Kristina **ULICNA**
PhD in Computational Biology

- 📍 London, United Kingdom
- ✉ kristina.smith.ulicna@gmail.com
- 🐦 Twitter | 💼 LinkedIn | GitHub
- G Google Scholar | 🌐 My Webpage

PhD Project Summary

Theme: **Quantitative following of single-cell trajectories in time-lapse microscopy**

1. *Trajectory reconstruction & lineaging*
- Co-developed a robust, supervision-free, deep learning-based cell tracking pipeline for deep lineage analysis of live-cell microscopy 2D cell lines data
- Analysed multi-generational lineage trees of >20k single-cell trajectories to interpret proliferation characteristics predisposing cells to fast divider rates

2. *Track representation & interpretation*
- Generated an explainable AI model to learn dynamic image representations & interpretable latent space features to map similarities of cell cycle continuity
- Transformed a sequence of image representations into an unsupervised trajectory annotation & temporal landscape visualisation of diverse cell fates

Directly supervised a Masters student's project to develop an AI-driven cell segmentation tool from microscopy datasets

Computational Skills

Strongest programming language: *Python*
Experience with deep learning strategies for image analysis & computer vision apps
- *Fully supervised:* U-Net, ConvNet, TCN
- *Weakly supervised:* multiple-instance
- *Self supervised:* generative (VQ-) VAE
- *Unsupervised:* hierarchical clustering
- *Dimensionality reduction:* PCA, UMAP

Skilled in "image2seq" representations & time-sequence trajectory data analysis
- *Machine learning libraries:* skimage, sklearn, torch, pytorch lightning, pytorch geometric, btrack, arboretum
- *Standard & scientific libraries:* numpy, scipy, pandas, matplotlib, seaborn, h5py, networkx, napari, dtaidistance

Experienced in **conda** envs, **GitHub** (git), **LaTeX** (overleaf), **iPython** (jupyter & colab)

Laboratory Skills

- DNA sequencing data readout analysis
- Molecular biology & vector construction
- Cell-based assays & imaging platforms
- Cell / gene engineering & tissue culture
- Gene expression detection methods

Summary

*As a **Research Associate** at The Alan Turing Institute, I apply my **deep learning & bioimage analysis skills** across multi-disciplinary projects combining cell biology, computational single-cell tracking & **interpretable AI/ML**. I focus on **Python development** for time series image data analysis to identify **meaningful biological patterns** controlling cell cycle & fate. As a practical & detail-oriented scientist with **biomedical background**, I have demonstrated my **research & leadership skills** in individual & collective settings, gained via work experience in **academic biomedical research** groups, leading **technological companies** & through **community projects**.*

Education

Oct 2018 – Dec 2022
PhD in Biosciences, BBSRC LIDo DTP Programme, UCL | London, UK
- Fully-funded doctoral thesis: 'Machine Learning for Single-Cell Trajectory Analysis'
- Advisors: Drs Alan Lowe & Guillaume Charras | Defended Feb 2023; no corrections
- 3x merit-based scholarships: *Yale School of Medicine, Tatra Bank Research Grants*

Sep 2014 – Jul 2018
BSc Biomedical Science (Hons), King's College London | London, UK
- First Class Hons **(76%)** *Biomedical Science with Molecular Biology Extramural Year*
- Awards & Scholarships: *Desmond Tutu Scholarship '14, Best Lay Article Award '15*

Industrial & Academic Experience

Feb 2023 – Present
Research Associate @ The Alan Turing Institute | London, UK
- Co-developing graph representation analysis for connected embeddings (GRACE) for automated object identification of structural patterns in (bio-)imaging datasets
- Built an explainable, autoencoder-driven image representation learning framework for dynamic single-cell trajectory analysis for self-supervised cell cycle annotation
- ***"Best Poster Award"*** at 2023 ICML Comp Bio Workshop, sponsored by CZI & GSK

Apr 2021 – Sep 2021
Research Intern @ Microsoft Research Cambridge | Cambridge, UK
- Developed an AI-based end-to-end pipeline to classify subcellular protein localisation in single cells from Human Protein Atlas' Kaggle dataset of weakly labelled microscopy images using Azure computing & InnerEye Deep Learning OS toolkit
- Trained a competitively-performing model (MIL / SimCLR & BYOL methodology) in collaboration with competition organisers evaluated as best approach off-chart

Sep 2016 – Aug 2017
Industrial Trainee @ Crescendo Biologics Ltd. | Cambridge, UK
- Engineered a novel, universal tool cell line for early drug discovery, i.e. phage display selection & functional screening of antibody fragment onco-therapeutics

Jun 2016 – Sep 2016
Cancer Research UK Intern @ Cambridge University | Cambridge, UK
- S. Bohndiek Lab: Characterised anti-angiogenic drug effects via breast cancer cell-based growth, viability assays to evaluate oxygen role in cancer progression

