Ashesh.

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Professional Summary

Currently a postdoctoral researcher at Human Technopole, holding a PhD in Computer Science focused on applying computer vision methods to microscopy image decomposition. Prior research includes published studies on gaze estimation and rainfall prediction. Skilled in variational models (H-VAE), iterative inference models (inDI), transformer architectures, and discriminator-based frameworks. Previously worked as a data scientist with professional experience in Python and C++.

Publications

Journal Articles

1 Ashesh, F. Carrara, I. Zubarev, *et al.*, "Microsplit: Semantic unmixing of fluorescent microscopy data," *In review (Nature Methods)*, 2025. 🔗 URL: https://www.biorxiv.org/content/10.1101/2025.02.10.637323v1.

2 D. Gong, C. Cai, Ashesh, F. Jug, and N. F. Scherer, "Aberration-free, multi-plane, multi-color, and deep learning-empowered virtual multi-channel structured illumination microscopy," *Biophysical Journal*, vol. 123, Issue 3, 553a, 2024.

3 Ashesh, C.-T. Chang, B.-F. Chen, H.-T. Lin, B. Chen, and T.-S. Huang, "Accurate and clear quantitative precipitation nowcasting based on a deep learning model with consecutive attention and rain-map discrimination," *Artificial Intelligence for the Earth Systems*, vol. 1, no. 3, 2022.

Conference Proceedings

1 Ashesh and F. Jug, "scSplit: Bringing Severity Cognizance to Image Decomposition in Fluorescence Microscopy," in *NeurIPS*, 2025. 🔗 URL: http://arxiv.org/abs/2503.22983.

2 A. Ray, Ashesh, and F. Jug, "Dehazing light microscopy images with guided conditional flow matching: Finding a sweet spot between fidelity and realism," in *arXiv*, Jun. 2025. 🔗 URL: https://arxiv.org/abs/2506.22397.

3 Ashesh, J. Deschamps, and F. Jug, "MicroSSIM: Improved Structural Similarity for Comparing Microscopy Data," in *BIC Workshop, ECCV*, 2024.

4 Ashesh and F. Jug, "Denoisplit: A method for joint image splitting and unsupervised denoising," in *ECCV*, 2024.

5 Ashesh, A. Krull, M. D. Sante, F. S. Pasqualini, and F. Jug, "μSplit: Image decomposition for fluorescence microscopy," in *ICCV*, 2023.

6 Ashesh, C.-S. Chen, and H. Lin, "360-degree gaze estimation in the wild using multiple zoom scales," in *BMVC*, 2021.

Poster/Oral Presentations

Aug 2025: Oral presentations at IIT Hyd, TIFR Hyd, IIT Delhi, and Ashoka University on 'Image decomposition in Fluorescence Microscopy: A posterior sampling based approach'.

Dec 2024: Oral presentation at Data science department, IISER Pune on 'MicroSplit: Semantic Unmixing of Fluorescent Microscopy Data'.

Dec 2024: Oral presentations at IIT Madras (RBCDSAI center), CSE dept. at IIT Mumbai and STCS, TIFR Mumbai on 'Image decomposition in Fluorescence Microscopy: A posterior sampling based approach'.

Nov 2024: (Remote) Oral presentation at Google Research, USA on 'Image decomposition in Fluorescence Microscopy: A posterior sampling based approach'.

Oct 2024: Poster presentation at ECCV 2024 on 'denoiSplit: a method for joint microscopy image splitting and unsupervised denoising'.

Oct 2024: Poster presentation at BIC Workshop, ECCV 2024 on 'MicroSSIM: Improved Structural Similarity for Comparing Microscopy Data'.

Oct 2024: Poster presentation at $I2K$ 2024 (From Images to Knowledge) conference, Milan on 'MicroSplit: Semantic Unmixing of Fluorescent Microscopy Data'.

