elastic Contact," *Proceedings of the ACM on Computer Graphics and Interactive Techniques*, 2023. DOI: 10.1145/3606924.
- Y. Jin, **Y. Han**, Z. Geng, J. Teran, and R. Fedkiw, "Analytically Integratable Zero-restlength Springs for Capturing Dynamic Modes unrepresented by Quasistatic Neural Networks," in *ACM SIGGRAPH 2022 Conference Proceedings*, 2022. DOI: 10.1145/3528233.3530705.

Awards

- NSF MENTOR Fellowship - $34,000, September 2019 – September 2020.
- Howard Tucker Award, University of California, Irvine, June 2019.

References

Available upon request.