CHUNRU LIN

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EDUCATION

University of Massachusetts Amherst, *PhD* — *Sept. 2023 - Present*
Computer Science — advised by Prof. Chuang Gan

Shanghai Jiao Tong University, *Undergraduate* — *Sept. 2019 - June 2023*
Computer Science and Technology (ACM Honors Class) — Overall GPA: 3.8/4.3 (Rank: 5/29)

INDUSTRY EXPERIENCE

Dolby Laboratory Inc. — May. 2024 - August. 2024
PhD Research Intern, working with Vijay Sundaram and Lie Lu

RESEARCH EXPERIENCE

University of Massachusetts Amherst — Sept. 2023 - Today
PhD Student in CICS, advised by Prof. Chuang Gan

- **GranularLab**

In this work, we aim to teach robots to manipulate various granular materials. We're going to implement an efficient and fully differentiable simulation platform tailored for robotic interactions with diverse granular materials possessing varying material properties, enabling flexible manipulation and locomotion skill learning and evaluation.

Main techniques: Granular Simulation (MPM, DEM, Height field), MuJoCo

Shanghai Qi Zhi Institute, China — Mar. 2023 - Sept. 2023
Research Intern, advised by Prof. Tao Du

- **Seeing Through Surface with Gaussian Splatting and Topology Optimization**. **Chunru Lin***, Changyu Hu*, Pingchuang Ma, Chuang Gan, Tao Du. Target at ECCV 2024.

This work considers predicting the internal structure of an elastic object from multi-view video input of its motion. Previous research assumed that the elastic object was solid and focused on tasks such as reconstructing the object's outer surface and predicting its physical parameters. Here we introduce a new task, which involves reconstructing the object's surface while simultaneously predicting its internal structure. We propose a topology optimization-based method that reconstructs the object's surface through Gaussian scattering and optimizes the object's internal structure using differentiable physics simulations.

Main techniques: Gaussian Splatting, Finite Element Method, Topology Optimization

Massachusetts Institute of Technology — May. 2022 - Dec. 2022
Visiting Student Researcher in CoCoSci Lab, advised by Prof. Josh Tenenbaum and Chuang Gan

- **3D Concept Learning and Reasoning from Multi-View Images**. Yining Hong, **Chunru Lin**, Yilun Du, Zhenfang Chen, Joshua B. Tenenbaum, Chuang Gan. Accepted by **CVPR 2023**.

We propose the novel task of 3D concept learning and reasoning from multi-view images. By exploring the environments with a camera randomly, we collect a large-scale benchmark on 3D multi-view visual question answering (3DMV-VQA). We devise a model that incorporates a neural radiance field, a 2D pretrained vision-language model, and neural reasoning operators to ground the concepts and

perform 3D reasoning on the multi-view images. We illustrate that our model outperforms all baseline models and perform an in-depth analysis of the challenges of this new task and highlight potential future directions.

Main techniques: Realistic Simulator (Habitat, SoundSpaces, CARLA), 2D Pretrained Vision-Language Models

3D Concept Grounding on Neural Fields. Yining Hong, Yilun Du, **Chunru Lin**, Joshua B. Tenenbaum, Chuang Gan. Accepted by **NeurIPS 2022**

In this paper, we propose 3D-CG, which utilizes the differentiable nature of neural descriptor fields (NDF) to ground concepts and perform segmentations. We define a set of neural operators, including a neural counting operator on top of the NDF. With 3D-CG, semantic and instance segmentations can emerge from question-answering supervision. Our 3D-CG outperforms baseline models in both segmentation and reasoning tasks and also generalizes well to unseen shape categories and real scans.

Main techniques: 3D Representations

DiffVL: Scaling Up Soft Body Manipulation using Vision-Language Driven Differentiable Physics. Zhiao Huang, Feng Chen, Yewen Pu, **Chunru Lin**, Hao Su and Chuang Gan. Accepted by **NeurIPS 2023**

Combining gradient-based trajectory optimization with differentiable physics simulation is an efficient technique for solving soft-body manipulation problems. We introduce DiffVL, a method that enables non-expert users to communicate soft-body manipulation tasks – a combination of vision and natural language, given in multiple stages – that can be readily leveraged by a differential physics solver. We have developed GUI tools that enable non-expert users to specify 100 tasks inspired by real-life soft-body manipulations from online videos. We leverage large language models to translate task descriptions into machine-interpretable optimization objectives.

Main techniques: GUI Development, User Interface, Program Design, Differentiable Solver

PROJECT EXPERIENCE

A Toy CPU 2020

- Hardware Programming Language Verilog
- Tomasulo Out of Order Algorithm

A Toy Compiler 2021

- Developed in Java
- For C++-like Language
- Similar IR Design to LLVM

TEACHING EXPERIENCE

Student Instructor 2020.6-2020.8
Principle and Practice of Computer Algorithms

Teaching Assistant 2021.3-2022.1
Computer System

DISCIPLINE COMPETITIONS

2019 CCPC, Qinhuangdao	Silver Medal, Best Women's Team
2019 CCPC Final	Silver Medal, Best Women's Team
2019 ICPC, Jakarta	Bronze Medal
2021 CCPC Girls' Competition	Gold Medal, The Third Place

*ICPC: International Collegiate Programming Contest *CCPC: Chinese Collegiate Programming Contest

SKILLS AND INTERESTS

Programming
C++/Python/Java/Rust/Verilog/JavaScript

Language
Mandarin (native), English, Sanskrit (Beginner)

AWARDS

Spaulding-Smith Fellowship, UMass Amherst	2023
Academic Excellence Scholarship, SJTU (Top 5%)	2022
Zhiyuan Honorary Scholarship	2020, 2021, 2022