AVIGYAN SINHA

Address: 218 North Charles Street, Apt. 1006, Baltimore, MD 21201, USA **Website**: https://avigyan.github.io
Phone: +1 6673207702 **GitHub**: https://github.com/avigyan **Google Scholar**: https://tinyurl.com/avigyansinha
Email: avigyan15@gmail.com, asinha12@alumni.jh.edu **LinkedIn**: https://www.linkedin.com/in/avigyansinha

SUMMARY

An AI, Deep Learning researcher, and engineer with 10 years of industry experience and a strong focus on Computer Vision, multi-modal analysis, Explainable AI, and Generative AI. Expertise in designing and implementing the latest deep learning architectures, including CNNs, **RNNs**, **GANs**, and **diffusion** models **from scratch**. Demonstrated proficiency with cutting-edge models such as ResNet, Mask R-CNN, **YOLOv11**, **Transformers**, **DDPM**, and **DDIM**. Utilized advanced techniques, including data augmentation, transfer learning, hyperparameter optimization, and ensemble learning to enhance model performance. Proven ability to foster collaboration and communication, ensuring effective teamwork on highly technical and novel projects.

PROFESSIONAL SKILLS

- **Python**, **C++**, **C**, **MATLAB**, Java, Embedded C, HTML, CSS, PHP.
- **Keras**, **TensorFlow**, **PyTorch**, **OpenCV**, **Google Colab**, **Anaconda**, **Jupyter Notebook**, **SHAP**, **Gensim**, **Scikit-image**, **Scikit-learn, NLTK**, **XGBoost**, **Scipy**, **PIL**, MXNet, NumPy, Kaldi, Pandas, PyQt, CuPy, Caffe, ImageJ, Audacity, 3d Slicer.
- **Linux** (Ubuntu, Linux Mint, Kubuntu), **Windows**, **VxWorks** - Wind River Systems (**RTOS**), Arduino Nano, Raspberry Pi.

RESEARCH EXPERIENCE

Senior Engineer I, R&D – Vasoptic Medical, Inc. **(Columbia, MD, USA) 04/2023 – Present**

- Developed **blood vessel segmentation** (enhanced multi-scale line detector), **optic disc segmentation** (modified **nnU-Net**), and **artery-vein classification** algorithm with 95% accuracy, for ocular Laser Speckle Contrast Imaging (LSCI) video data.
- Enhanced model transparency and **explainability** by using **SHAP** (SHapley Additive exPlanations) analysis, Principal Component Analysis (**PCA**), and Factor Analysis of Mixed Data (**FAMD**) to reveal **latent** relationships and rank the importance of features, thereby providing key insights into the predictions made by complex machine learning models.
- In a team of 3, contributed to the production and delivery of 4 new image **analytics** software to customers, with novel deep learning pipelines and the capability of handling **multi-modal** data, resulting in a 45% increase in predictive accuracy.
- Guided 7+ research teams in analysis of LSCI **video sequences**, contributing to **AI** models that achieved 34% improvement in diagnosis rates across 3 different ocular conditions assessed in a cohort of 300+ patients.

Data Analytics Consultant – Vasoptic Medical, Inc. **(Kolkata, WB, India) 06/2020 – 04/2023**

- Researched **time-series** segmentation. Designed novel cost functions for interactive image segmentation using **Livewire** (Intelligent Scissors). Published papers on image and time sequence analytics using AI, Deep Learning, and Computer Vision.

