Jason Ken Adhinarta

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Research Experience

Boston College Computer Vision Lab — Chestnut Hill, MA

Research Assistant (advised by Prof. Donglai Wei) — *Sep 2021 – Present*

- *Ongoing*: Crafted object-centric constraints for **terabyte-scale superpixel agglomeration** methods for **PyTorch Connectomics** using the SegCLR (**segmentation-guided contrastive learning**) pretrained model, in an attempt to build an open source competitor to Google's Flood Filling Networks. In collaboration with Zengyu Yang
- *Ongoing*: Clustered vesicles in *Hydra vulgaris* samples using PyroVED **translation/rotation equivariant autoencoders**, characterizing neurons using spatial distribution of vesicles. Part of larger work to build a toolbox for **vesicle analysis** for electron microscopy. In collaboration with Shulin Zhang from Prof. Rafael Yuste's lab at Columbia University [A] [B]
- *Ongoing*: Adapted **cell tracking models** (3DeeCellTracker and Ultrack) to extract **whole-brain neural dynamics** from **calcium imaging** of 118 NeuroPAL-strain roundworms across 5 labs. Work done in collaboration with Daniel Sprague from the UCSF Foundations of Cognition Lab, Prof. Erdem Varol at the NYU Neuroinformatics Lab, and Prof. Eviatar Yemini at UMass Chan Medical School [C]
- Benchmarked PointNet++, RandLA-Net, and PointTransformer **point-cloud segmentation architectures** on our dataset of 4,476 spines sourced from electron microscopy of 70 dendrites, demonstrating **zero-shot cross-species generalization** of our proposed Frenet-Serret **equivariant geometric transform** on the mouse visual cortex (94.1% Dice) and human frontal lobe (81.8% Dice). Also wrote extensive pipelines for morphology processing and mesh visualization. Part of a project to improve **segmentation on tree-like structures**; locating synapses in neurons and aneurysms in blood vessels. Collaborated with Shixuan Gu at the Harvard Visual Computing Group [D]
- Analyzed **blood vessel morphologies** in mouse, human, and macaque cortical samples using Kimimaro **centerline extraction**. Evaluated the performance of the U-Net3D baseline model on the largest electron microscopy blood vessel dataset to date. Part of a project to develop a **zero-shot 3D segmentation method** using **Segment Anything Model**. In collaboration with Prof. Jia Wan from Harbin Institute of Technology, China, the Harvard Visual Computing Group, and the Harvard Lichtman Lab [E]
- Finetuned Cellpose, a **foundation model for cell segmentation**, to automatically detect ∼5 million neuronal vesicles in 20 volumes. Work done with Dr. Xiaomeng Han from Prof. Jeff Lichtman's lab at Harvard to develop a novel microscopy technique incorporating fluorescent markers to facilitate **identification of cell types and functions**. [F]
- Prototyped methods to correct deformed **spinal vertebrae mesh predictions** using Probreg **point-cloud registration** for Dr. Zongwei Zhou at JHU
- Maintained **Docker evaluation containers** for the ISBI 2013 SNEMI3D neuron segmentation challenge, MICCAI 2021 AxonEM axon segmentation challenge, and the ISBI 2023 RNR-EXM expansion microscopy image registration challenge on the **Grand Challenge** platform, to simplify benchmark evaluation for 320+ participants
- Developed the ChunkPipeline package to perform distributed volumetric computations on the **Boston College Linux Cluster**, contributed bugfixes to the Princeton Seung Lab's suite of tools for connectomics, onboarded research interns onto the PyTorch Connectomics ecosystem

EPFL CVLab — Lausanne, Switzerland

Research Intern (advised by Dr. Jiancheng Yang and Prof. Pascal Fua) — *May 2023 – Aug 2023*

- Orchestrated pipelines integrating the STU-Net **medical image segmentation foundation model** with our **geometrically-constrained neural implicit fields** to generate anatomically accurate heart structures from our aggregated dataset of 140 **MRI scans**. Contributed to the Heart Augmented Reality Training System, in collaboration with Swiss medical imaging company ADIS and the Cardiology Division of Lausanne University Hospital [G]
- Evaluated **voxel/point-cloud segmentation** models (PointNet/PointNet++, DGCNN, PointCNN, nnU-Net) and **centerline extraction** techniques (Kimimaro, L1-Medial Skeletonization) on our proposed dataset of 660 **CT scans** and 15,466 individually annotated ribs. Implemented a Docker compatability wrapper for the L1-Medial Skeletonization codebase from 2016. Ongoing work to incorporate the **mesh representations of ribcages** into the **MedShapeNet2.0** dataset. In collaboration with radiologists at Huadong Hospital, China and Shixuan Gu at Harvard Visual Computing Group [H]

Emmerich Research Center Jakarta, Indonesia

Research Intern (advised by Dr. Eden Steven) *Aug 2018 – Aug 2021*

- Studied the **temperature-dependent excitation** curves of $SrAl_2O_4$:Eu^{2+}, Dy^{3+} glow-in-the-dark crystals. Built vacuum-sealed optical probes operating at cryogenic temperatures. In collaboration with Dr. Muhandis Shiddiq from Indonesia's National Research and Innovation Agency and Prof. Henri Uranus from Universitas Pelita Harapan [I]
- Developed an **OpenCV-based contamination detection system** featuring perspective normalization, shadow removal, and blob detection, to control a CNC-sprayer for disinfection of fungal cultures. Delivered a proof-of-concept robot for MycoWorks, a California-based startup producing **plant-based synthetic leather** [J]
- Trained the YOLACT **instance segmentation** model to track Black Soldier Fly larvae. Wired an Arduino-controlled linear-slider system for recording larvae behavior in arrays of petri dishes. Set up CVAT data annotation pipelines. An effort to **optimize larvae feed and rearing conditions for waste-processing** in collaboration with Hermetia Bio Sciences
- Automated palm oil **fruit quality assurance** using OpenCV and XGBoost tree models. Deployed training pipelines on Google Cloud Platform. In collaboration with manufacturing company PT. Sawit Asahan Tetap Utuh
- Finetuned the YOLACT segmentation model on the TACO waste dataset, integrated with a 3-DOF robotic arm with a gradient-descent-based **inverse kinematics** solver. Presented at Indonesia Science Expo 2019
- Computationally modeled angle-dependent Ohmic resistance of stacked hexagonal lattices analogous to twisted bilayer graphene using **CUDA-accelerated sparse linear solvers**, attempting to understand magic angle superconductivity
- Co-designed a 23-week long **Arduino-based electronics programming curriculum** for Sekolah Pelangi Kasih's afterschool program. Co-instructed the electronics portion of Sekolah Pelita Harapan's 2019 Summer Science Academy