Jun 2024: Oral presentation at Ph.D. and Post-Doc Symposium, Human Technopole on 'Image splitting with unsupervised denoising'. **(Best oral presentation award)**.

Oct 2023: Poster presentation at ICCV 2023 on 'μSplit: efficient image decomposition for microscopy data'.

Achievements

2025   **PhD:** Awarded PhD with 'exceptional performance' from TU Dresden, and the PhD thesis was nominated for the Best Thesis Award at TU Dresden.

2024   **EMBO Scientific Exchange Grant:** Won the EMBO Scientific Exchange grant of 8700€, which funded my 3-month internship to Julian Tachella's lab at ENS de Lyon, Lyon, France.

2023   Was selected to attend the QI@CSHL 2023 course, a prestigious course in microscopy run by Cold Spring Harbor Laboratory, USA.

2010   **IIT JEE:** Secured AIR-247 in IIT JEE exam in general category.

Education

2022 – 2025   **Ph.D., TU Dresden,** Computer science.
Research done at Human Technopole, Milan, Italy.
Image decomposition task on Fluorescence microscopy data: The aim was to extract individual constituent channels (C_1, C_2) from the superimposed image X, where $X \simeq C_1 + C_2 + noise$. Worked on aleatoric uncertainty quantification and calibration. Discovered issues with SSIM metric for microscopy data and proposed an alternative. Developed a method capable of handling multiple levels of superposition in the input, that is, extract (C_1, C_2) from X, where $X \simeq wC_1 + (1-w)C_2, w \in [0, 1]$.
Coding contributions: Contributed to (a) MMCore, a C++ based open source code for interacting with microscopes and to pymmcore-plus, a SWIG enabled python binding to MMCore, (b) microsim, a light microscopy simulator, (c) created a Python PIP package predtiler for stitching tiled predictions and (d) helped create CAREamics, a PyTorch library containing image restoration and decomposition algorithms.

2010 – 2015   **B.Tech & M.Tech in Computer Science, IIT Delhi**.
CGPA: 8/10
ML-related courses: Artificial Intelligence, Machine Learning, Special Topics in AI: Probabilistic Graphical Models, Computer Vision, Digital Image Analysis, Graph Theory. *Bio-related courses:* Molecular cell biology, Modern biology for engineers, Biometry, Systems Biology, High Dimensional Biology, and Intr. to Prac. Modern Biology.

Employment History

2021 – 2022   **Pre-doc, Jug group, Human Technopole** A COVID induced informal pre-doc. Worked on Structural noise removal using Contrastive learning. Was able to segregate the latent space into two regions: one capturing the content and the other capturing the structural noise. Enabled structural noise removal and its injection by simply manipulating the latent space https://ashesh-0.github.io/structural_noise_removal/.

Employment History (continued)

2020 – 2021   **Research Assistant, Computer Vision, NTU, Taiwan** Worked on three different projects: Gaze estimation, Rainfall prediction and Imaging analysis of liver region for Biliary atresia disease with first-author publications in the first two.
3D Gaze estimation in unconstrained environments using both image and video frames as input. Full 360° variation in yaw handled using sine-cosine based target space transformation. Improved prediction on frontal gazes using a weighted predictive scheme. Robustness with respect to varying head sizes in images and extraction of features present at multiple magnification levels were handled jointly using multi-scale feature aggregation. *Extreme precipitation prediction* for Taiwan region using Radar data. An image-to-image translation network setup with GRU as recurrent units. Used adversarial learning to generate realistic rainmaps.

2019-2019   Self motivated exploration of deep learning field. Did 5 Coursera certifiable courses targeted on specific deep learning domains including but not limited to computer vision, reinforcement learning and bayesian methods. Participated in 4 Kaggle competitions. Was in the top 2-3 percent in the last 2.

