

# Sonal Shukla

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## Research Interests

- Deep Learning, Computer Vision, Federated Learning, Machine Learning
- Algorithm Design, Edge Computing, Blockchain
- Privacy-Preserving AI, Whole Slide Imaging, Digital Pathology, Medical Imaging

## Education

- **Ph.D., Computational Cell Biology, Anatomy & Pathology**, University at Buffalo – SUNY, 8/2021–7/2025 (expected)
- **MS, Computer Science**, University at Buffalo – SUNY, 01/2020–07/2021
- **B.Tech, Computer Science & Engineering**, Banasthali Vidyapith, India, 07/2015–07/2019

## Professional Activities

### Skills

- **Programming:** Python, C/C++, Java, Shell Scripting, MATLAB
- **AI & ML Frameworks:** TensorFlow, PyTorch, BERT, Federated Learning
- **Imaging Tools:** DICOM, Visiopharm, QuPath, Whole Slide Imaging, CT, MRI Analysis
- **Network Security:** VPN, SSH, DNS, Network Isolation, Secure Data Sharing in AI
- **Cloud Platforms:** AWS, Apache Solr, Distributed Computing Frameworks
- **Database Management:** MongoDB, Oracle, SQL, NoSQL
- **Web Development:** HTML, CSS, Flask, Web Deployment
- **Miscellaneous:** Grant Writing, Computational Pathology, AI Ethics

## Experience & Internships

- **Research Assistant**, SUNY Research Foundation, University at Buffalo, SUNY, Present  
Investigated the impact of inter-institutional variability and dataset heterogeneity in whole slide imaging for cancer diagnosis. Addressed domain shift challenges by implementing techniques such as stain normalization, domain adversarial training, and batch effect correction to improve model generalizability across diverse pathology sources. Contributed to scalable model design capable of handling large gigapixel pathology images while preserving diagnostic accuracy across varied tissue types and staining protocols.
- **Co-op Research Scientist**, Pfizer, 09/2024–04/2025  
Developed and deployed advanced computer vision and deep learning algorithms for whole slide imaging analysis, focused on cancer detection and classification across multiple organ systems. Designed and implemented image segmentation and classification pipelines to support histopathological analysis in oncology research. Collaborated with cross-functional teams including pathologists, data scientists, and bioinformaticians to integrate AI-driven insights into clinical workflows for precision medicine.
- **Digital Pathology Intern for AI**, Iron Mountain, 06/2024–08/2024  
Applied state-of-the-art AI algorithms for cell detection and segmentation in medical imaging, addressing challenges like dataset variability and limited annotations. Optimized machine learning workflows for improved model performance, generalizability, and diagnostic accuracy using large-scale annotated datasets. Automated data preprocessing and evaluation pipelines to enhance reproducibility and scalability across research projects.
- **Guest Lecture**, Center for AI in Medicine, Imaging & Forensics (CAIMIF), India, 2024  
Delivered a comprehensive lecture on federated learning pipelines for whole slide imaging datasets, focusing on privacy-preserving AI in computational pathology and strategies to mitigate batch effects in histopathological imaging.

- **Guest Lecture**, ML for Biomedical Data, University at Buffalo – SUNY, Spring 2024  
Covered advanced machine learning techniques for analyzing biomedical datasets, including preprocessing workflows, feature extraction, and integration with clinical decision systems.
- **Automating Testing and DevOps Integration at ISRO**, 06/2018–12/2018  
Developed and implemented automated testing pipelines using Selenium, improving efficiency and reducing manual efforts for key DevOps operations.

## Projects

- **Federated Learning for Computational Pathology:** Developed a pipeline using federated learning for whole slide imaging datasets to enable collaboration across institutions without data sharing. Addressed challenges like data privacy, large-scale gigapixel image handling, and algorithm generalization across diverse datasets.
- **Workplace Safety: Real-time Hand Gesture Recognition and Traffic Light Control:** Designed and implemented a deep learning-based system for detecting hand gestures in real-time, enhancing workplace safety and optimizing traffic control systems. Utilized computer vision frameworks and integrated gesture recognition with IoT devices.
- **Explainable Text Information Extraction using BERT:** Developed a machine learning pipeline to extract explainable text insights from contextual cues using BERT. Focused on natural language understanding and application in clinical and operational decision-making.
- **Light Web Application for Tweet Analysis:** Built a lightweight, scalable web application for sentiment analysis and trend tracking in social media data using natural language processing techniques. Integrated Flask backend with MongoDB for real-time data analysis.

## Awards & Grants

- Collaborated with my PI to secure a **\$50K CTSI Pilot Study Grant 2024 (NIH)** for the project titled "Initiative for Private and Secure Collaborative AI Training in Computational Pathology."

### Reviewer for Journals:

- IEEE Transactions on Medical Imaging
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- SPIE Journal of Medical Imaging

### Reviewer for Conferences:

- SPIE Digital Pathology & Medical Imaging Conference
- USCAP Annual Pathology Conference

## Publications

1. **Shukla S**, Doyle S, Brandwein-Weber M, Samankan S, Ayad A, and Rabie M: Federated Learning in computational pathology: classification of tall cell patterns in papillary thyroid carcinoma. *Proc. SPIE 12933-28, Medical Imaging 2024*.
2. **Shukla S**, Doyle S, Brandwein-Weber M, Samankan S, Ayad A, and Rabie M: Advancing Computational Pathology through Federated Learning: Identifying Tall Cell Patterns in Papillary Thyroid Carcinoma. *Proc. USCAP 113th Annual Meeting*, March 2024.
3. **Legala A, Shukla S**, Doyle S: Quantification of site-specific differences for digital pathology datasets. *Proc. SPIE 13413-30, Medical Imaging 2025*.