Project Guide – IHRD **(Thiruvananthapuram, Kerala, India) 10/2019 – 05/2020**

- Supervised over 13 teams on **Deep Learning** R&D projects using **Python**, **C++**, **MATLAB**. Projects are mentioned below.
  - **Language identification** from speech signals with an accuracy of **98%**.
  - Automatic extraction of **video gaming highlights** from Twitch or YouTube streaming content.
  - Detection of breast cancer through gene expression data with an accuracy of **99.9%**.
  - **Text topic classification** via machine learning with an accuracy of **85%**.
  - **Real-time facial emotion recognition** from among six classes: angry, afraid, happy, sad, surprised, neutral.
  - **Real-time hand gesture recognition** with an accuracy of **96%** out of 9 classes.
  - Automatic **brain hemorrhage detection** using an artificial neural network with an accuracy of **94.5%**.
  - **Drowsiness detection** from **real-time** video with **97%** accuracy to create Advanced driver-assistance systems.
  - Generation of music audio files from images of Western staff notation.
  - **Defect Detection** and **Localization** in Industrial Products with **Class Activation Mapping**.
  - Plant species classification from images of leaves of 8 species of tropical trees.
  - **Eye tumor detection** with **95%** accuracy, to improve ocular health.
  - Venue mapping from unlabeled geospatial data – latitude, longitude, timestamp.

Software Engineer (**R&D**) **– Vehere** **(Kolkata, WB, India) 12/2016 – 05/2019**

- Conceptualized and designed an algorithm for **Drone** (Unmanned Aerial Vehicle) **Detection** and **Identification** with 90% accuracy, resulting in a patent. Ensured that computation time and memory requirements met the needs for a **real-time** commercial application.
- Fructified automatic classification of the modulation scheme of an unknown signal using **ensemble** neural networks and cyclo-stationary features, which has applications in Cognitive Radio, snooping, real-time surveillance, and spectrum sensing.
- Designed Wi-Fi demodulation and interception with MATLAB, LabVIEW, and an Orthogonal Frequency Division Multiplexing (OFDM) receiver and transmitter for Wi-Fi signals as per the IEEE 802.11 standard.
  Supervisor – Dr. Kankar Shubra Dasgupta, Former Director - Development and Educational Communication Unit, **ISRO**.

Junior Research Fellow – CSE Department, IIT Kharagpur (Kharagpur, WB, India) 01/2016 – 06/2016

- Researched deep learning for automated feature discovery in **Hyperspectral** images, intended for **remote sensing**, and achieved an accuracy of 97.48%, funded by **ISRO**. Refined the architecture with Caffe, **TensorFlow**, MATLAB, and C++.
  Supervisor – Prof. Pabitra Mitra, IIT Kharagpur, India.

Graduate Research Assistant – CS, ECE Department, JHU (Baltimore, MD, USA) 09/2013 – 08/2015

- Analyzed **activity recognition** and skill assessment in cataract **surgery videos**, using **computer vision** and deep learning, with an annotation tool and pipeline created in **MATLAB**, **Python**, and PHP for training junior surgeons.
  Mentors – Prof. Swaroop Vedula, Prof. Austin Reiter, JHU, USA.
- Worked on "Development of efficient, autonomous **asteroid detection** and **tracking** algorithms on satellite time-series images, for **real-time** onboard applications on spacecraft hardware", funded by **NASA**, in collaboration with **JHU APL**. The project encompassed image analysis and prioritizing the downlinked data from a satellite to a ground-based processor, with techniques to make the pipeline robust to noise and sensor performance, attaining an accuracy of **100%** with **VxWorks** and **C++**. Co-authored a peer-reviewed paper in IEEE.
  Advisors – Prof. Bruno Jedynak, Prof. Philippe M. Burlina, Prof. Gregory D. Hager, JHU, USA.
- Developed "**Segmentation** of brain **MRI** using 3D multi geometric deformable models, ensuring the preservation of topology of the anatomical structures" at IACL, JHU. Designed internal and external energy-based image forces for 3D **surfaces** instead of 2D **active contours**.
  Advisor - Prof. Jerry L. Prince, JHU, USA.

EDUCATION

Johns Hopkins University **Baltimore, USA**
M.S.E, Electrical & Computer Engineering, GPA 3.39/4 **09/2013 – 12/2014**

Indian Institute of Technology Kharagpur **Kharagpur, India**
B. Tech, Major in Electronics and Electrical Communication Engineering **07/2009 – 07/2013**
Minor in Physics, GPA 8.45/10

