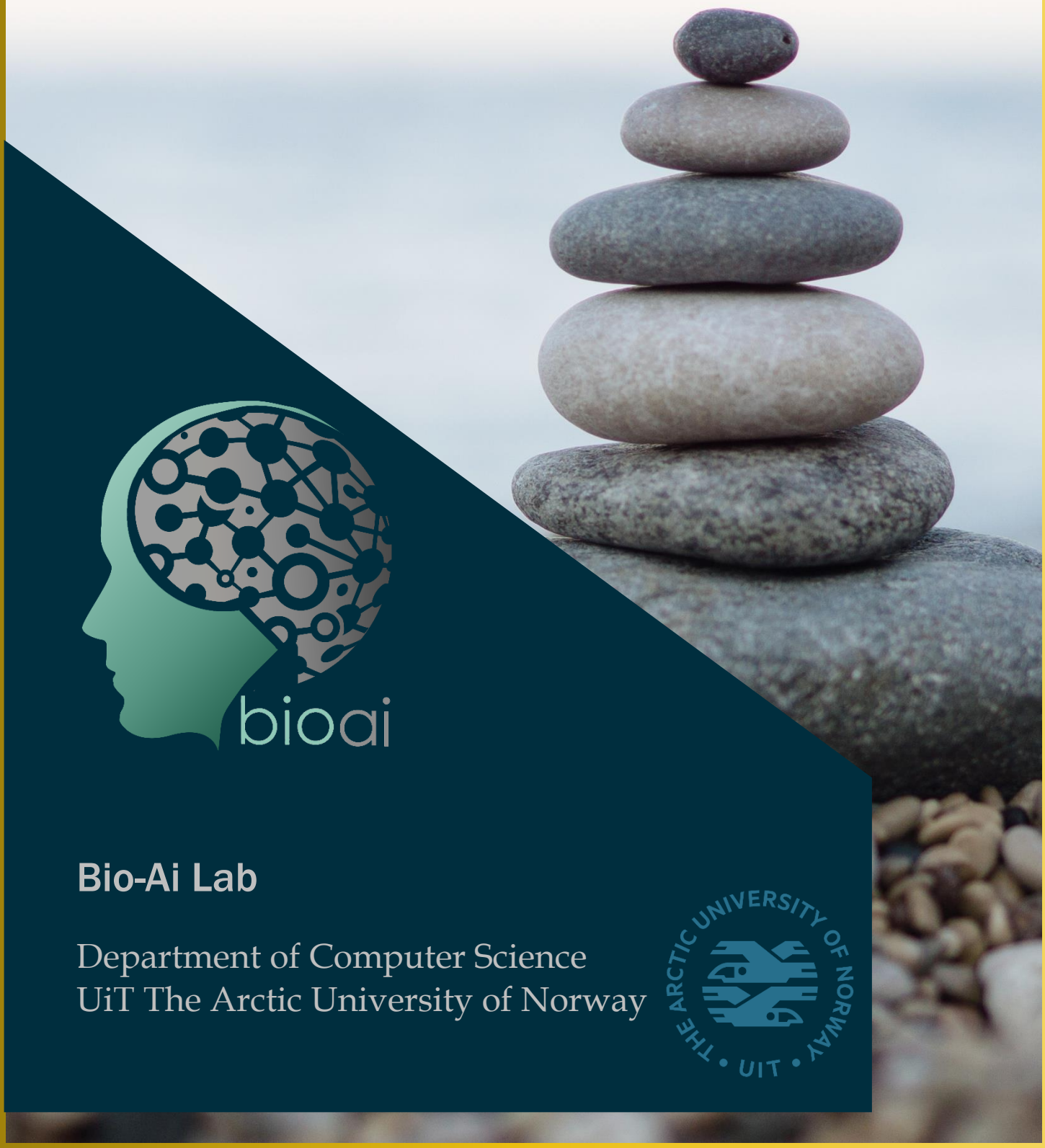
# Annual Report 2023



bioai

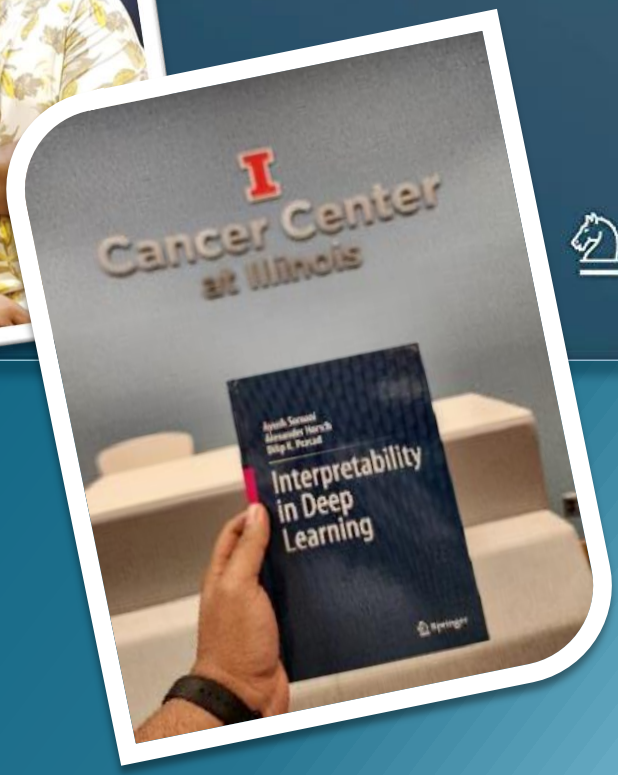
## Bio-Ai Lab

Department of Computer Science
UiT The Arctic University of Norway

THE ARCTIC UNIVERSITY OF NORWAY • UIT •

Ayush Somani
Alexander Horsch
Dilip K. Prasad

# Interpretability in Deep Learning


Springer


A team that enjoys together performs better

Barbeque, Aug'23,
@Telegrafbukta, Tromsø

## Contents


bioai

# INTRODUCTION

**Dilip Prasad and Alexander Horsch**

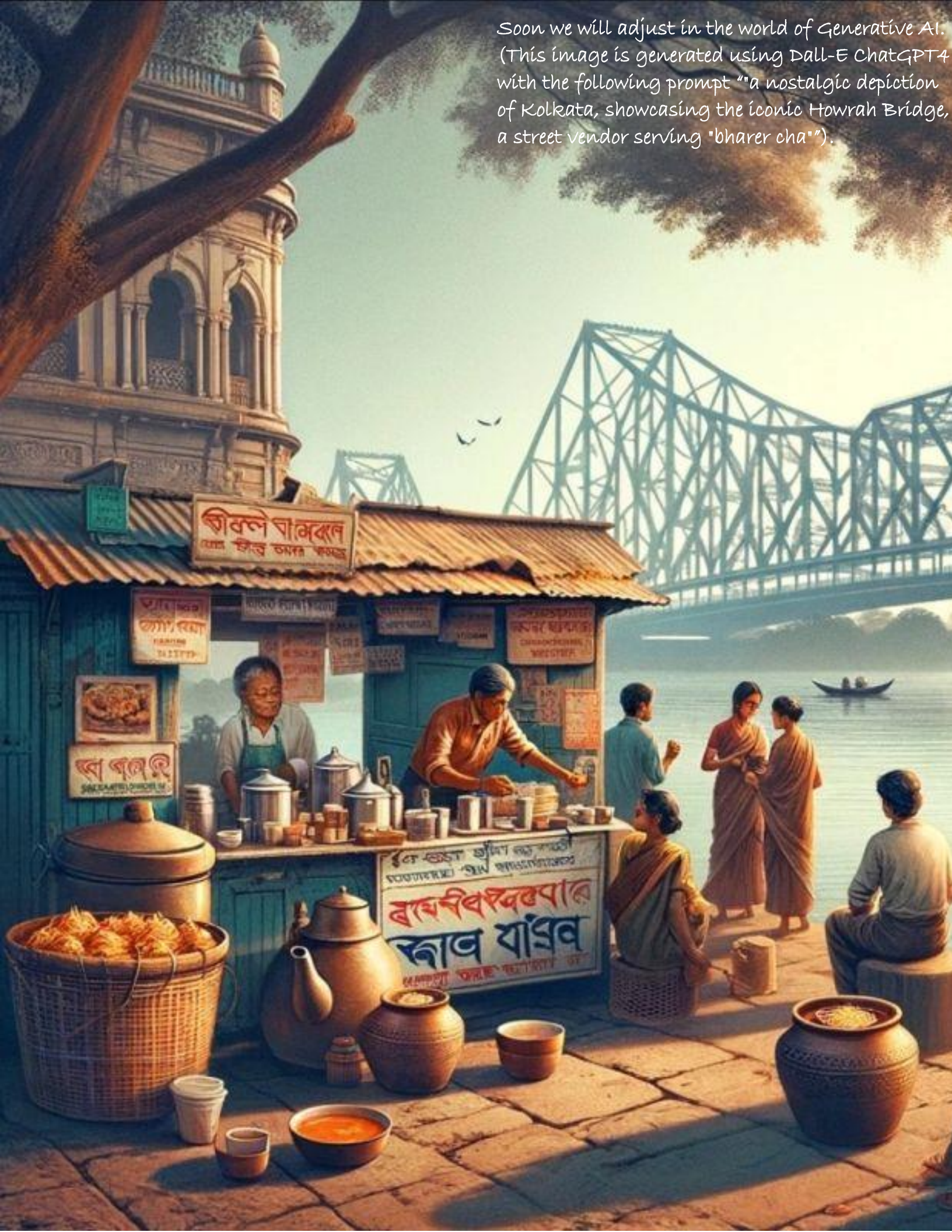
*As we bring 2023 to a close, we present the first annual report of the BioAI Lab at UiT The Arctic University of Norway.*