2015-2018   **Data Scientist, Qplum Software Labs, India** *ML model for portfolio:* Development of autoencoder-based market neutral strategy. Generated synthetic data to aid in training. It managed 5% of the portfolio (Python). *ML model for execution:* Development and analysis of multiple intraday execution algorithms and meta algorithms. Used regularized LR and traditional trading techniques like mean reversion, and momentum. Daily $\$50K$ was traded using my algorithms saving 1-2 bps (Python, C++). *ML data pipeline:* Extraction and distributed processing of data from raw tick data files and web APIs. Used airflow and celery for distributed processing (Python).
Non data science projects involved Conversion of sequential simulation engine to vectorized simulation engine. Achieved 5x speedup. Creation of Execution pipeline, Order routing server, and Reconciliation pipeline for multiple brokers (Python, C++).

2015-2015   **Software Developer**, Readersdoor Pvt. Ltd, Delhi, India. Developed a recommendation module which recommends new rooms and unread books for the users. Scraping news content from the internet and integrating it in the website.

Other Courses/ Training

Apr 2023:. Quantitative Imaging Course, Cold Spring Harbor Laboratory. A two week 70hr/week course imparting conceptual and laboratory experience on different microscopy modalities.
I did several online certifiable coursesa courses on different domains of deep learning.
2019: a) deep learning in computer vision, (b) practical reinforcement learning, (c) bayesian methods for machine learning, (d) how to win a data science competition, and (e) introduction to deep learning.
2017-2018: (a) neural networks and deep learning, (b) improving deep neural networks: hyperparameter tuning, regularization, and optimization, (c) structuring machine learning projects, (d) convolutional neural networks, and (e) sequence models. *Link to certification*.
In these courses, I trained neural networks to do facial recognition, face detection, face generation using GANs, image captioning, car detection with YOLO algorithm, and art generation with style transfer. In the reinforcement learning domain, I trained neural networks to do approximate Q-learning on Cartpole, DQN on Atari, and Advantage actor critic on atari.

Other projects

(M.Tech Project) Subcellular Regulatory Network Learning using MLN.
Jul 2014 - May 2015
A model that jointly learns the biclusters and links (activating and inhibiting) in the gene regulatory network using Markov Logic Networks on Halobacterium dataset of Inferelator. Used canopy clustering results as the initial state. With synthetic data, were able to show the limitations of our approach in terms of available data

size and the complexity of the network.

(Kaggle Competition) Prediction of magnetic interactions between atoms in a molecule.
Jul 2019 - Aug 2019
Ensemble of MPNN(message passing neural networks) and GBDT. Extensive feature engineering for GBDT was done. Reached in top 3% of solutions. Github link.

(Kaggle Competition) Predicting next month's sales of products in shops.
May 2019 - Jun 2019
Primarily feature engineering was done. Used PCA on top of TF-IDF on item names and shop names to get important features. Mean encodings, lagged features, city features, and several other features were created. Nearest neighbors was also used to create features. GBDT was used as a model. At submission time, the solution was in the top 2%. Github link.

Skills

DL Architectures	■	Hierarchical Variational Autoencoders, Diffusion Models, Transformers, Contrastive learning, Generative Adversarial Networks.
Coding	■	Python, C++, MySQL, Matlab.

References

Dr. Florian Jug	■	Ph.D. supervisor. Research Group Leader, Jug Group, Human Technopole, Milan, Italy. Email: florian.jug@fht.org
Prof. Francesco Pasqualini	■	Synthetic Physiology Laboratory, University of Pavia, Pavia, Italy. Email: francesco.pasqualini@unipv.it.
Prof. Hsuan-Tien Lin	■	Department of Computer Science and Information Engineering, National Taiwan University. Email:htlin@csie.ntu.edu.tw.
Dr. Julian Tachella	■	Research scientist, Sisyph laboratory, ENS de Lyon, France. Email:julian.tachella@ens-lyon.fr.
Dr. Talley Lambert	■	Associate Director of the Nikon Imaging Center, Harvard Medical School, USA. Email:talley@hms.harvard.edu.