

# Aakash Madhav Rao, BSc

University of Birmingham, Edgbaston, UK | [mraoakash.github.io](https://mraoakash.github.io) | [LinkedIn](#)

## Education Qualifications

<b>MSc Artificial Intelligence and Machine Learning</b> <i>University of Birmingham, Edgbaston, United Kingdom</i>	09/2024 to 09/2025
<b>Post-graduate Diploma Advanced Studies and Research (DipASR) Computer Science</b> <i>Ashoka University, Sonipat, India.</i> Magna Cum Laude and Bronze Medal in Computer Science	09/2023 to 05/2024
<b>BSc (Honors) Computer Science</b> <i>Ashoka University, Sonipat, India.</i> President of the Academic Society for Computer Science	09/2020 to 05/2023

## Work and Research Experience

<b>Research Assistant - Generative AI</b> <i>Digital Healthcare and Medical Imaging Research Group, University of Birmingham, United Kingdom</i> Advisor: Dr. <a href="#">Le Zhang</a> <ul style="list-style-type: none"><li>Leveraged cross-attention-based concept learning to improve embeddings for text-conditioned oral cancer image synthesis.</li><li>Worked with state-of-the-art algorithms such as textual inversion, latent diffusion, and multi-concept-prompt-learning to improve the generative capabilities of diffusion models.</li></ul>	11/2024 to Present
<b>Visiting Researcher - Machine Learning</b> <i>The Neuroethology Laboratory</i> Advisor: Prof. <a href="#">Bittu Kaveri Rajaraman</a> <ul style="list-style-type: none"><li>Designed and implemented a machine learning pipeline using YOLOv8 to automate animal movement tracking in behavioural experiments, achieving an mAP of 98.29% and significantly improving efficiency over manual methods; annotated and processed 8,000 video frames using Roboflow for model training.</li><li>Coauthored a manuscript on depression-like behaviour in Zebrafish, leveraging the pipeline to analyze 10 hours of data; conducted statistical analyses to uncover novel context-specific advantages of behaviours typically perceived as negative.</li></ul>	01/2024 to Present
<b>Research Assistant - Machine Learning</b> <i>Dept. Computer Science, Ashoka University.</i> Advisor: Prof. <a href="#">Debayan Gupta</a> <ul style="list-style-type: none"><li>Enhanced a text-conditioned Latent Diffusion Model (LDM), achieving a 1.27 FID improvement (22.39 to 21.11) over state-of-the-art models while reducing GPU memory usage by 7%.</li><li>Conducted a literature review on generative models for cancer histopathology, leading to a state-of-the-art model with significant FID reductions (9.45 over Stable-Diffusion, 18.38 over Medfusion) and authored a pre-print manuscript under review.</li></ul>	01/2024 to 05/2024
<b>Research Intern - Machine Learning</b> <i>Dept. Computer Science, Ashoka University.</i> Advisor: Dr. <a href="#">Rintu Kutum</a> <ul style="list-style-type: none"><li>Collaborated with the Indian Institute of Science Education and Research (IISER) Pune to develop a large-scale histopathology image dataset of 1,000 images, enabling advancements in machine learning for medical imaging while leading a team to automate data pipelines and reduce processing time by 30%.</li><li>Managed and mentored a team handling 5,000 GB of data, delivering results that exceeded expectations and demonstrating expertise in project coordination, team leadership, and machine learning applications.</li></ul>	06/2023 to 09/2023
<b>Research Assistant - Machine Learning</b> <i>Trivedi School of Bio-sciences, Ashoka University.</i> Advisor: Dr. <a href="#">Tanveer Ahmad</a> and Dr. <a href="#">Rintu Kutum</a> <ul style="list-style-type: none"><li>Led the development of India's first Oral Cancer image dataset (OrCHID) with 300,000+ annotated images in collaboration with Jamia Millia Islamia, leveraging machine learning techniques to achieve 90% accuracy in classification tasks, with findings published in <i>Nature</i>, <i>Scientific Data</i>.</li><li>Presented innovative research on machine learning algorithms for classifying stages of Oral Squamous Cell Carcinoma (OSCC) at the ISMB/ECCB conference, showcasing an ensemble algorithm with 95% classification accuracy.</li></ul>	01/2023 to 01/2024
<b>Research Intern - Machine Learning</b> <i>Centre for Healthcare Analytics and Research Trends, Ashoka University.</i> Advisor: Dr. <a href="#">Rintu Kutum</a>	12/2022 to 01/2023