Jun 2015 – Aug 2015
Visiting Scholar, Whitehead Institute @ MIT | Cambridge, USA
- R. Weinberg's Lab: Investigated determinants of cancer cell invasion, metastasis & tumour stroma immunomodulation upon epithelial-to-mesenchymal transition

Teaching & Outreach Experience

Mar 2020 – Mar 2022
Graduate Teaching Assistant @ UCL BIOC0016 module | London, UK
- Co-designed iPython practical sessions for 70+ undergraduates to introduce concepts in bioimage analysis & bioinformatics to train an ML cell state classifier

Jan – Dec 2021
Google Certified Trainer for AI Tech & Tools | Bratislava, Slovakia
- Empowering non-tech professionals by leveraging their expertise & leadership in AI tech field via AI-basics talks & workshops with Google Slovakia outreach team

May – Jun 2021
"Smart Microscopy" Workshop @ ZEISS | Gothenburg, Sweden
- Trained 30+ intermediate-level attendees at "Train Your Own Model" hands-on workshop session to use (bio-)image analysis tools to annotate cell imaging data

May - Jun 2020
"Introduction to Deep Learning" @ UCL Cancer Domain | London, UK
- Delivered beginner-friendly masterclass series for 100+ interdisciplinary scientists with real-life examples of deep learning-based bioimage analysis from PhD project

Leadership & Teamwork Experience

Sep 2019 – Feb 2023
Student Ambassador, LIDo PhD Programme @ UCL | London, UK
- Outlined programme structure & shared own experience with new student cohorts
- Guided individual students through responsibilities with changing rotation projects

Sep 2015 – Aug 2017
Jury Member, LEAF Award @ LEAF | Bratislava, Slovakia
- Shortlisted self-driven, talented students with community involvement in jury team

Sep 2016 – Aug 2018
University Mentor, Talent Guide @ LEAF | Bratislava, Slovakia
- Counselled college choices with gifted high-schoolers & edited personal statements

Awards & Scholarships

- 2023 **"Best Poster Award"** @ ICML Computational Biology Workshop
- 2023 ICML **Complimentary Registration** by Women in Machine Learning (WiML)
- 2022 **"Best Chalk Talk"** @ Marie Curie Summer School of Cell Biology & Cancer
- 2022 Full **Travel Grant Scholarship** for EMBO PhysCell2022 by LIDo Consortium
- 2021 **30 under 30** @ *Forbes Slovakia*
- 2019 **European Union** Council Delegate
- 2019 **Travel Grant:** *Students to the World*
- 2019 **Travel Grant:** *Talents of New Europe*
- 2017 **United Nations** Assembly Delegate
- 2017 **GSK Healthcare** STEM Awardee
- 2014 *'Absolute Winner at the Festival of Science & Technology'* @ AMAVET
- 2013 *'The Special Award by the Dean of the Faculty of Natural Sciences'*

Science Popularisation & Lay Audience Engagement

- 2023 **Pint of Science** Event | London, UK
- 2022 **Reflect Festival** | Limassol, Cyprus
- 2015 **Universal Expo Milano** | Milan, Italy
- 2014 **Intel ISEF Finals** | Los Angeles, USA
- 2013 **Global Scholars Programme** @ ALA | Johannesburg, South Africa
- 2013 **International Congress of Young Investigators** | Zaragoza, Spain

Language Skills

Slovak — native proficiency

Czech — bilingual proficiency

English — full professional proficiency
IELTS & iBT TOEFL language test certificates

German — limited working proficiency
High-school certificate; German evening classes

Hobbies & Interests

- Ballroom dancing; standard & Latin style (UK national partner competitions level)
- Bachata & salsa social dancing (int/adv)
- Long-distance running (half-marathons)
- Playing tennis (competitively at school)

Press Releases

- 2022 **Reflect Festival** "AI for Science" talk
- 2022 **Forbes Slovakia** laureate survey
- 2021 **Forbes Slovakia** 30 under 30 chart
- 2021 **"Zijem Vedu"** researcher interview
- 2020 **PyLadies Dublin** key note interview
- 2020 **UCL Cancer Domain** masterclass
- 2020 **StartItUp** research profile interview

General

- Member of the University of London DanceSport Society (active competitor)
- EU / Slovak driving licence | *B type*

Specialist Trainings & Summer Schools

Dec 2022	**Moroccan Advanced Science Institute**	**| Rabat, Morocco**

- 'AI for Science' Workshop with poster presentation to research industry sponsors

Sep 2022	**Weizmann Institute of Science**	**| Rehovot, Israel**

- 'International School of Biological Physics of Cells', part of EMBO PhysCell 2022

