Anirudh Phukan

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Research Interests

Multimodal Representation Learning, Natural Language Processing, Interpretability, Multilinguality, Efficiency

Education

Bachelor of Technology, Indian Institute of Technology Guwahati *July 2019 – May 2023*
Major in Computer Science and Engineering with Minor in Robotics and Artificial Intelligence

- CGPA: **9.59/10.00**

Experience

Research Associate - Adobe Inc. (Big Data Intelligence Lab) *Bangalore, India*
Group: Multimodal Content Group *July 2023 – Current*

- Contributed to projects on Document Grounding, Hallucination Detection and Mitigation, LLM Optimization, Multilinguality, and Multimodality
- Facilitated cross-functional and global research collaboration, strategically engaging with diverse stakeholders to align cutting-edge research with strategic business objectives
- Published research papers, filed patents, and delivered talks on both my projects and literature. Integrated research advancements into Adobe products, driving real-world impact

Research Intern - Adobe Inc. (Big Data Intelligence Lab) *Bangalore, India*
Mentors: Sumit Shekhar, Inderjeet Nair, Akhash Amarnath *May 2022 – July 2022*

- Developed a framework to deconstruct infographics into components and reformat them for improved readability across various screen sizes while preserving the original reading order.
- Generated a synthetic dataset of 27K PowerPoint SmartArts and fine-tuned YOLOv5 and LayoutReader to detect components and determine reading order. Adapted Felzenszwalb's graph-based image segmentation algorithm for precise geometric pattern extraction of components.
- Provided users with 9 optimized layouts for any given aspect ratio using LayoutGAN++, integrating heuristics, beautification principles, and relational constraints. Filed **a patent** for the framework.

Publications

1. **Anirudh Phukan**, Divyansh, Harshit Kumar Morj, Vaishnavi, Apoorv Saxena, and Koustava Goswami. **Beyond Logit Lens: Contextual Embeddings for Robust Hallucination Detection & Grounding in VLMs**, *Under ACL Rolling Review (Meta-Review Score: 4/5).*
2. Shwetha Somasundaram, **Anirudh Phukan**, and Apoorv Saxena. **PLD+: Accelerating LLM inference by leveraging Language Model Artifacts**, *Under ACL Rolling Review (Meta-Review Score: 4/5).*
3. **Anirudh Phukan**, Shwetha Somasundaram, Apoorv Saxena, Koustava Goswami, and Balaji Vasan Srinivasan. **Peering into the Mind of Language Models: An Approach for Attribution in Contextual Question Answering**, *In Findings of the Association for Computational Linguistics: ACL 2024.*
4. S. Kumar*, **A. Phukan*** and A. Sur. **IPCL: Iterative Pseudo-Supervised Contrastive Learning to Improve Self-Supervised Feature Representation**, *ICASSP 2024 - 2024 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP).*

Patents

1. **Anirudh Phukan**, Koustava Goswami, Divyansh, Harshit Kumar Morj, Vaishnavi. **Generating Multimodal Attribution of Artificial Intelligence Responses** [Filed] (US Patent App. 18/927,104)
2. Shwetha S., **Anirudh Phukan**, Apoorv Saxena. **Generating Draft Sequence rankings for Speculative Decoding using Large Language Model Hidden States** [Filed] (US Patent App. 18/924,398)

3. Inderjeet Nair, **Anirudh Phukan**, Aravind Veluri, Lakshya J., Mohar Kundu, Akhash Amarnath, Niyati Chhaya, Sumit Shekhar. **Reflowing Infographics for Enhanced Cross-Device Consumption** [Filed] (US Patent App. 18/446,765)

Scholastic Achievements

Undergraduate Distinctions *2019 - 2023*

- Achieved 3^{rd} Rank in Computer Science and Engineering among 111 Students, Class of 2023
- Awarded Outstanding Grade AS in 5 courses including *Deep Learning* and *Optimization*

Engineering Entrance Examinations *2019*

- Secured All India Rank 1,974 in JEE Advanced among 250,000 shortlisted candidates (99.2 Percentile) and All India Rank 1,201 in JEE Mains among 1,500,000 applicants (Top 0.1%)
- Secured 10^{th} rank in KCET among $\sim$ 200,000 applicants