*This year, our focal points were Generative AI and Ethics in AI. We reflect on these topics in the first two essays. We present a selection of reflections from the members of the BioAI Lab. They also present their individual opinions on the two focal points. We then summarize the collective achievements of the BioAI lab and present our experiences on the three big events we organized – a summer school, a workshop, and an ICCV workshop.*

*Lastly, we present a map with footprints of the BioAI lab members in 2023 and conclude the report with our outlook for 2024.*

*We hope you rejoice with us while reading the report. Adieu 2023!*

*- The BioAI Team*


Soon we will adjust in the world of Generative AI.
(This image is generated using Dall-E ChatGPT4 with the following prompt “"a nostalgic depiction of Kolkata, showcasing the iconic Howrah Bridge, a street vendor serving "bharer cha"”).

# Generative AI in focus

Generative AI, the technological admire that enables machines to produce creative and original content, has become a focal point in contemporary discussions in recent times. Generative AI is a gateway to limitless creativity, making creative expression accessible to everyone. It's redefining the way we create content, from writing emails to designing eye-catching visuals for meeting presentations. This in turn could revolutionize various industries, including art, entertainment, and marketing, by streamlining content creation processes and unlocking new levels of innovation. It is obvious that generative AI has the potential to revolutionize industries that rely on creative output, fostering a symbiotic relationship between human ingenuity and machine-generated assistance.

> Generative AI is the canvas of imagination, where algorithms become the brushstrokes of a new era of creativity
>
> *– ChatGPT-4 with prompt "nice quote for Generative AI which users finds fascinating."*

However, the impact of generative AI on education and science is something one may not see obviously, but cannot unsee once seen. Generative AI can potentially make personalized education and learning a reality – where a student indeed learns from the content specially designed to cater his/her personal strengths and weaknesses and specific learning objectives. In the domain of science and research, data deficiency and ground truth hardness are the two main problems that plague the absorption of modern machine learning in this domain. No wonder, scientists stick to hypothesis validation approach rather than knowledge discovery through hypothesis generation approach. The lack of time and expertise to follow the trails of new knowledge in the data pile results in conventional evidence matching approach. Generative AI can solve these problems by not just creating high quality scientifically annotated datasets but also challenging the scientists by proposing creative, out-of-box hypotheses and following new knowledge trails by connecting remotely scattered dots.

In essence, this technology isn't just about what it can create; it's about the potential it unlocks in each of us to innovate and imagine a new era of creativity.

However, with great power comes great responsibility. We are reminded of the importance of transparency and ethics in AI applications. The possibility of generative AI being used to generate false information or fake modalities is a major concern. Critics also worry about the unintended consequences of deploying such systems that may inadvertently perpetuate biases present in their training data. Potential misuse for example through deepfake is also a concern, especially creating threats to personal and institutional credibility of the victims of misuse. It calls into question the very essence of trust and transparency that I advocate for in AI systems. We are at a crossroads where the potential for misinformation and the opacity of AI's decision-making process can undermine efforts to foster trust in AI technologies.

Additionally, as it continues to evolve, concerns about its impact on employment arise. The fear of job displacement is a valid consideration, as automation could render certain tasks obsolete, affecting industries that rely on manual labour.

We stay optimistic that we will eventually be able to overcome these obstacles. This transformative technology is not about replacing human creativity but augmenting it, providing a canvas where our wildest ideas can take shape. We can use generative AI's capabilities to boost our work while upholding the integrity and trustworthiness that are essential in AI applications. The road ahead is not without challenges, but with collaboration and commitment to ethical standards, we can ensure that generative AI serves as a force for good, driving innovation and creativity in a responsible and transparent manner.

# Ethics in AI

Imagine a world where the barrier to artistic creation knows 'no bound'. It democratizes creativity, making it accessible to all, where intricate designs, complex musical compositions, and innovative product ideas can be generated with just a few prompts. This is the world generative AI is ushering us into irrespective of technical skill or artistic ability. As we pilot in an era where machines can learn, reason, make decisions autonomously, and even create on demand, it becomes imperative to scrutinize the ethical dimensions that underpin the use of AI.

Should it become a standard ethical practice to acknowledge the use of AI in our work, in the same way that we credit human collaborators?

*– Ayush Somani."*

In today's world, data privacy and security stand as pivotal ethical concerns. Ensuring the confidentiality and protection of our sensitive information is crucial, especially in an age where every piece of information is just a Google search away. Equally pressing is the risk of bias in AI algorithms. Furthermore, transparency and explainability in AI decisions are of utmost importance, especially in a high-stakes field like healthcare to prevent misuse. If not carefully curated, AI systems can continue to reinforce and even exacerbate existing societal biases, leading to discriminatory outcomes. The use of AI in decision-making processes, particularly in areas such as hiring, law enforcement, and finance, has raised apprehensions about the fairness and accountability of these systems. We believe that ethical considerations in AI are not only necessary, but also fundamental to the technology's success and societal acceptance.

**Prompt given to ChatGPT 4 for the image on the left:**

Create an image that visually represents the intersection of ethics in AI and biological research. The setting is a futuristic laboratory, where AI technology and biological studies converge. In the foreground, a large, transparent, interactive AI interface displays complex cell and tissue structures, symbolizing the group's focus on biological cell and tissue mechanism understanding. The AI interface shows various aspects of AI technology, such as scalable AI structures, sustainable AI elements, and large vision models, all integrated seamlessly into the study of biology for engineered heart tissue, liver cells, hela cells. Around the interface, scientists of diverse backgrounds are actively engaged in discussion, emphasizing the collaborative and interdisciplinary nature of their work. In the background, we see a harmonious blend of nature and technology, illustrating the sustainable approach to AI. The overall atmosphere of the image should convey a sense of ethical responsibility and deep contemplation, reflecting the critical importance of ethical considerations in AI, particularly in sensitive areas like biological research.

**Points of interest and intrigue:**

- Interesting to see scientists interacting among each other and then bioAI reactor in the center
- Some meaningful renderings for example of heart, mitocjondria, led blood cell, endoplasmic reticulum, etc.
- Some meaningless text
- Conjoined bodies and dismorphed on the bottom left table
- BioAI reactor’s size is so much bigger than the conventional lab space

Finding common ground in the discourse on AI ethics involves navigating a complex web of considerations. Yet, we believe that that ethical concerns can be effectively addressed through responsible development and thoughtful implementation. We argue that clear guidelines and standards must be established to ensure that AI systems operate within ethical boundaries. By promoting openness and responsible conduct, AI can be harnessed as a tool for positive societal transformation.

As researchers and practitioners of AI, we have a duty to lead by example. We underscore the importance of transparency and accountability in the development process. We must contribute actively to create robust AI framework that not only comply with regulations such as HIPAA and GDPR, but also uphold the principles of user confidentiality and trust.


A2

# This year, we were here

# When people come together

Abhinanda Punakkal

The year 2023 started with writing the DLN cross-project activity. I learned a lot from my co-applicant Joy, who is excellent at perceiving the need of the hour and designing the document in such a way that it highlights what the readers are looking for. Additionally, the success of this grant application and the activities that followed was a great opportunity to understand the workflow and challenges in a cross-project activity.

My first teaching assignment for the year was for the, AI- applications and methods. It was interesting to see the students come up with lots of fun projects including designing their games. The second teaching assignment was for the course “Cloud and Big Data Technology”, was a personal learning experience of the cloud platform.