- *Innovative AI Solutions in Healthcare*: Co-designed a tuberculosis diagnostic model using MFCC-based feature extraction and ANN, achieving 92.87% accuracy, secured 6th place, and served as a consortium coauthor in the CODA-TB-Dream Challenge 2023.
- *Advancing Histopathology Research*: Developed deep spectral methods for unsupervised tissue segmentation in breast cancer histopathology (CVPR) and authored a manuscript on spectral graph theory as a pre-processing technique.

#### Research Intern - Machine Learning

08/2022 to 12/2022

Dept. Computer Science, Ashoka University.

Advisor: Prof. [Subhashis Banerjee](#), Dr. [Madhura Kulkarni](#), and Dr [L. S. Shashidhara](#)

- Improved tumour classification accuracy by 9% using InceptionV3 in breast cancer histopathology through optimal utilization of contextual information in image patches and demonstrated a 3% accuracy gain by increasing image context by 2.7x while balancing dimensionality reduction.
- Authored a study on the interplay of dimensionality and context in machine learning models, showcasing a 7% AUC increase by integrating specific contextual features for breast cancer histopathology image analysis.

#### Research Intern - Machine Learning

04/2022 to 08/2022

Mphasis Labs for Machine Learning and Computational Thinking, Ashoka University.

Advisor: Prof. [Subhashis Banerjee](#), Dr. [Madhura Kulkarni](#), and Dr [L. S. Shashidhara](#)

- Co-founded a pioneering student-led research think-tank integrating machine learning with breast cancer research, collaborating with scientists from premier institutions (IISER, IIT-D, ICGA) to advance innovative solutions.
- Designed and implemented machine learning algorithms for large-scale image analysis, achieving 80% accuracy in patch categorization while gaining proficiency in TensorFlow, PyTorch, and advanced programming during industry collaboration with Mphasis.

## Publications and Presentations

- [1] A. Ghosh, [A. M. Rao](#), P. Middha, S. Lal, and B. K. Rajaraman, "Social isolation reduces metabolic rate and social preference in wild-type zebrafish (*Danio rerio*)," 2024. DOI: [10.1101/2024.11.22.624675](#).
- [2] [A. M. Rao](#) and D. Gupta, *Improving text-conditioned latent diffusion for cancer pathology*, 2024. arXiv: [2412.06487 \[eess.IV\]](#). [Online]. Available: <https://arxiv.org/abs/2412.06487>.
- [3] D. Jaganath, S. K. Sieberts, M. Raberahona, *et al.*, "Accelerating cough-based algorithms for pulmonary tuberculosis screening: Results from the coda tb dream challenge," *medRxiv*, G. Ahuja, [A. M. Rao](#), S. Akbarian, *et al.*, Eds., 2024. DOI: [10.1101/2024.05.13.24306584](#). eprint: <https://www.medrxiv.org/content/early/2024/05/14/2024.05.13.24306584.full.pdf>. [Online]. Available: <https://www.medrxiv.org/content/early/2024/05/14/2024.05.13.24306584>.
- [4] N. Chaudhary, A. Rai, [A. M. Rao](#), *et al.*, "High-resolution ai image dataset for diagnosing oral submucous fibrosis and squamous cell carcinoma," *Scientific Data*, vol. 11, no. 1, Sep. 2024. DOI: [10.1038/s41597-024-03836-6](#).
- [5] [A. M. Rao](#), P. Vaid, and M. Kulkarni, "Investigating the effects of context in multi-label classification of breast cancer histopathology images," 2022.
- [6] N. Chaudhary, [A. M. Rao](#), M. Imam, *et al.*, "Grade-level classification of oral squamous cell carcinoma (oscc) from digital pathology using ensemble deep learning algorithms," in *Poster Presentation at The 31st Annual Intelligent Systems For Molecular Biology and the 22nd Annual European Conference on Computational Biology*, Jul. 2023. [Online]. Available: <https://tinyurl.com/y5yn8dfv>.
- [7] [A. M. Rao](#), "The future of china's minorities with the growing power and breadth of technology," *Journal of Social and Political Sciences*, *Asian Institute of Research*, vol. 5, no. 2, pp. 52–67, Apr. 2022. DOI: [10.31014/aior.1991.05.02.347](#).