Kishore Vaigyanik Protsahan Yojana (KVPY) Scholar *2019*

- Awarded by Dept. of Science and Technology, Govt. of India to students with an aptitude for research
- All India Rank 404 among $\sim$ 100,000 applicants (Top 0.5%)

Awarded National Talent Search Scholarship *2017*

- Conducted by NCERT to identify and nurture talented students
- Acceptance rate of $< 0.1\%$ out of $\sim$ 1,000,000 applicants

Standardized Tests

- GRE - 334/340, TOEFL - 114/120

Key Projects

Enhancing Contextual Faithfulness in Language Models *July 2024 – Current*
Adobe Research

- Proposed a fast, scalable, inference-time method that ensures LLMs maintain faithfulness to the context
- Introduced a novel data curation strategy to train a steering vector and apply activation steering to elicit the desired behavior
- Demonstrated superior performance and less sensitivity to hyperparameters compared to prominent alternatives such as Context Aware Decoding

Robust Visual Hallucination Detection & Grounding *May 2024 – Oct 2024*
Adobe Research

- Developed a **modality-agnostic** grounding technique for Grounded VQA, delivering robust performance across diverse image types including scans, charts, infographics, and natural images
- Demonstrated the utility of contextual embeddings in achieving robust visual hallucination detection and implemented the method across *InternlmVL, Qwen2VL, MiniGemini, and Llava-1.5*.
- Submitted a first author paper and filed **a patent**, with keen interest from Adobe Business Unit leaders and active plans for potential product integration

Plug-and-Play Inference Optimization for LLMs *Feb 2024 – Oct 2024*
Adobe Research

- Explored use of model internals such as leveraging attention weights and hidden representations to enhance draft proposals during speculative decoding, accelerating LLM inference
- Designed an out-of-the-box usable method to rank input spans for semantic relevance, improving draft quality in scenarios with substantial input copying
- Achieved significant speedups over training-free baselines and surpassed training baselines in 4/5 tasks. Filed **a patent** and submitted a co-authored paper

Towards Improved Document Attribution *Oct 2023 – Oct 2024*
Adobe Research

- Formulated the problem of attributing text to document references through the lens of **interpretability**
- Utilized the contextual nature of LLM embeddings to design a training-free, granular attribution algorithm. Curated a dataset to evaluate fine-grained attribution and published a first author paper at **ACL 2024**
- Improved entity disambiguation accuracy from 50 to 95% on internal datasets. Successfully **productized**

entity attribution in contracts in Adobe Acrobat

- Enabled attribution support for high-resource languages by conducting studies on the similarity of representations across languages for similar content

Beyond Manual Augmentations for Self-Supervised Feature Learning *July 2022 – May 2023*
Prof. Arijit Sur, Dept. of CSE *IIT Guwahati*

- Proposed a framework that integrates seamlessly with existing **self-supervised contrastive learning methods**, enhancing representation learning for downstream computer vision tasks
- Combined supervised and self-supervised contrastive loss to leverage intra-class variations, utilizing pseudo-labels generated through clustering, while ensuring stability of existing methods.
- Achieved performance gains on *CIFAR-10* and *STL-10*, with further improvements by iterative cluster updates. Joint first author paper accepted at **ICASSP 2024**

Grasp Recognition through Object Affordances using IRL *July 2022 – Nov 2022*
Prof. Shyamanta M Hazarika, Dept. of ME and DS&AI *IIT Guwahati*

- Developed a multi-layer **inverse reinforcement learning** framework leveraging object affordances for grasp recognition
- Highlighted the importance of high-level semantic information, showing a 33% performance drop on the *Yale Human Grasping Dataset* when object affordances were removed

Mentoring Experience

- Co-mentored 4 Undergraduate students in Adobe Research India's 2024 Summer Internship program
- CSEA Department Academic Mentor to 5 freshmen, helping them cope up with the curriculum and solving their general concerns.