The research tasks of this year involved more of the good old data processing of large datasets. I appreciate all the people who have worked on creating and publishing large datasets for machine learning. This is a task that often does not get credited appropriately. The fact that this task is still ongoing is a bit frustrating but at least now with the support from Oracle for Research, I now have a platform that I can work on. Two journal articles on which I worked got published. One of the articles was a video journal which was something new for me.

## Solving shape and motion modeling in Cell Microscopy

Fluorescence imaging is used for the study of different biological molecules under different conditions to determine healthy vs non-healthy conditions. My PhD project is aimed at exploring Artificial Intelligence (AI) solutions for modeling the shape and behavior of components of cell and tissue samples used for biological studies.

Thanks to Ayush and his amazing video-making skills, proceeded without much hiccups. Planning and coordinating between different groups for the manuscript and then working on how to present it using a video was an interesting activity.

### *Opinion about generative AI*

*I think that generative AI models will continue to become more powerful and will be an inevitable part of life. Although generative AI has numerous potential applications, we are also witnesses to scams using deepfakes and the creation of fake news.*

The LLM workshop was a surprising event of the year. Though apprehensive in the beginning about how the event would turn out without hands-on experience in the topic it turned out to be a fantastic experience. The time crunch and the teamwork worked magic on the final output. It was also the first time that the BioAI lab organized an event and it was a bonding experience for the team. It made me realize how much more can be accomplished when people come together rather than working individually.

## Ethics in AI

With the fast-paced progress and rapid reach of Generative AI, Ethics in AI can no longer be ignored. Current discussions are structured into the concerns of bias, transparency, and privacy. The concerns of AI on the economy and society as a whole are also growing. The developments in LLMs and generative AI raise the question of what education in the future will be. I believe Ethics in AI should also address the various ways in which it has a psychological impact on individuals and society where the lines of what is real and what Is not, is blurred.

Outside of work, I tried cross-country skiing this year and alpine. I tried several new hiking routes and joined Yoga classes in the second semester of the year and it has been great in helping me center and ground down. I am grateful to my supervisors for their constant support and encouragement and for believing in me even when I have been doubtful.

## Highlight of 2023

It was the first time that the BioAI lab organized an event and it was a bonding experience for the team. It made me realize how much more can be accomplished when people come together rather than working individually.

***Achievements in 2023***

- ***2 Journal articles***
- ***1 Arxiv***
- ***1 Code release***
- ***2 Industry engagements***
- ***1 funding award (25 KNOK)***
- ***2 Teaching assistantships***
- ***2 supervision roles***
- ***Organized LLM workshop and Bio-AI journal club***
- ***Reviewer ICML and NeurIPS workshops***

## PLANS FOR 2024

- Get MiShape published
- Work on shape modelling
- Work on motion modelling
- Internship/Research visit

## Scalable AI Architecture for Collective Dynamic Modeling of Sub-Cellular Organelles

My research harnesses the power of AI to revolutionize the way we analyze cell morphology and interpret biological events inside cell. My project integrates multi-scale captioning and multi-event analysis within the sophisticated framework of the Collective Dynamic Model (CDM). My research aims to contribute to a deeper, more nuanced understanding of life at the cellular level, opening new avenues for scientific discovery and innovation.

# A significant shift

**Iqra Qasim**

2023 marked a significant shift in my life, involving moving to a new country and boarding on my PhD journey, filled with questions and uncertainties. As this year comes to a close, I find myself enriched with so many new experiences and substantial personal growth. A strong research team and the admirable work-life balance in Norwegian culture are probably the two most prominent things I am grateful for.

One of the year's highlights has been my involvement in the Journal Club. These sessions, aimed at shaping our skills as researchers,

### *Opinion about generative AI*

*Imagine a world in which authors use algorithms to tell tales that connect with readers on a global scale, painters work with AI to create heavenly pieces of art, and musicians combine their tunes with AI-generated melodies to create previously unheard symphonies. Thanks to Generative AI, we have stepped into this reality now; it is not the future. Generative AI is a bridge between the impossible and the possible, transforming abstract ideas into tangible realities. More than just datasets and algorithms, generative AI is a mirror of our mutual objectives and what is possible when ethics and technology coexist together. Generative AI has a brilliant, breathtaking future full of limitless opportunities that might push mankind to new levels.*

provided me with invaluable opportunities to connect with my team members. Witnessing their active engagement and dedication was both inspiring and motivating. Moreover, the project meetings have been a source of enjoyment and learning. These interactions with my supervisors have not only bolstered my confidence in discussing my research but also made me more comfortable in addressing challenges I encountered and grow as a researcher. Having the opportunity to connect with researchers beyond Norway has also been a wonderful experience.

## Ethics in AI

The ethics of AI, including issues of privacy, fairness, transparency, and accountability, feel more relevant than ever. I realized we need to work harder to pursue the ethical value of AI. Alongside all the hype, we have seen many critiques addressing the 'black box' nature of AI. In my opinion, the biasness in AI system is causing all the conflicts and suspects. With human-in-the-loop systems, AI systems can experience unintentional or sometimes intentional bias, such as data labeling, model interpretation, and data collection. There's much to overcome, but with some positive initiatives, ethical AI is attainable. These positive initiatives could include, diverse data collection, defining ethical roadmaps, algorithmic transparency, awareness, feedback systems, diverse production groups, and open-source partnerships to highlight a few.

Along with the rigorous academic challenges, I enjoyed moments of relaxation with team and outside team. From our Friday Coffee gatherings, celebrating winter's coziness, to the summer BBQ party, each event has left a lasting impression on me. The experiences of this year have not only shaped me as a researcher but have also instilled a deeper appreciation for the academic community I am a part of. I look forward to further embracing the challenges and opportunities that lie ahead, confident that they will continue to enrich my personal and professional growth.

## Highlight of 2023

One of the year's highlights has been my involvement in the Journal Club. These sessions, aimed at shaping our skills as researchers, provided me with invaluable opportunities to connect with my team members.

***Achievements in 2023***

- ***1 Arxiv and journal submission***
- ***Won Demola EUGLOH Summer 2023 Idea Pitch***
- ***Presented in the Arctic LLM workshop***

## PLANS FOR 2024

- Increase my research output
- develop strategies for a healthier work-life balance
- Participate in more collaborative projects

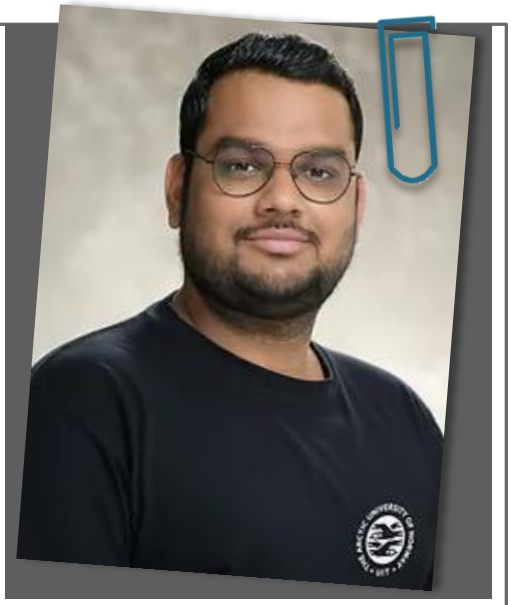
# A testament to our hard work

## Ayush Somani

As 2023 draws to a close, my reflections mark the year as both challenging and rewarding. Academically, this year has been an absolute roller coaster of productivity, personal development, and the art of balancing diverse responsibilities, each contributing uniquely to my growth. My book "Interpretability in Deep Learning" has finally been published, a significant milestone, stands as a testament to our hard work and significant contributions to the domain. Holding and signing the hard copy of the book was a morale boost after a sluggish start to the year and struggling to adjust to Singapore's scorching heat, being more acclimatized to Nordic weather conditions.

An interesting aspect for the past two years was traveling worldwide participating for various conferences, training exchange and networking sessions. Despite the fact that travel takes some of my energy and time prioritization, my visit to Singapore, India, Canada, and the USA within a year fulfilled a childhood dream, ironically through academic pursuits.

Reflecting back, managing time and prioritizing deliverables has been a struggle, notably in the midst of my PhD journey. The delay in some self-imposed goals served as a reminder of research's inherent unpredictability. Nevertheless, my typical habit to keep myself



### Interpretable Deep Learning for Multi-Modality Data

My research aims to overcome the traditional accuracy-explainability trade-off, towards merging advanced deep learning with human understanding. By integrating interpretability into the heart of AI, we're paving the way for more transparent, reliable decision-making, essential in high-stakes applications. It's a crucial step towards a future where AI and human expertise collaborate seamlessly.

engaged has kept me constantly active in these arctic conditions.

