# Shubham Innani

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## Education

**2016-2020** **Bachelor of Technology**, *Department of Electronics and Telecommunication Engineering*, *Shri Guru Gobind Singhji Institute of Engineering and Technology, Nanded*, Maharashtra - India.

## Experience

**December 2023 - Present** **Research Analyst**, *Division of Computational Pathology, Indiana University School of Medicine*, Indianapolis, United States of America.
Working on research and developing algorithm for intepretability, biomarkeres, survival from Digital Pathology Images.

**August 2022 - November 2023** **Visiting Associate**, *Center for Biomedical Image Computing and Analytics (CBICA), University of Pennsylvania*, Philadelphia, United States of America.
Developing algorithm for intepretability, survival from Digital Pathology Images.

**January 2021- July 2022** **Assistant System Engineer**, *Tata Consultancy Services*, Pune, India.
Worked with a leading US Bank for migration from legacy to cloud systems.

**March 2020- June 2020** **Data Science Intern**, *Nymo.ai*, Bangalore, India.
Worked developing real-time edge computing technology.

## Awards

**2020** **$2^{nd}$ Prize** in Semantic Segmentation Challenge on IDD dataset organized at Indian Conference on Computer Vision, Graphics and Image Processing (ICVGIP) at IIT Jodhpur, by IIIT Hyderabad, and Intel, India.

**2020** Participated in Retinal Fundus Glaucoma Challenge Edition2 (REFUGE2) challenge at MICCAI, ranked in top 10.

**2020** Participated in Age Related Macular Degeneration(AMD) challenge at IEEE International Symposium on Biomedical Imaging (ISBI) and ranked in top 10.

**2020** Participated in Agriculture Vision Prize Challenge at Computer Vision and Pattern Recognition (CVPR), ranked in top performing team.

**2019** **$1^{st}$ Prize** in Semantic Segmentation Challenge on IDD lite dataset organized at National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG),India, by IIIT Hyderabad, India and Intel, India.

**2019** Travel Grant awarded to attend National Conference on Computer Vision, Pattern Recognition, Image Processing and Graphics (NCVPRIPG).

## Publications

### Abstract

2023 **Shubham Innani**, Bhakti Baheti, MacLean P Nasrallah, Spyridon Bakas, PATH-39. INTERPRETABLE IDH CLASSIFICATION FROM H&E-STAINED HISTOLOGY SLIDES, Neuro-Oncology, Volume 25, Issue Supplement_5, November 2023, Page v177, https://doi.org/10.1093/neuonc/noad179.0669

2023 Bhakti Baheti, Sunny Rai, **Shubham Innani**, Garv Mehdiratta, Sharath Chandra Guntuku, MacLean P Nasrallah, Spyridon Bakas, EPCO-15. DETECTING HISTOLOGIC & CLINICAL GLIOBLASTOMA PATTERNS OF PROGNOSTIC RELEVANCE, Neuro-Oncology, Volume 25, Issue Supplement_5, November 2023, Page v126, https://doi.org/10.1093/neuonc/noad179.0478

2023 Bhakti Baheti, **Shubham Innani**, Garv Mehdiratta, MacLean P. Nasrallah, Spyridon Bakas, Interpretable whole slide image prognostic stratification of glioblastoma patients furthering disease understanding, Neuro-Oncology, Volume 25, Issue Supplement_2, September 2023, Pages ii103–ii104 https://doi.org/10.1093/neuonc/noad137.347.

2023 Bhakti Baheti, **Shubham Innani**, MacLean P. Nasrallah, Spyridon Bakas, Unsupervised clustering of morphology patterns on whole slide images guide prognostic stratification of glioblastoma patients, Neuro-Oncology, Volume 25, Issue Supplement_2, September 2023, Page ii15, https://doi.org/10.1093/neuonc/noad137.043.

## Conference

2022 **Shubham Innani**, Prasad Dutande, Bhakti Baheti, Ujjwal Baid and Sanjay Talbar, Deep Learning based Novel Cascaded Approach for Skin Lesion Analysis. 7th International Conference on Computer Vision & Image Processing, Nagpur, India.