## Teaching Experience

#### CS1206 - TA for Design and Analysis of Algorithms

01/2024 to 05/2024

Department of Computer Science, Ashoka University.

Worked with Prof. Anirban Sen. Focussed on Dynamic Programming and competitive coding style problems.

#### CSL2010 - TA for Introduction to Machine Learning

06/2023 to 09/2023

Indian Institute of Technology, Jodhpur

Worked with Prof. Rintu Kutum, Prof. Sucharita Dey, and Prof. Pankaj Yadav. Primarily responsible for grading.

#### CS2378 - TA for The New Geography of the Information Age

01/2023 to 05/2023

Department of Computer Science, Ashoka University.

Worked with Prof. Debayan Gupta. Focussed on the development of technical projects of the students.

#### CS1230 - TA for Data Structures I

09/2022 to 12/2022

Department of Computer Science, Ashoka University.

Worked with Prof. Soumyottam Chatterjee, Prof. Debayan Gupta. Focused on tree structures and dynamic programming

Awards and Accomplishments

<b>Global Masters Scholarship International Scholarship</b> <i>University of Birmingham, United Kingdom.</i> 2000£ merit tuition scholarship was awarded for exceptional academic achievement and research acumen.	09/2024
<b>Bronze Medal</b> <i>Dept of Computer Science. Ashoka University, Sonipat India.</i> Awarded for exceptional academic achievement, securing one of the highest cumulative GPAs in the department.	05/2024
<b>Magna Cum Laude</b> <i>Ashoka University, Sonipat India.</i> Received Latin honours for graduating in the top 10% of the class of 2024 with a GPA of 3.80.	05/2024
<b>Dean's List</b> <i>Ashoka University, Sonipat India.</i> Recognized on the Dean's list for an exceptional GPA for two consecutive semesters. Winter 2023 and Fall 2024.	05/2024
<b>Student Travel Grant and Award</b> <i>Centre for Supporting Students in External Engagement. Ashoka University, Sonipat India.</i> Awarded a \$1200 travel grant and award for exceptional research work towards a presentation at ISMB/ECCB 2023.	07/2023
<b>Singapore International Pre-graduate Award (SIPGA)</b> <i>Agency for Science, Technology, and Research, Singapore.</i> Awarded a grant of \$6000 and an attachment to the Bio-Informatics Institute (BII) in Singapore.	04/2023