Juggling teaching, attending key conferences and maintaining research momentum has been challenging but rewarding. It taught me the importance of flexibility and resilience in the face of setbacks.

Lastly, I'm still to master the art of tackling procrastination. I learned through traveling that I am not alone in this vast ocean, and just as others have navigated it successfully, so shall I. The support and mentorship from my collaborators have been steadfast, keeping me on track towards my PhD. As I look towards the future, I am filled with a sense of optimism and determination. The experiences of this year, both good and bad, have prepared me for the challenges ahead and have solidified my resolve to contribute meaningfully to the field of AI. I am eager to continue this journey, embracing the opportunities and challenges that come with striving for excellence in AI research.

## *Opinion about generative AI*

*I envision generative AI as a gateway to limitless creativity, making creative expression accessible to everyone. What excites me the most is its potential role in learning and development, making education a truly personalized journey for each individual.*
*The possibility of generative AI being used to generate false information or fake modalities is a major concern. It calls into question the very essence of trust and transparency that I advocate for in AI systems. We are at a crossroads where the potential for misinformation and the opacity of AI's decision-making process can undermine efforts to foster trust in AI technologies.*

## Ethics in AI

I believe that ethical considerations in AI are not only necessary, but also fundamental to the technology's success and societal acceptance. As researchers and practitioners, we have a duty to lead by example, demonstrating how generative AI can be used to augment human capabilities ethically and effectively. We must create robust AI framework that not only comply with regulations such as HIPAA and GDPR, but also uphold the principles of user confidentiality and trust.

## Highlight of 2023

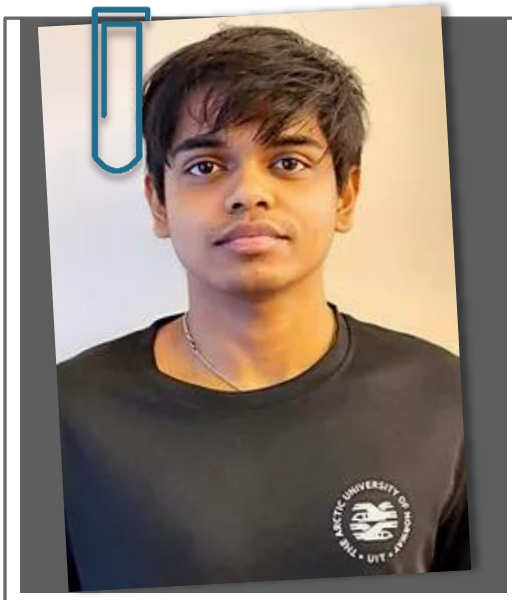
My visit to Singapore, India, Canada, and the USA within a year fulfilled a childhood dream, ironically through academic pursuits.

***Achievements in 2023***

- ***1 Book***
- ***2 Journal articles***
- ***1 Conference article***
- ***3 Codesets release***
- ***2 Video lectures release***
- ***1 Course organization and delivery***
- ***3 international engagements***
- ***5 visibility drives***
- ***Winner, Arctic Optica Image Contest***
- ***1 Teaching assistantship***
- ***Special Issue Editor: Nordic Machine Intelligence (NMI) Journal***

## PLANS FOR 2024

- 10 Journal/conference publications
- Possible industry internship or collaborations
- Targeted interdisciplinary grants and workshop proposals



## Shape representation and event detection of sub-cellular structures in high content microscopy

The project is about finding solution in data representation challenges in managing and analyzing the vast data generated by nanoscopy imaging, which is comparable to the total data usage by humankind in 2022.

# A good year

### Nirwan Bannerjee

2023 was a good year for me. I was lucky enough to have my first paper published. I took part in the interpretability course and that lead to exciting new opportunities for me. I also took part in the LLM Workshop and was able to learn a lot. I also received critical guidance from my supervisors and Samir da(elder brother in Bengali) without which I would probably still be lost.

### *Opinion about generative AI*

*Generative AI is an exceedingly potent instrument that perhaps debuted a spot too soon. Undoubtedly, it has a profound effect on society and is an indispensable instrument for the advancement of technology. However, far too many occupations are being replaced at an alarming rate, far outpacing the ability to generate new jobs. This is certain to generate discord among the various social classes. Moreover, tech giants now hold a substantial monopoly on generative AI. Even though this is beginning to shift, it significantly complicates the process of integrating Generative AI into society by introducing mistrust and friction.*

## Ethics in AI

Due to its innate nature and the requirement of public discourse, ethics in AI will take quite some time to get to fruition. It is a serious concern against the misuse of AI. The discourse surrounding AI ethics has expanded beyond the realm of academic research and non-profit organizations. Presently, major technology corporations such as IBM, Google, and Meta have formed teams to address the ethical concerns that emerge from the accumulation of vast quantities of data. Concurrently, governments and intergovernmental organizations have initiated the development of ethics policies and laws derived on academic study.

## Highlight of 2023

. I was lucky enough to have my first paper published

***Achievements in 2023***

- ***1 conference article***
- ***1 teaching assistantship***
- ***privateGPT++ repository with UI,vectorDB,Langchain,openLLM(CPU/GPU)***
- ***3 presentations in Bio-AI Jounral club.***

## PLANS FOR 2024

- Extract meaningful representations of complex subcellular structures from dense nanoscopy data
- Track and observe changes in the subcellular structures

## Scalable AI architectures for modeling dynamic complex systems

My research centers on developing scalable AI architectures for modeling complex dynamic systems in real-time. This specifically caters to online learning where the input dimensions can change at any time instance. Additionally, I am engaged in efforts to enhance the capabilities of Large Language Models.

# Broadening of horizons

### Rohit Agarwal

My journey of 2023 was about seeking to broaden my professional horizons. Upon beginning my PhD, I had resolved to focus solely on one task at a time, as my past experiences during my bachelor's and master's degrees had been characterized by involvement in multiple activities, including academics, sports, and management. I was saturated by doing so many tasks and thus I decided to focus on only one task. After a year and a half in my PhD program, I came to realize that my previous approach of focusing solely on one task at a time was not conducive to my productivity nor the enjoyment of my research. Consequently, I have since modified my work style and daily routine to allow for greater flexibility and involvement in multiple projects, including those related to my PhD topic as well as other areas of AI. In addition to my work in AI, I have also undertaken a physics-based problem with limited AI involvement.

Outside of work, I have pursued various personal interests, such as learning to swim. A significant development for me this year has been my active engagement in managerial tasks. I

find great satisfaction in interacting with people and tackling new and complex challenges, which has motivated me to organize multiple events for the BioAI team. Furthermore, , I have become a member of the Digital Life Norway Junior Research Group (DLN-JRG) with the aim of expanding DLN's activities in North Norway.

### *Opinion about generative AI*

*Generative AI has significantly transformed the AI landscape and has been widely adopted in various fields, including healthcare, finance, and media, underscoring the importance of generative AI, particularly large language models (LLMs), in our rapidly evolving world. I anticipate that generative AI will permeate almost every industry, revolutionizing the way we work and creating numerous opportunities for innovation and efficiency. However, it is crucial to ensure the secure growth of generative AI in the future.*
*Generated using privateGPT with the prompt "Rephrase the above paragraph in formal tone".*

My most significant experiences this year has been through attending various scientific dissemination events. I have gained valuable knowledge and skills in networking and presenting myself and my work to a broader audience. This has highlighted for me the importance of public dissemination of research, which will serve as a stepping stone for my future endeavors. Finally, I found great enjoyment and gained substantial knowledge from my experience supervising a master's student. This experience allowed me to develop skills in time management, expectations management, and learning new topics.

## Ethics in AI

I strongly believe that ethics in AI will play a crucial role in addressing the challenges in adoption of AI. It is encouraging to see that several organizations and companies are engaging in conversations about ethics in AI and planning their activities accordingly. Going forward, the primary focus should be on the proper implementation of ethical standards that safeguard all parties involved while supporting innovation and research.
Generated using privateGPT with the prompt "Rephrase the above paragraph in formal tone".

## Highlight of 2023

, I am currently supervising five interns in my lab, each specializing in different AI fields.

***Achievements in 2023***

- ***1 Journal article***
- ***2 Conference articles***
- ***2 Arxiv submissions***
- ***3 codesets release***
- ***2 Youtube videos***
- ***2 international collaborations***
- ***1 overseas research stay***
- ***Lecture in Arctic LLM workshop***
- ***Multiple visibility drives***
- ***2 teaching assistantships***

## PLANS FOR 2024

- 5 first author articles, 10 others
- Industry internship
- 2 international and 2 internal collaboration projects
- Book writing

# Innovation is an underappreciated aspect of academia

Suyog Jadhav

2023 was a great year for me personally. I completed my masters, and got set on track for my PhD project. I got to work on innovation projects and realized how interesting I find these practical innovation challenges.

