

# KYU SANG HAN, Ph.D.

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## SUMMARY

Versatile data scientist with expertise in computational biology, digital pathology, and machine-learning algorithms for 3D tissue microanatomy analysis. Adept at presenting complex findings and driving collaborative, data-driven initiatives. Proven track record in leading interdisciplinary research teams, publishing impactful studies, and mentoring junior researchers.

## EDUCATION

**Johns Hopkins University** | Baltimore, MD

**Ph.D.**, Chemical and Biomolecular Engineering

August 2023

**M.S.E.**, Chemical and Biomolecular Engineering

December 2018

**B.S.**, Chemical and Biomolecular Engineering

December 2017

## TECHNICAL SKILLS

**Programming languages** Python, MATLAB, R, SQL, Bash (HPC clusters), C, C++

**Tools & Frameworks** TensorFlow, Keras, PyTorch, Scikit-Learn, Dask, Pandas, Jupyter, Caret, Git, Flask, Docker, Spark, NAS

**Data Analysis** ETL (Extract, Transform, Load) Processes, Exploratory Data Analysis (EDA), Hypothesis Testing,

A/B Testing, Dimensionality Reduction, Clustering, Regression, Bayesian Inference, Generative AI

**Data Visualization** Matplotlib, Plotly, ggplot, tidyverse, Seaborn, Adobe Creative Suite, 3D Printing, Laser Cutting, Woodshop

**Laboratory** High-Throughput Confocal Imaging, Whole Slide Scanning, Transfection, Live cell culture, Spatial transcriptomics, Immunohistochemistry staining, Multi-omics

## RESEARCH EXPERIENCE

**Johns Hopkins University -- Institute for NanoBioTechnology** | Baltimore, MD (P.I. : Denis Wirtz and Pei-Hsun Wu)

### Postdoctoral Fellow

September 2023 – Present

- Lead **Tissue Mapping Center** for the NIH-funded **Human BioMolecular Atlas Program (HuBMAP)**, managing 13 Ph.D. students across multiple institutions ([Nature Cell Biology, 2023](#))
- Engineered scalable workflows for analyzing **3D multi-omics** big data, including RNA spatial transcriptomics, MALDI, H&E, IHC, and IF imaging.
- Developed a **generative AI model** for **biomedical image** (e.g. H&E, MRI, CT, Cryo-EM, Light sheet microscopy) **restoration** and interpolation (preprinted on [BioRxiv](#), submitted to Nature Methods).
- Designed an optimization algorithm to 3D-print detailed, tangible models of pancreatic ducts, making it easier to visualize structural changes during tumorigenesis. ([Advanced Materials Technologies, 2024](#)).

### Doctoral Researcher

January 2019 – August 2023

- Implemented deep learning workflow to label skin tissue architecture and quantified structural features at single cell resolution to understand the effect of aging in healthy human skin using a cohort of 7.8 million nuclei and 17,600 mm<sup>2</sup> tissue.
- Published workflow in [Nature Methods \(2022\)](#). Biological findings are under revision for **Nature Communications**.

### Master Researcher

*Project: Visually-Aided Morpho-Phenotyping Recognition tool (VAMPIRE)*

January 2018 – December 2018

- Developed the Visually-Aided Morpho-Phenotyping Recognition Tool (VAMPIRE), enabling biologists to quantify morphological features and visualize cellular states via unsupervised machine learning. Published on [Nature Protocols \(2021\)](#).

### Undergraduate Researcher

January 2016 – December 2017

*Project: aneuploidy of breast cancer cells influenced by the extracellular matrix stiffness*

- Conducted research on the relationship between extracellular matrix stiffness and breast cancer aneuploidy, receiving Provost's Undergraduate Research Award (\$3,000).

**Institut Curie** | Paris, France (P.I. : Danijela Vignjevic)

*Project: collective migration of A431 human epidermal carcinogenic cells under various microenvironment*

May 2017 – July 2017

- Investigated collective migration of A431 epidermal cancer cells and characterized EMT markers across various substrates (matrigel, fibronectin, collagen) to reveal how the microenvironment influences cancer cell behavior and epithelial-mesenchymal transition (EMT) dynamics.