Apr 2022	**Institut Curie & Sorbonne Université**	**| Paris, France**

- 'International course of Cell Biology & Cancer' with the 'Science & Life' workshop

Dec 2020	**Jumping Rivers Ltd.**	**| London, UK**

- Two intermediate courses: *'Machine Learning with Python'*, *'Python & Tensorflow'*

Aug 2019	**University of Hong Kong**	**| Hong Kong**

- Practical course *'Advanced Imaging: Deep Learning in Live Imaging & Cell Biology'*

Jun 2019	**University of Genova**	**| Genova, Italy**

- *'Machine Learning Crash Course'* covering theoretical foundations & core concepts

Sep 2016	**University of Cambridge**	**| Cambridge, UK**

- Two beginners courses: *'Solving Biological Problems', 'Statistical Analysis'* using R

Jun - Jul 2012	**Johns Hopkins University**	**| Baltimore, USA**

- Interactive class *'The History of Disease'* by Centre for Talented Youth (CTY JHU)

Invited Talks

2023 Speaker | Crick BioImage Analysis Symposium (CBIAS) @ The Francis Crick Institute
Speaker | Network of EU BioImage Analysts Symposium (NEUBIAS) @ Porto, Portugal

2021 Speaker | Machine Learning Methods Advances @ Recursion CytoData Society Meeting
Speaker | AI Microscopy Symposium | The Allen Institute for Brain Science @ Seattle, US
Panelist | "See the Hidden": Future of AI in Microscopy Workshop @ Leica Microsystems
Panelist | "Women in AI for Global Health" Session @ Mozilla Festival Tech Conference

2020 Speaker | UCL BioImage Analysis Interest Group @ Laboratory of Molecular Cell Biology
Speaker | Imperial College Brain Sciences Seminar @ UK Dementia Research Institute
Speaker | Python Software Foundation Pro Network Meetup @ #PyLadies Dublin 2020

Contributed Talks

2023 Speaker | Spotlight talk + poster @ ICML Comp Bio Workshop @ Honolulu, Hawaii, USA
Speaker | 'Work-in-progress' spotlight @ CVPR CVMI Workshop @ Vancouver, Canada

2022 Poster | 'AI for Science' Workshop @ Advanced Science Institute @ Rabat, Morocco
Poster | EMBO Workshop: Physics of Cells (PhysCell Conf 2022) @ Ein Gedi, Israel
Poster | Women in Machine Learning (WiML) Panel @ ICML Conference Workshop
Speaker | The Crick Annual PhD Student Symposium @ The Francis Crick Institute

2021 Speaker | Health Intelligence Lab | Internship project summary @ Microsoft Research
Poster | Women in Machine Learning (WiML) Panel @ NeurIPS Conference Workshop
Poster | Crick BioImage Analysis Symposium (CBIAS) @ The Francis Crick Institute
Poster | Women in Data Science (WiDS) Worldwide Conference @ Stanford University
Speaker | Virtual Seminars in Biomedical Science @ Imperial College London

2020 Poster | London Stem Cell Network Annual Symposium @ The Francis Crick Institute
Poster | Society of Biomolecular Imaging & Informatics High Content Conference
Speaker | UCL Institute of Structural & Molecular Biology Postgraduate Symposium

2019 Speaker | UCL Institute of Structural & Molecular Biology Friday Wrap @ Birkbeck Univ.
Speaker | Quantitative Systems Biology Workshop @ King's College London
Poster | UCL Graduate Student Symposium @ The Francis Crick Institute

Publications

Ulicna, K., Kelkar, M., Soelistyo, C.J., Charras, G.T. & Lowe, A.R. (**2023**). *Learning dynamic image representations for self-supervised cell cycle annotation.* ICML Comp Bio Workshop. doi.org/10.1101/2023.05.30.542796 | ICML Comp Bio Workshop | BioRxiv | GitHub repository

Soelistyo, C.J., **Ulicna, K.** & Lowe, A.R. (**2023**). *Perspective: Machine learning enhanced cell tracking.* Frontiers in Bioinformatics, Expert Opinions in Computational Bioimaging | Frontiers

Ulicna, K., Ho, L.T.L., Soelistyo, C.J., Day, N.J. & Lowe, A.R. (**2022**). *Convolutional neural networks for classifying chromatin morphology in live cell imaging.* Methods in Molecular Biology, Chromatin Architecture, Springer Nature Protocols | Springer | GitHub repository

Ulicna, K., Vallardi, G., Charras, G. & Lowe, A.R. (**2021**). *Automated deep lineage tree analysis using a Bayesian single cell tracking approach.* Frontiers in Computer Science, Computer Vision: Methods & Tools for Bioimage Analysis | Frontiers | BioRxiv | GitHub repository