### *Opinion about generative AI*

*Generative AI is very good for my work personally, as it helps mitigate the problem of ground-truth deficiency in microscopy. For LLM training, I need a lot of data with their correct ground truth, which is typically lost in the case of microscopy, but can be effectively replaced using a well-trained generative AI model. Controlling the hallucinations or at the very least making the outputs bound by physical constraints is a good research area in my opinion. Good work in this area will lead to huge gains for AI in microscopy community.*

On the research side of things, we typically face challenges dealing with unexplored territories of knowledge. On the innovation side, the challenges are more upfront and manifest in the form of logical implementation challenges. You need to account for a lot more things, since the product you are developing needs to be usable

## PhD topic: LLMs applied to microscopy

I am working on building tools to help AI work on microscopy. Upcoming PhD work will focus on applying LLMs to microscopy data. This year's work mostly focused on building the groundwork leading to it.

by an end user, instead of other, tech-savvy researchers. This challenges you to focus on optimizing your approach, coming up with solutions that are sustainable and will work for a long time. In general, I think working on innovation projects is an underappreciated aspect of academia.

Working on a startup idea in a non-academic setting is highly stressful. Academic grants for innovation take the stress out by letting one focus on building the solution. You also receive assistance from a much highly-qualified people from academia, which allows you to work on more cutting-edge problems.

Apart from that, I also participated in some research activities with other Bio-AI lab members, which is now leading me to more interesting research pathways, such as better ideas for microscopy data simulation. I also got to participate more in Journal club and conduct workshops, which has immensely helped me learn new things at a quick pace. Overall, I feel confident going into 2024. Great things lie ahead!

## Ethics in AI

With the growing popularity of generative models, ethics is a very valid concern. If the data used for learning the generative AI models is not sanitized properly, it could lead to biased outputs from the model, factual inaccuracies, copyright infringement etc. Github's Copilot and OpenAI's DALL-E recently got in controversy for utilizing publicly available data to train their models. Since training on such data opens up possibilities for entire works being repurposed and art styles being copied, this is a very grave issue that needs to be addressed properly. I think putting a standard in place that deals with outlining accepted practices with regards to scraping public data will be the next big thing in this field.

## Highlight of 2023

I got to participate more in Journal club and conduct workshops, which has immensely helped me learn new things at a quick pace. Overall, I feel confident going into 2024.

***Achievements in 2023***

- ***1 Arxiv submission***
- ***2 journal articles***
- ***1 Master thesis***
- ***1 conference article***
- ***1 Dataset release***
- ***Worked on 2 innovation projects***
- ***Conducted a session for the Arctic***

## PLANS FOR 2024

- Refine and publish PointNormalNet (master thesis work)
- Refine and publish MiShape
- Work on BioAI-Tools: Simulation tools for microscopy
- Work on: PhD topic
- Work on Spermotile: Innovation Project

## Discover unique spatiotemporal patterns in Engineered Heart Tissues

I am developing self-supervised AI models that can identify different morphological structures in microscopy data and localize their interactions over time, without relying on labeled data. The main objective is to discover unique spatiotemporal patterns that can be used to learn about healthy and diseased physiological conditions in engineered heart tissues.

# Many landmark developments in AI

**Himanshu Buckchash**

In 2023, there were many landmark developments in AI technology.

Personally, I learned a lot about the rapidly evolving field of large language models and was able to submit a few research papers and move forward with the Organ Vision project. My first half of 2023 was less active, while the second half was filled with multiple research activities.

### *Opinion about generative AI*

*Due to almost unbounded scaling capabilities, generative models are able to learn from an unimaginable pool of knowledge, containing the knowledge of all people combined, making them superior to any one single person. This hints towards super intelligence and unimaginable possibilities, making it the most revolutionary development because all the progress humans have made so far is only because of our intelligence. In essence, this is the most revolutionary technology ever developed by humans, with benefits and consequences beyond what we can imagine now.*

## Ethics in AI

It is not the technology that creates problems, but the way it is used. I believe there are two sides to ethics in AI.

The first is how models should be evaluated. Current AI models sometimes hallucinate and are not free from human biases. We are constantly running short of good benchmarks for evaluating the emerging capabilities in LLMs. Therefore, efforts need to be put into the development of better benchmarks.

The second is the ethics in their application and impact on society. We need to evaluate the impact generative AI is going to have on society due to the involvement of large corporations, dormant governments, and a blind race for profit-making. This is an urgent matter requiring grave attention.

## Highlight of 2023

With the advent of deep learning, the idea of generative AI has truly come to fruition.

***Achievements in 2023***

- ***2 Journal articles***
- ***Tutorial delivered in Bio-AI LLM workshop***
- ***3 presentations in the Bio-AI Journal club***
- ***Completed the University pedagogy course***

### PLANS FOR 2024

- 4 student projects
- A book on generative AI
- A proposal for student challenge

## Novel AI methods to handle very large images

My research interest includes Image Processing, Pattern Recognition, Artificial Intelligence (AI), Optimization, and Computer Vision. I am currently working on developing novel AI methods to handle very large images from the domains of Microscopy and Nanoscopy. In addition to this, I am also working on sustainable AI and transforming compute/resource-intensive AI methods to low-resource/compute methods or designing energy-efficient AI mechanisms.

# A journey of exploring and adjusting

**Samir Malakar**

The year 2023 is mixed with different experiences. In February from Kolkata, India, I moved to UiT The Arctic University of Norway, Tromsø, Norway to join as a postdoctoral fellow in the Nano-AI project at Bio-AI Lab at UiT. A journey of exploring and adjusting to the new environment and adapting to the new workplace culture started in February and it is ongoing. This journey also expanded my research direction and a new way of thinking about the research: thanks to Bio-AI lab members. I felt that I will not be able to cope with the change from teaching intensive position to research intensive position and its commitment.

In addition to other life events, I'd like to share some positive and negative aspects. In 2022, I achieved significant milestones, including the publication of 9 international SCI journals and 1 international conference paper. I also organized the ICCV-2023 workshop titled "Resource Efficient Deep Learning for Computer Vision" and served as the Artificial Intelligence and Data Science track chair at ICDEC-2023. My Google Scholar

citations is 1000+, only in 2023, the count has risen to over 400. Additionally, I held positions as an executive council member of the IEEE Computer Society and IEEE Young Professionals in the Kolkata section. Moreover, I served as a reviewer for many top AI along with numerous international conferences. Lastly, our course proposal, "Generative AI for Life Sciences," has been approved by the Digital Life Norway (DLN) Research School for organization in 2024. One of the downsides of this year was the research outcomes falling below my expectations. This may be due to me being more relaxed with my new work life. Despite putting in considerable effort, I couldn't achieve a breakthrough solution for the assigned project, which is a concern I'm eager to address in the future. Several projects began but didn't yield the desired results, resulting in only a limited number of completed works. Additionally, I faced challenges with unproductive research collaboration initiatives.

## *Opinion about generative AI*

*Generative AI is like all other revolutionary technologies used in the present days as gifts of science and technology. Supporters are considering the issues raised by the critics as a challenge. They are trying to employ their innovative ideas for its betterment and the generative AI technologies are evolving by every passing day. With reduced number of negative impacts, society will start considering it as another gift from science and technology in near future.*

## Ethics in AI

- Finding common ground in the discourse on AI ethics involves navigating a complex web of considerations.
- By fostering dialogue and engagement, diverse perspectives can contribute to the development of ethical frameworks that guide the responsible use of AI.
- The ultimate responsibility lies with human designers, developers, and decision-makers.
- Striking a balance between fostering innovation and safeguarding against potential harm requires a collaborative effort on a global scale.