2021 Bhakti Baheti, **Shubham Innani**, Suhas Gajre and Sanjay Talbar, Pedestrian Detection and Movement Direction Recognition with Convolutional Neural Network. 9th International Conference on Pattern Recognition and Machine Intelligence. 2021 December.

2021 **Shubham Innani**, Prasad Dutande, Bhakti Baheti, Sanjay Talbar, and Ujjwal Baid, Fuse-PN: A Novel Architecture for Anomaly Pattern Segmentation in Aerial Agricultural Images. In Proceedings of the IEEE CVF Conference on Computer Vision and Pattern Recognition (CVPR) Workshops(pp. 2960-2968).

2020 M. T. Chiu,X. Xu, K. Wang, J.Hobbs, Brunner R., Andrew Ng, U. Baid, **Shubham Innani**, P. Dutande, B. Baheti, S. Talbar, "The 1st Agriculture-Vision Challenge: Methods and Results," 2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), 2020, pp. 212-218, doi: 10.1109/CVPRW50498.2020.00032.

2020 Bhakti Baheti*, **Shubham Innani***, Suhas Gajre and Sanjay Talbar, "Eff-UNet: A Novel Architecture for Semantic Segmentation in Unstructured Environment," 2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), 2020, pp. 1473-1481, doi: 10.1109/CVPRW50498.2020.00187.(*contributed equally)

## Journal

2023 **Shubham, Innani**, Prasad Dutande, Ujjwal Baid, Venu Pokuri, Spyridon Bakas, Sanjay Talbar, Bhakti Baheti, and Sharath Chandra Guntuku. "Generative adversarial networks based skin lesion segmentation." Scientific Reports 13, no. 1 (2023): 13467.

2022 Fang H, Li F, Fu H, Sun X, Cao X, Lin F, Son J, Kim S, Quellec G, Matta S, Shankaranarayana SM, Ujjwal B, **Shubham I** and others, ADAM Challenge: Detecting Age-related Macular Degeneration from Fundus Images, in IEEE Transactions on Medical Imaging, doi: 10.1109/TMI.2022.3172773.

2020 Bhakti Baheti, **Shubham Innani**, Suhas Gajre, Sanjay Talbar. Semantic scene segmentation in unstructured environment with modified DeepLabV3+. Elsevier Pattern Recognition Letters, Volume 138, 2020, Pages 223-229, ISSN 0167-8655,doi: 10.1016/j.patrec.2020.07.029.

### Arxiv

2023 Bhakti, Baheti, Sunny Rai, **Shubham Innani**, Garv Mehdiratta, Sharath Chandra Guntuku, MacLean P. Nasrallah, and Spyridon Bakas. "Detecting Histologic & Clinical Glioblastoma Patterns of Prognostic Relevance." arXiv preprint arXiv:2302.00669 (2023).

2022 Fang H, Li F, Fu H, Sun X, Cao X, Son J, Yu S, Zhang M, Yuan C, Bian C, Lei B., Ujjwal B, **Shubham Innani** and others, REFUGE2 Challenge: Treasure for Multi-Domain Learning in Glaucoma Assessment. arXiv preprint arXiv:2202.08994. 2022 Feb 18.

## Posters & Presentations

2023 Oral Presentation & Poster accepted at $18^{th}$ Meeting of the European Association of Neuro-Oncology (EANO 2023), Rotterdam, Netherlands.

2023 Oral Presentation & Poster accepted at $19^{th}$ European Congress on Digital Pathology (ECDP 2023), Budapest, Hungary.

2020 Poster Presentation at IEEE Conference on Computer Vision and Pattern Recognition (CVPR) in Agriculture Vision Workshop.

## Projects

- **Oncocytic Renal Tumor Subtyping**
  Focus is to develop a computational algorithm for subtyping oncocytic renal tumors from H&E stained whole slide images (WSI).

