KRISTINA ULICNA

PhD Candidate (final year) @ UCL

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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:*** k-means clustering
- ***Dimensionality reduction:*** PCA, UMAP

Skilled in "image2seq" representations & time-sequence trajectory data analysis

- ***Machine learning libraries:*** skimage, sklearn, torch, pytorch lightning, tensorflow 2.0, keras, innereye-deeplearning, btrack, HPACellSegmentator, CSBDeep
- ***Standard & scientific libraries:*** numpy, scipy, pandas, matplotlib, seaborn, pyplot, h5py, tqdm, napari, dtaidistance

Work comfortably in **conda** venvs**, GitHub** (git), **iPython** (jupyter) notebooks, **LaTeX** (overleaf) & **Sigmaplot Statistics** software

Analysis of **DNA sequencing** data :

- SnapGene software: vector construction
- CLC workbench: Sanger sequencing
- Nanopore sequencing platform interface

Laboratory Skills

Molecular biology & vector construction:

- PCR (RT-, colony-, sequential-, nested-)
- Plasmid preparation (mini- & midi-prep)
- Restriction endonuclease gene cloning
- Gateway cloning & Gibson Assembly
- Preparation & purification of mRNA
- Cell-free protein synthesis (PURExpress)

Cell engineering & tissue culture:

- Stable cell transfection via lipofection or lentiviral & retroviral transduction
- Colony selection with antibiotic titration
- Tet(Dox)-inducible gene expression
- Cell fractionation & organelle isolation
- Induction of cell differentiation (DMSO)
- Cell culture (passaging) with cell lines: *MDCK, HeLa, HL60, CHO, HEK-293, MCF-7 / 10A, MDA-MB-231, HMLER, LNCaP, HaCaT*

Cell-based assays & imaging platforms:

- IncuCyte ZOOM live-cell analysis system cell proliferation assay with colorimetric cell viability, ratiometric [Ca^{2+}] release & fluorimetric protein release assays

Gene expression detection methods:

- SDS-PAGE, Western (dot) blotting
- Immunocytochemistry (IF cell staining)
- Extra- & intracellular flow cytometry
- FACS-sorted clonal cell line expansion

Summary

*As a **PhD researcher** at UCL, I apply my **programming & laboratory skills** in a multi-disciplinary project combining cell biology, computational single-cell tracking & interpretable **deep learning**. I focus on **Python research development** for **large image data analysis** to identify biological patterns influencing diverse **cell cycling** control mechanisms. I am a practical, detail-oriented wet-lab scientist with **cell engineering** background, experienced in dry-lab **machine learning research** applied to single-cell biology. I have demonstrated my **leadership skills** in individual & collective settings, which I gained through UK & US work experience in **academic biomedical research** groups & international bio-/medical & **microscopy imaging research** teams in leading **technological companies,** and through my involvement in **volunteering & community projects**.*

Education

Oct 2018 – Nov 2022 (expected) — **PhD in Biosciences, BBSRC LIDo DTP Programme, UCL | London, UK**

- Fully-funded Doctoral Thesis: "Learning Meaningful Representations of Computationally Tracked Single-Cell Trajectories in Heterogeneous Cell Lines using Deep Generative Modelling", advised by Alan Lowe & Guillaume Charras (UCL & Turing)
- 3x merit-based scholarships: *Yale School of Medicine exchange visitor (postponed)*

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*

Research Experience

Mar 2019 – Present — **PhD Researcher, the "DeepTree" project @ UCL | London, UK**

- Co-developed a robust, supervision-free, deep learning-based tracking pipeline for deep lineage analysis of large time-lapse live-cell microscopy data of 2D cell lines
- Published two computational framework articles (*U-Net, CNN, bTrack* multi-object tracking algorithm) applicable for deep single-cell trajectory lineage reconstruction
- Analysed multigenerational lineage trees (>20k single-cell tracks) to interpret proliferation determinants which predispose cells to commit to fast divider fates
- Generated explainable image-based representations of single-cell time sequences
- Directly supervised Masters project to develop an AI-based cell segmentation tool

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' dataset of weakly labelled confocal microscopy images using Azure computing & InnerEye Deep Learning OS toolkit
- Trained a competitively-performing model (MIL / SimCLR & BYOL architectures) upon evaluation with Kaggle competition authors (Prof. Emma Lundberg's Lab)
- Summarised project to Health Intelligence Lab leadership at End-of-Internship talk

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
- Presented project outcomes to senior scientists & company management board

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 Experience

Mar 2020 – Present — **Graduate Teaching Assistant @ UCL BIOC0016 module | London, UK**

- Co-designed an iPython-based practical session for 70+ undergraduate students for introductory concepts in bioimage analysis, bioinformatics & machine learning to hand-label image mini-dataset & train simplified classifier of cell mitotic state

Jan 2021 – 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 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 (*napari, jupyter notebooks*) to annotate cell imaging data to train deep learning model to classify cell cycle state

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
- Contrasted deep learning to other computer vision methods, demonstrated the utility & benefits, emphasised fundamentals of 'learning' component, outlined common evaluation metrics & listed current challenges in computer vision field

Awards & Scholarships

- 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

- 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)

General

- Member of the University of London DanceSport Society (active competitor)
- Member of London Stem Cell Network
- Member of British Pharmacol Society
- EU / Slovak driving licence | *B type*
- First aid training course certificate

Academic Referees

- **Prof Guillaume Charras** (UCL)
  - PhD thesis project primary advisor
- **Dr Alan R. Lowe** (UCL; Alan Turing Inst.)
  - PhD thesis project secondary advisor
- **Prof Geraint Thomas** (UCL)
  - LIDo PhD Programme Deputy Director

Leadership & Teamwork Experience

Sep 2019 - Present — **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

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

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

Specialist Trainings & Summer Schools

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

2021
- Speaker | Machine Learning Methods Advances @ Recursion CytoData Society Meeting
- Speaker | AI Microscopy Symposium @ The Allen Institute for Brain Science & AIVIA
- 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

Contributed Talks

2022
- Poster | EMBO Workshop: Physics of Cells (PhysCell Conf 2022) @ Ein Gedi, Israel
- Poster | Women in Machine Learning (WiML) Workshop @ ICML Conference
- Speaker | The Crick Annual PhD Student Symposium @ The Francis Crick Institute

2021
- Poster | Women in Machine Learning (WiML) Workshop @ NeurIPS Conference
- 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
- Speaker | Quantitative Systems Biology Workshop @ King's College London
- Poster |. UCL Graduate Student Symposium @ Francis Crick Institute

Publications

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

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