## Highlight of 2023

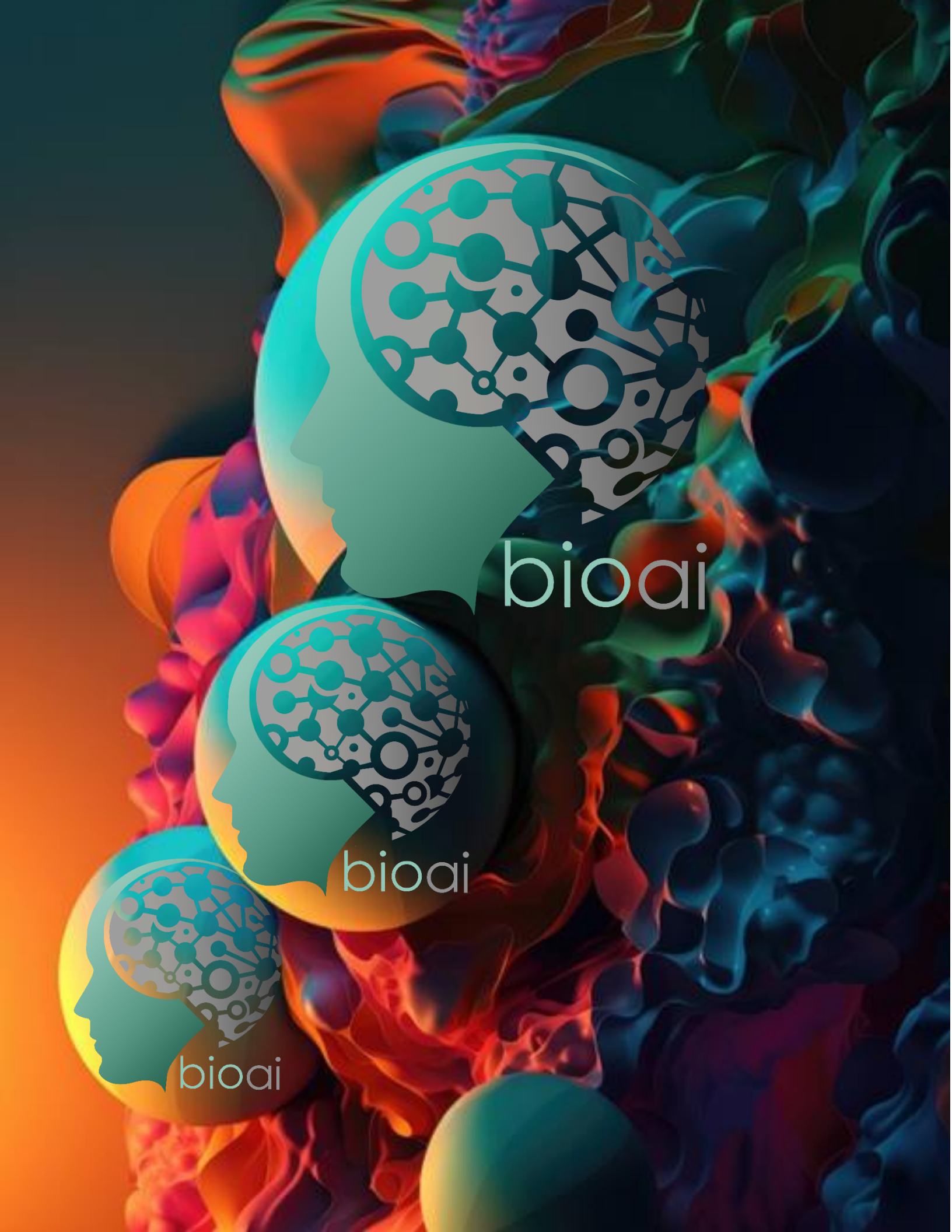
My publications crossed 1000 google scholar citations mark

***Achievements in 2023***

- ***9 Journal articles***
- ***1 conference article***
- ***Supervision roles for 2 PhD students and several bachelor students***
- ***Main organizer of an ICCV workshop***
- ***Talk in Bio-AI's LLM workshop and Bio-AI's journal club***

## PLANS FOR 2024

- Better utilization of time
- At least 5 publications (3 journals and 2 conferences)
- At least 7 publications (3 journals + 4 conferences) through supervision
- 1 single-author paper
- Organizing 3 international conferences / workshops
- Establishing 2 research collaborations.
- Submitting 2 research proposals.
- Completing Basic pedagogy training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# Outputs of BioAI Lab in 2023

## Books and theses

- [Book] Somani A, Horsch A, Prasad DK. Interpretability in Deep Learning. Springer Cham; 1st ed. 2023 edition(Hardcover ISBN : 978-3-031-20638-2; Published: 01 May 2023) https://doi.org/10.1007/978-3-031-20639-9 . . UiT The Arctic University of Norway.
- [PhD Thesis] J. I. Arnes, Toward a Collaborative Platform for Hybrid Designs Sharing a Common Cohort.
- [Master Thesis] S. Jadhav, Reconstructing 3D Geometries of Sub-Cellular Structures from SMLM point clouds. UiT The Arctic University of Norway. Grade: A
- [Master Thesis] A. V. Celeste, Presenting CODS (Cell Organelle Dynamic Simulation). UiT The Arctic University of Norway. Grade: A. Link

## Journal articles

- Punnakkal, A. R., Godtliebsen, G., Somani, A., Maldonado, S. A. A., Birgisdottir, Å. B., Prasad, D. K., ... & Agarwal, K. (2023). Analyzing Mitochondrial Morphology Through Simulation Supervised Learning. JoVE (Journal of Visualized Experiments), (193), e64880.
- Godtliebsen, G., Larsen, K. B., Bhujabal, Z., Opstad, I. S., Nager, M., Punnakkal, A. R., ... & Birgisdottir, A. B. (2023). High-resolution visualization and assessment of basal and OXPHOS-induced mitophagy in H9c2 cardiomyoblasts. Autophagy, 19(10), 2769-2788.
- Malakar, S., Sen, S., Romanov, S., Kaplun, D., & Sarkar, R. (2023). Role of transfer functions in PSO to select diagnostic attributes for chronic disease prediction: An experimental study. Journal of King Saud University-Computer and Information Sciences, 35(9), 101757.
- Somani A, Horsch A, Bopardikar Ajit, Prasad DK. Propagating Transparency: A Deep Dive into theInterpretability of Neural Networks. Nordic Machine Intelligence (2023) Special Issue [in press].

- Biswas, M., Buckchash, H., & Prasad, D. K. (2023). pNNCLR: Stochastic Pseudo Neighborhoods for Contrastive Learning based Unsupervised Representation Learning Problems. Neurocomputing Journal. doi.org/10.48550/arXiv.2308.06983
- Singh, A., Bhambhu, Y., Buckchash, H., Gupta, D. K., & Prasad, D. K. (2023). Latent Graph Attention for Enhanced Spatial Context. Pattern Recognition Journal. doi.org/10.48550/arXiv.2307.04149
- Agarwal, Rohit, et al. "Aux-Drop: Handling Haphazard Inputs in Online Learning Using Auxiliary Dropouts." Transactions on Machine Learning Research (2023). Link
- Jadhav, S., Kuchibhotla, R., Agarwal, K., Habib, A., & Prasad, D. K. (2023). Deep learning-based denoising of acoustic images generated with point contact method. Journal of Nondestructive Evaluation, Diagnostics and Prognostics of Engineering Systems, 6(3).
- Bhatt, S., Butola, A., Kumar, A., Thapa, P., Joshi, A., Jadhav, S., ... & Mehta, D. S. (2023). Single-shot multispectral quantitative phase imaging of biological samples using deep learning. Applied Optics, 62(15), 3989-3999.

## Conference articles

- Somani A, Banerjee P, Rastogi M, Agarwal K, Prasad DK, Habib A. Image Inpainting with Hypergraphs forResolution Improvement in Scanning Acoustic Microscopy. In Proceedings of the IEEE/CVF Conference onComputer Vision and Pattern Recognition 2023 (pp. 3112-3121).
- Banerjee, N., Malakar, S., Gupta, D. K., Horsch, A., & Prasad, D. K. (2023, November). Guided U-Net Aided Efficient Image Data Storing with Shape Preservation. In Asian Conference on Pattern Recognition (pp. 317-330). Cham: Springer Nature Switzerland.
- Agarwal, Rohit, et al. "Mabnet: Master Assistant Buddy Network with Hybrid Learning for Image Retrieval." ICASSP 2023-2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP). IEEE, 2023. Link
- Agarwal, Rohit, et al. "Auxiliary Network: Scalable and agile online learning for dynamic system with inconsistently available inputs." International Conference on Neural Information Processing. Cham: Springer International Publishing, 2022. Link

- S. Jadhav1, S. Majhi, A.S. Chowdhury, D.K.. Prasad, K. Agarwal, Reconstructing 3D shape from 3D ThunderSTORM Point Clouds Focus on Microscopy Conference 2023, Porto, Portugal
- Jadhav, S., Kuchibhotla, R., Agarwal, K., Habib, A., & Prasad, D. K. (2023). Deep learning-based denoising of acoustic images generated with point contact method. Journal of Nondestructive Evaluation, Diagnostics and Prognostics of Engineering Systems, 6(3).