- **Biomarker Identification in Gliomas**
  Focus is to develop a computational algorithm for biomarker prediction of glioma patients based on digital H&E stained whole slide images (WSI) using weakly supervised approach. We explore Self Supervised Learning based algorithms based on ViT and DINO.

- **Prognostic Stratification of Glioblastoma**
  Focus is to develop a computational algorithm for survival prediction of GBM patients based on digital H&E stained whole slide images (WSI) using weakly supervised approach. We also aim at interpretability analysis i.e. the important regions from WSI driving the decision.

- **Automatic Number Plate Recognition**
  Focus was on the development of novel and realtime algorithms for Automatic Number Plate Recognition. This algorithm implements end-to-end You Only Look Once (YOLO) based object detector and Mask-RCNN based Region Proposal Network.

- **Retinal Fundus Glaucoma Analysis (REFUGE2 Challenge, MICCAI 2020)**
  Algorithm for Retinal Fundus Glaucoma Analysis with segmentation of optic disc and cup, classification of glaucoma and localization of fovea is being developed. We leverage the power of Efficientnets and Unet for all the tasks.

- **Anamoly Pattern Segmentation in Agriculture(Agriculture Vision Challenge, CVPRW 2020)**
  Novel and effective algorithms is developed for agricultural pattern recognition from aerial images using Feature Pyramid Network as encoder and varying the decoder backbones.

- **Age Related Macular Degeneration (AMD Challenge, ISBI 2020)**
  Development of algorithms associated with the diagnosis of Age-related Macular degeneration (AMD) and segmentation of lesions in fundus photos from AMD patients with Convolutional Neural Networks.

- **Semantic Scene Segmentation in Unstructured Environment (AUTONUE Challenge, ICCV 2019 & NCVPRIPG Challenge 2019 & ICVGIP Challenge 2020)**
  Encoder-Decoder architecture is developed for semantic scene segmentation in unstructured environment with various backbones like InceptionResNetV2, EfficientNets using Deep Learning on Indian Driving Dataset (IDD) and IDD lite.

- **Skin lesion Segmentation and Classification (ISIC Challenge, MICCAI 2018)**
  Generative Adversarial Network based architecture is developed for skin lesion segmentation and classification with Convolutional Neural Network. The classification task is carried out with state-of-the-art networks like ResNets, MobileNets, Xception, EfficientNets.

## Skills

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|---|---|
| AI Tools | Convolutional Neural Network (CNN), Segmentation Models, CNN based classification models, Object detection models, Generative Adversarial Networks (GAN) |
| Libraries | Keras, Tensorflow, Numpy, Pandas, Pytesseract, Scikit-Learn, Scikit-Image, Openslide, Pytorch (Beginner) |
| Outros | Python, C, Colab, GPU, SCRUM, SPRINT, Git |

## Reviewer Experience

IEEE Transaction in Medical Imaging

Nature Scientific Reports

IEEE Signal Processing Letters

IEEE Transactions on Neural Networks and Learning Systems

IEEE Computer Vision and Pattern Recognition (Workshops) Conference

IEEE International Symposium on Biomedical Imaging Conference

Elsevier Neurocomputing Journal

## Certifications

Deep Learning Specialization by deeplearning.ai on Coursera by Andrew Ng

AI for Medicine on Coursera

Introduction to TensorFlow for Artificial Intelligence, Machine Learning, and Deep Learning by deeplearning.ai on Coursera

Deep Neural Networks with PyTorch on Coursera

## About me

I aim to work in an organization with research-based opportunities where I can utilize my skills to achieve the organization's objective and grow personally and professionally. Despite the short period of experience in the research sector, I have interest and willingness to learn new things.

## Personal Details

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| Date of Birth | $8^{th}$ September 1998 |
| LinkedIn | https://www.linkedin.com/in/shubhaminnani |
| GitHub | https://github.com/shubhaminnani |
| Google Scholar | https://scholar.google.com/citations?user=AwOCjT8AAAAJ&hl=en |
| Website | https://shubhaminnani.github.io/ |

Name: Shubham Innani          Place: Indianapolis, IN, USA          Date: $1^{th}$ January, 2024