## TEACHING EXPERIENCE

### Modern Data Analysis and Machine Learning for ChemBEs

February – May 2020

- Served as a teaching assistant and led a 1.5hr lecture to discuss applications of machine learning in medical image analysis.
- Tracked individual/group progress for 86 undergraduate students using online resources; outlined achievements and milestones based on evaluation criteria; communicated progress during advising appointments

### Chemical & Biomolecular Separation

January 2021 – March 2022

- Developed lesson agendas, course web pages, assessment materials, and content for weekly 1-hour recitation sessions as a stand-alone instructor.

## LEADERSHIP EXPERIENCE

### JHU Korean Graduate Student Association

President

September 2019 – May 2023

- Promoted networking, academic, and cultural events for Korean graduate student body at JHU (Average participants: 50)

### Korean American Scientists and Engineers Association–JHU YG Chapter

Visual Art Director

January 2016 - July 2018

- Organized intra-collegiate seminars, guest lectures, cultural events for Korean American student body (Average participants: 40)

## PRODUCE DEVELOPMENT PROJECTS & AWARDS

### HopHacks, JHU hackathon

February 2018

- **First place winner**
- Designed a web application that compares the user's medical expenses to others who received similar level of medical services.

### Johns Hopkins University Dean's Master's Fellowship

December 2017

- Graduate scholarship awarded to master's students covering 50% of tuition

### YHacks, Yale university hackathon

December 2017

- **Best Use of the Datapoint JavaScript Utility Award (Viacom); Best Hot Technology Predictor Award (Informa)**
- Engineered a search engine that predicts emerging technology and products, providing credible insight for the investors based on the big data collected from the web.

### HopHacks, JHU hackathon

September 2017

- **Sponsor Awards: Judge's Choice (Facebook) Best User Experience (Deloitte) Best Financial Hack (Capital One)**
- Developed a mobile app that facilitates seamless exchange between fiat and cryptocurrency, using the blockchain technology.

### Student Initiatives Fund, JHU Whiting School of Engineering

June 2017

- Selected as one of top 4 individually proposed independent engineering projects to be awarded \$3,500 in funding.
- Project Topic: self-powered air circulation system for crudely constructed houses to prevent respiratory diseases

### MedHacks, JHU medical themed hackathon

October 2016

- **Second place winner**
- Created a mobile app that reads electroencephalogram (EEG) brain signals sent from a hairband called MUSE and translate it to the user's (i.e. autistic child) emotional status.

### Provost's Undergraduate Research Award (PURA)

March 2016

- Research scholarship awarded to undergraduate students with outstanding research proposal (\$3000)

## PUBLICATIONS (See full list of publications at [Google Scholar](#); Total citations N = 338)

Generative interpolation and restoration of images using deep learning for improved 3D tissue mapping (bioRxiv, 2024)

<https://doi.org/10.1101/2024.03.07.583909> under revision for **Nature Methods**

High-Resolution 3D Printing of Pancreatic Ductal Microanatomy Enabled by Serial Histology (**Advanced Materials Technologies 2024**)

<https://doi.org/10.1002/admt.202301837>

Substrate stiffness modulates the emergence and magnitude of senescence phenotypes (bioRxiv, 2024)

<https://doi.org/10.1101/2024.02.06.579151> under revision for **Aging Cell**

qMAP enabled microanatomical mapping of human skin aging (bioRxiv, 2024)

<https://doi.org/10.1101/2024.04.03.588011> under revision for **Nature Communications**

Advances and prospects for the Human BioMolecular Atlas Program (HuBMAP) (**Nature Cell Biology 2023**)

<https://doi.org/10.1038/s41556-023-01194-w>

CODA: quantitative 3D reconstruction of large tissues at cellular resolution (**Nature Methods 2022**)

<https://doi.org/10.1038/s41592-022-01650-9>

A robust unsupervised machine-learning method to quantify the morphological heterogeneity of cells and nuclei (**Nature Protocol 2021**)

<https://doi.org/10.1038/s41596-020-00432-x>