## Arxiv documents

- Punnakkal, A. R., Jadhav, S. S., Horsch, A., Agarwal, K., & Prasad, D. K. (2023). MiShape: 3D Shape Modelling of Mitochondria in Microscopy. arXiv preprint arXiv:2303.01546.
- Iqra Qasim, Alexander Horsch, and Dilip K. Prasad. 2023. Dense Video Captioning: A survey of Techniques, Datasets, and Evaluation Protocols. Submitted to ACM Computing Surveys https://doi.org/10.48550/arXiv.2311.02538
- Arora, Gauri, et al. "Taxonomy of hybridly polarized Stokes vortex beams." arXiv preprint arXiv:2306.05974 (2023). Link
- Agarwal, Rohit, et al. "Modelling Irregularly Sampled Time Series Without Imputation." arXiv preprint arXiv:2309.08698 (2023). Link
- S. Jadhav, S. Majhi, A.S. Chowdhury, D.K.. Prasad, K. Agarwal, Reconstructing 3D shape from 3D ThunderSTORM Point Clouds Focus on Microscopy Conference 2023, Porto, Portugal

## Datesets/codesets release

- Tool & Video Protocol: Tool on fluorescence microscopy images of fixed cardiomyoblasts.
- Paper Code: Image Inpainting With Hypergraphs for Resolution Improvement in Scanning Acoustic Microscopy[CVPR Workshop 2023]
- Summer School Course Tutorial: Interpretable DL Playground
- Paper Code: Virtual Labeling of Mitochondria in Living Cells using Physics-guided Deep Learning [Data Release]
- Lab's Repository Management: Arctic LLM Workshop Hands-on Tutorial Session
- Aux-Drop: https://github.com/Rohit102497/Aux-Drop
- Mabnet: https://github.com/Rohit102497/MABNet

- Modelling Irregularly Sampled Time Series Without Imputation: https://github.com/Rohit102497/SLAN
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## Video release

- Video Lecture: INF-8605/3605 [TEKNOBYGGET 1.022AUD] Course recording released at UiT Panopto
- YouTube video of Auxiliary Network Paper: Link
- YouTube video of MABNet: Link

## Major visibility and dissemination events

- Summer School on 'Interpretability in deep learning' in June 2023
- The Arctic LLM workshop, organized in October 2023
- ICCV-2023 workshop titled "Resource Efficient Deep Learning for Computer Vision" in December 2023.

## Intellectual property and invention disclosures

## Industry outreach and visibility

- Oracle Cloud Platform
  Help review and perform benchmarking of different GPUs for 'Oracle for Research Project Award' for our project on Generative AI for Microscopy.
- NVIDIA
  Engaged with NVIDIA for opportunities of funding and support for the research activities of the lab.

## International cooperation

- Collaboration with CLIMB, Beckmann Institute, UIUC, USA
- Collaboration with IIT (ISM) Dhanbad, India
- Collaboration with the University of Lorraine, France
- Collaboration with IIT Guwahati, India (March – May 2023)

## Visibility, popular science, public dissemination

- Website: Interpretability in Deep Learning one-stop website with all the resources and course information.
- Participation in NORA Startup Event 2023 held in Tromsø, Norway. [Link]
- Invited Guest Lecture [Dec 2023]: Titled "Learning LLMs and Generative AI landscape for Biological Research" organized at Skibotn Fieldstation by ArcEcoGen – Arctic Ecosystem Genomics – A UiT Aurora Centre and The Arctic University Museum of Norway.
- Presentation [Sept 2023]: "Interpretability advancements in label-free research, multi-modal imaging and AI applications" at Beckman Institute for Advanced Science and Technology, Illinois, USA.
- Book Felicitation: "Visit of the Indian Ambassador to UiT" India-Norway Co-operation Meeting

## Engagement with research communities

- Somani A, Horsch A, Prasad DK., submitted proposals to both: (a) Call for Application for Educational Courses for NORA Research School; (b) 7th open call for course proposals to Digital Life Norway Research School and successfully secured funding of 100 kNOK from both entities – Norwegian Artificial Intelligence Research Consortium (NORA) and the Digital Life Norway (DLN), to conduct the 5-ECTS summer school 2023. A notable achievement was the publication of three chosen projects from the course participants in a scientific journal. Webpage, UiT Course Page, NORA Coverage.
- Participation in the OrganVision Annual meeting held 19-21st June at Tromsø.
- Participation in the NORA Annual Conference 2023 held 5-6th June at Scandic Ishavshotel, Tromsø.
- Participation in the N-CRiPT Technical Workshop held 20th April at NUSS Kent Ridge Guild House, Singapore
- **Conference**, 2023: NORA. Annual Conference. Place: Copenhagen, Denmark. **Poster Presentation**
- **NorwAI Innovate**, 2023: LLM conference by NorwAI. https://www.norwaiinnovate.no/ . Place: Stavanger, Norway. **Poster Presentation**

- **Conference,** 2023**:** DLN. https://www.digitallifenorway.org/conference/. Place: Bergen, Norway. **Poster Presentation**
- **Symposium,** 2023: Association for the Advancement of Artificial Intelligence (AAAI). https://aaai.org/conference/summer-symposia/summer-series-2023/. Place: Singapore.
- **Summer School,** 2023**:** AI in Neuroscience Summer School from NRSN. https://www.ntnu.edu/nrsn/summer-school. Place: Stavanger, Norway

## Funding

- Ghosh, B., Punnakkal, A., Received a grant of 25 kNOK on pilot project "Testing AI-based 3D synthetic reconstructions of cell organelles of 2D real microscopy images" as a part of Digital Life Norway's (DLN) cross-project funding.
- A. Somani, Awarded the Erasmus+ Staff Mobility Grant (2022-23) for research travel to the Beckmann Institute, University of Illinois Urbana-Champaign, Illinois, USA in Sept 2023.
- A. Somani and R. Agarwal, Secured the Funding for Staying Abroad (2022-23) from the committee for research training (NTF-FU 113-22) for three-months research internship at N-CRiPT Lab, School of Computing, National University of Singapore (NUS), Singapore.
- Somani A, Horsch A, Prasad DK., submitted proposals to both: (a) Call for Application for Educational Courses for NORA Research School; (b) 7th open call for course proposals to Digital Life Norway Research School and successfully secured funding of 100 kNOK from both entities – Norwegian Artificial Intelligence Research Consortium (NORA) and the Digital Life Norway (DLN), to conduct the 5-ECTS summer school 2023. A notable achievement was the publication of three chosen projects from the course participants in a scientific journal.

# ‘Interpretability in deep learning’ – summer school

## Ayush Somani

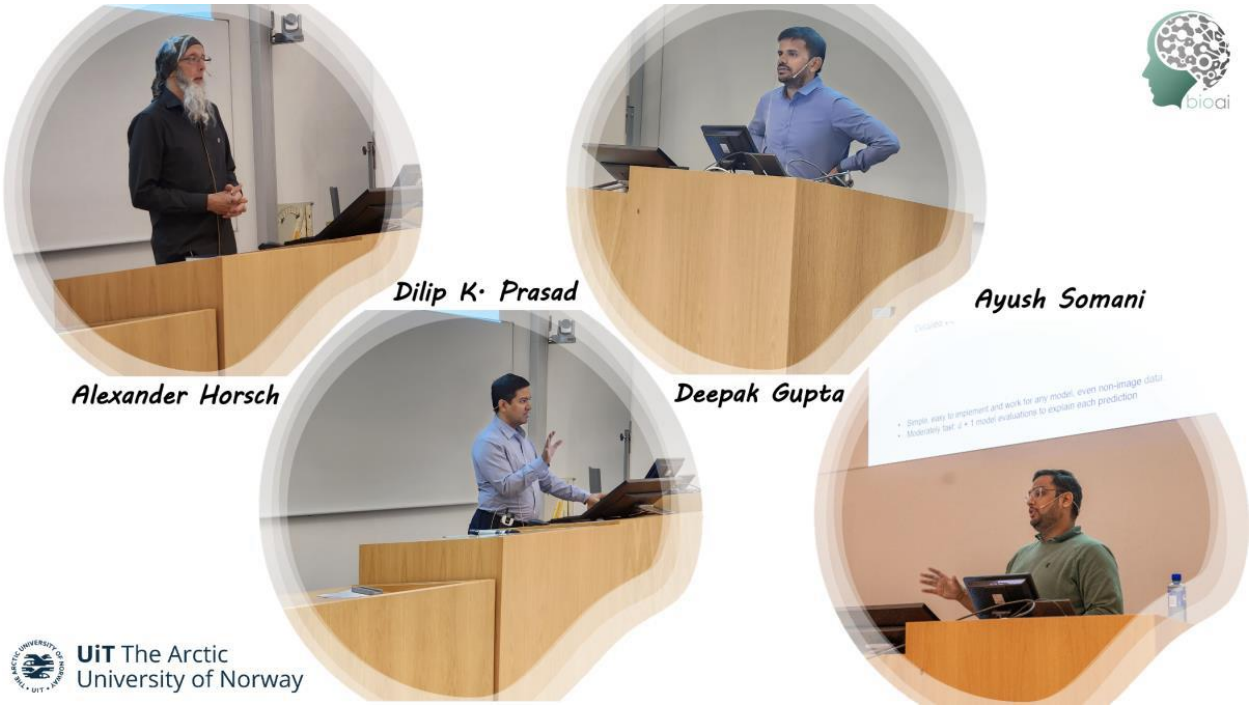
Imagine a world where artificial intelligence makes decisions that affect our daily lives, from healthcare to finance, without us having any insight into how or why those decisions are made. These scenarios is not far-fetched, as deep learning models, with their black-box nature, have posed challenges in understanding their inner workings. However, a summer school on “INF-3605/8605 Interpretability in Deep Learning” hosted by Department of Computer Science, UiT The Arctic University of Norway, Tromsø during 12-17 June 2023 has shed light on this crucial issue.