Leadership Experience

<b>Teaching Assistant</b> <i>Department of Computer Science, Ashoka University</i> Served as a Teaching Assistant for multiple courses during my undergraduate and postgraduate degrees: [CS2378] The New Geography of the Information Age, [CS1230] Data Structures I, [CSL2010] Introduction to Machine Learning, and [CS1206] Design and Analysis of Algorithms	01/2022 to 05/2024
<b>Research Team Lead</b> <i>Kutum Lab. Ashoka University, Sonipat, India.</i> Led a team of young undergraduates at the laboratory run by Dr. Rintu Kutum. entored, supported, and guided students and served as a sounding board for their research ideas.	09/2022 to 12/2023
<b>Editorial Board Leader for Healthcare x Computer Science</b> <i>The Crossthink Journal. Ashoka University, Sonipat, India.</i> Reviewed articles and works submitted to the journal. uggested constructive changes to articles and evaluated arguments presented in the inter-sectional field of healthcare and computer science.	06/2022 to 05/2024
<b>President of the Academic Society for Computer Science</b> <i>Ashoka University, Sonipat, India.</i> Led a society of close to 50 undergraduate students. planned, oversaw, and executed multiple community-building and academic events. trengthened the position of the society in the academic space.	06/2022 to 06/2023






Volunteering Experience

<b>Course Representative, MSc AI and ML Program</b> <i>University of Birmingham, United Kingdom.</i> Acted as a liaison between students and faculty, voicing cohort feedback to enhance course quality and learning experience.	10/2024 to 09/2025
<b>Reviewer for the conference on Social Media and Society in India (SMSI)</b> <i>University of Michigan, Ann Arbor.</i> Served as a reviewer for the conference	04/2023
<b>National Conclave: The Future of Disability Inclusion in Higher Education</b> <i>Office Of Learning Support   Ashoka University, Sonipat, India.</i> Assisted in logistical arrangements. Guided guests with visual impairment and other disabilities.	09/2023

Key Skills

- **Machine Learning & Data Analysis:** Expertise in supervised and unsupervised learning, algorithm development, statistical modelling, and large-scale data analysis using Python, R, MATLAB, TensorFlow, and PyTorch.
- **Research & Programming:** Strong background in experimental design, quantitative and qualitative research, big data tools (Hadoop, Spark), and academic publishing, with industry experience in algorithm implementation and problem-solving.
- **Collaboration & Communication:** Effective team leadership, project management, and presentation skills with a focus on interdisciplinary collaboration and clear communication of complex ideas.

## References

<p><b>Prof. Le Zhang, PhD</b> </p> <p><i>School of Engineering, University of Birmingham, United Kingdom.</i></p> <p>A primary academic advisor and research supervisor at the Digital Healthcare and Medical Imaging Research Group.</p>	<p>Assistant Professor</p> <p><a href="mailto:l.zhang.16@bham.ac.uk">l.zhang.16@bham.ac.uk</a></p>
<p><b>Prof. Debayan Gupta, MSc, PhD</b> </p> <p><i>Dept. Computer Science, Ashoka University, Sonipat, India.</i></p> <p>A primary academic advisor who supervised the capstone thesis.</p>	<p>Assistant Professor</p> <p><a href="mailto:debayan.gupta@ashoka.edu.in">debayan.gupta@ashoka.edu.in</a></p>
<p><b>Prof. Lingadahalli Subrahmanya Shashidhara, MSc, PhD</b> </p> <p><i>Dept. Biology, National Centre for Biological Sciences, Bengaluru, India.</i></p> <p>Principle Investigator and advisor at Mphasis Labs.</p>	<p>Professor</p> <p><a href="mailto:lsshashidhara@ncbs.res.in">lsshashidhara@ncbs.res.in</a></p>
<p><b>Dr. Rintu Kutum, PhD</b> </p> <p><i>Dept. Biology and Computer Science, Ashoka University, Sonipat, India.</i></p> <p>Capstone Project advisor and joint advisor for all work on oral cancer.</p>	<p>Faculty Fellow</p> <p><a href="mailto:rintu.kutum@ashoka.edu.in">rintu.kutum@ashoka.edu.in</a></p>
<p><b>Prof. Bittu Kaveri Rajaraman</b> </p> <p><i>Dept. Biology and Psychology, Ashoka University, Sonipat, India.</i></p> <p>Principle Investigator and advisor at the Neuroethology Laboratory.</p>	<p>Associate Professor</p> <p><a href="mailto:bittu@ashoka.edu.in">bittu@ashoka.edu.in</a></p>