Amidst the breathtaking landscapes of Tromsø, known for its majestic fjords and mesmerizing auroras, the 5-ECTS “Interpretability in Deep Learning” summer school funded by the Norwegian Artificial Intelligence Research Consortium (NORA) and the Digital Life Norway (DLN) unfolded its week-long journey (12th to 16th June 2023) of knowledge discovery. While the summer sun never set, bathing the city in the glorious

hues of the midnight sun, the organizers along with 28 participants from diverse backgrounds embarked on their intellectual expedition with unmatched enthusiasm to address the pressing need for transparency and understanding in AI systems.

As the sun painted the horizon with shades of gold, discussions on the importance of interpretable AI echoed within the walls of the lecture room. The participants found inspiration in the natural wonders of Tromsø, just as the midnight sun revealed the beauty of the Arctic landscape, the summer school aimed to shed light on resolving the black-box nature of AI models. Moreover, the city's summer weather was nothing short of magical, with invigorating hiking trails and lush greenery inviting the curious souls to explore the stunning Norwegian wilderness during their free time.

Lectured by AYUSH SOMANI, DEEPAK GUPTA, DILIP K. PRASAD and ALEXANDER HORSCH from Bio-AI Lab at the Department of Computer Science, UiT The Arctic University of Norway, with administrative support from JAN FUGLESTEG and SVEIN TORE JENSEN and teaching assistance from SUYOG JADHAV, this first-of-its-kind summer school marked a significant milestone in the quest to unravel the mysteries of deep learning interpretability. From seasoned academics to enthusiastic PhD fellows and professionals from the industry, the summer school attracted a



diverse group of individuals driven by their shared passion for explainability in deep learning. With laptops in hand and minds ablaze with curiosity, participants in were immersed in a rigorous curriculum designed to explore various aspects of holding an AI model accountable for its decision

A total of nearly 20 hours of lecture and 3 hours of hands-on lab sessions covered a wide range of topics, starting with the evolution of deep learning and the historical context that led to the need for interpretability. From there, the participants delved into the importance of interpretable AI, gaining a deep understanding of its significance in promoting transparency, fairness, and ethical decision-making. The summer school provided a comprehensive refresher on deep learning architectures, ensuring that participants had a solid foundation to tackle the challenges of interpretability. Through engaging lectures, interactive group discussions, and hands-on exercises, attendees were introduced to model-agnostic approaches, encoding and visualizing neural network architectures, fuzzy learning, causal inferences, AI ethics, and emerging trends in model interpretability. Outside the lecture halls, the laughter of newfound friends echoed amidst the tranquility of nature, fostering a sense of community that enriched the summer school experience.
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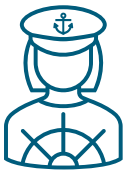
# Arctic LLM workshop

## Dilip Prasad

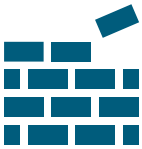
We conducted the 1st Arctic LLM Workshop 2023 at UiT- The Arctic University of Norway with ~40 participants on October 27-28, 2023. (Workshop page for ppt and resources - https://lnkd.in/g8ck_fKH). The aim of the workshop was to gain and impart a first hand exposure to the 'buzzword of 2023,' namely the large language models. It's a buzzword that is likely to keep buzzing for in the world of AI for a long time, and we wanted no one to feel left out.

During this workshop, we delved into a wide array of topics, offering our participants a hands-on experience alongside engaging lectures. Here's a glimpse of what we covered:



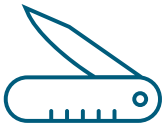
**Data Mastery:** We explored the nuances of data preparation for foundational model training, even tackling the intriguing challenge of language translation for low-resource languages like Norsk (Bokmål, Ny Norsk).

**Ultra-Low Resource Languages:** We discussed the unique challenges in handling ultra-low-resource languages, including Sami (with its 8 varieties).



**Building Foundations:** Our journey led us to foundational model training, understanding its requirements and intricacies.

**Diverse Tasks:** We dived into data preparation for LLM training across various tasks, giving our participants valuable insights.
**Fine-Tuning Simplified:** We made the complex simple by explaining the process of simple LLM fine-tuning.



**Cutting-Edge Adaptation:** We explored LoRA-based adaptation, a parameter-efficient fine-tuning technique that's on the cutting edge of AI innovation.

**Innovation in Action:** Participants got a taste of LLM application development using OpenAI API, Langchain, and Huggingface resources.

**Privacy Matters:** We unveiled the world of LLM-based application development using PrivateGPT++, complete with a GitHub repository. This empowers you to build your private LLM-based applications with a strong focus on privacy and security. Our university's IT division is even considering integrating this Docker-based solution for UiT researchers across departments.

**Supercharged Training:** We discussed foundational model training acceleration over distributed servers, along with the technical requirements of working with Nvidia GPU clusters and high-speed distributed AMD GPU servers.

Even with time constraints, we made all these wonders happen using a smaller-sized LLM model. Imagine the possibilities when we unleash the full power of larger models!

Centre for Digital Life Norway has funded 5 ECTS summer course on Generative AI for life sciences.


**A victory for the team BioAI:** We decided to conduct this workshop at a short notice of just 4 weeks. It started as a simple idea of learning within the group for keeping abreast with the hottest topic in AI. But, many got interested and it kept scaling upwards to eventually become a Norway scale event. 4 WEEKS – and expectations erupting at seams – we were tense, pushed, but excited!!!

***AND WE DELIVERED!***

**As a group, we conquered the race against time with elan!**

# ICCV workshop on ‘Resource–efficient deep learning for computer vision’

Dilip Prasad

The Resource Efficient Computer Vision Workshop (RCV) at ICCV 2023 (October 2023, Paris) brought together researchers and industry practitioners to address the growing scale of deep learning models. With a focus on practical training and inference efficiency, especially in the realm of computer vision, the workshop aimed to reduce computational memory requirements and associated times. A unique aspect was its emphasis on budget-aware model training and inference, acknowledging diverse resource constraints. RCV also featured challenges to optimize model training and inference under specific constraints, fostering collaboration and advancing research in resource-efficient deep learning. The event was sponsored by NORA – Norwegian Artificial Intelligence Research Consortium and co-organized by UiT The Arctic University of Norway.

**Workshop Highlights**

**Invited Talks:** Notable speakers included Prof. Song Han from MIT, USA; Dr. Prateek Jain from Google, India; Dr. Sangdoo Yun from Naver AI Lab, South Korea; and Prof. Efstratios Gavves from the University of Amsterdam, Netherlands.

**Paper Presentations:** The conference featured 50 posters and 3 oral presentations, showcasing diverse research in efficient computer vision models and applications. There were over 100 submissions and 53 were accepted after double blind reviews by the 3 set of reviewers for each submitted papers.

**Publication:** All 53 papers' proceedings were published by the Computer Vision Foundation as open access, contributing valuable insights to the research community. Proceedings are available at this link.

**RCV Challenges:** Papers from the RCV challenges were compiled and published at the ICCV Workshop 2023, demonstrating innovative solutions for resource-efficient model training and inference.

**Committee Involvement:** The event was organized by a dedicated team, with 16 members on the organizing committee and an additional 17 technical program committee members, ensuring a well-structured and impactful conference. The organizers were from university and industry such as Google Research, Google Brain, Qualcomm, Amazon, Samsung. The international consortium of organizing committee were from USA, Hong Kong, UAE, Netherlands, India and Norway.

# Outlook for 2024

Career development and fulfilment of ambitions and dreams of the team

Teaching new topics – generative AI for life sciences

Constortium building for generative AI

Books to make some heavily technical topics of broad interest accessible to general public

In focus – sustainability of AI

- Equity and diversity