ACHIEVEMENTS & AWARDS

- **Reviewer** of the Investigative Ophthalmology & Visual Science (IOVS) in 10/2025, Journal of International Research in Medical and Pharmaceutical Sciences in 10/2025, Journal of Imaging Informatics in Medicine (Springer Nature) in 08/2025, and Journal of Pharmaceutical Research International in 05/2025.
- **Subject Matter Expert** in Advanced Math at Chegg India Pvt. Ltd., 10/2020 – 12/2022.
- **1 lakh INR** scholarship in the Advanced Program in Digital Health and Imaging, 08/2020 by **IISc**, Bangalore.
- **Semi-Finalist** in Code Gladiators 06/2020 in India.
- Reviewer of the International Journal on Innovations and Implementations in Engineering in 03/2020.
- **Junior Research Fellowship**: 01/2016 at the CSE Department, IIT Kharagpur, India.
- **Research Assistantship**: 08/2014 – 07/2015 at **Computational Interaction & Robotics Laboratory**, JHU, USA**.**
- **ECE Graduate Fellowship**: 09/2013 – 07/2014, JHU, USA, and 03/2013, Rice University, USA.
- Research Internship: 05/2012 – 07/2012 at **TU**, **Dresden**, **Germany**.
- **IASc-INSA-NASI** Summer Research Fellowship in 03/2012 by the Science Education Program of the Indian Academy of Sciences.
- Nominated for **Inlaks Scholarship** at IIT Kharagpur in 03/2011 based on merit.
- **Dr. Ambedkar National Merit Award** for Meritorious Students of Higher Secondary School Examination, 2009, by the Ministry of Social Justice and Empowerment, Government of India.
- Ranked among the top **0.005%** (All India Rank) in **IIT JEE** 2009 and top **0.004%** (All India Rank) in **AIEEE** 2009.
- **1st** (Eastern India) in **National Level Talent Search Examination**, 11/2006.
- **97.17** percentile in 8th **National Science Olympiad**, 01/2006.
- **Gold Medal** for securing the Highest Marks (Science) in International Assessment for Indian Schools, 2005 (by the **University of New South Wales**, **Australia**, and Macmillan Publishers Ltd.) and **Distinction** in English.

SELECTED PUBLICATIONS

- Joyce Wang, Shaiza Mansoor, Jeong-Yoon Wu, Christina Kilby, He Forbes, Ria Kapoor, Sarah Ward, Jason Zhou, Kristin Williams, Moran Roni Levin, Sripriya Sundararajan, Larry Magder, **Avigyan Sinha**, Abhishek Rege, Janet L Alexander, "Retinal blood flow decreases following treatment with bevacizumab for retinopathy of prematurity", Ophthalmology Science, Vol. 5, Issue 6, 100857, November-December, **2025**.
- Alfred Vinnett, Jayanth Kandukuri, Christopher Le, Kyoung-A Cho, **Avigyan Sinha**, Samuel Asanad, Ginger Thompson, Victoria Chen, Abhishek Rege, Osamah J Saeedi, "Dynamic Alterations in Blood Flow in Glaucoma Measured with Laser Speckle Contrast Imaging", Ophthalmology Glaucoma, Vol. 5, Issue 3, **2022**, Pages 250-261, ISSN 2589-4196.

- Delia Cabrera DeBuc, Jayanth Kandukuri, **Avigyan Sinha**, Wen-Hsiang Lee, Elizabeth Crocco, Rishav Sapahia, Carlos Mendoza-Santiesteban, William E. Smiddy, Rajesh K. Garg, Maja Kostic, Michelle Marrero Alfonso, Bernard Baumel, Abhishek Rege, "Laser speckle-based retinal imager as a potential screening tool for mild cognitive impairment", Alzheimer's & Dementia, The Journal of the Alzheimer's Association, Vol. 17, e055864, December, **2021**, ISSN1552-5260.
- **Avigyan Sinha**, Aneesh R P, Malavika Suresh, Nitha Mohan R, Abinaya D, Ashwin G Singerji, "Brain Tumour Detection Using Deep Learning", 2021 Seventh International Conference on Bio Signals, Images, and Instrumentation (ICBSII), **2021**, pp. 1-5.
- **Avigyan Sinha**, R P Aneesh, Sarada K Gopal, "Drowsiness Detection System Using Deep Learning", 2021 Seventh International Conference on Bio Signals, Images, and Instrumentation (ICBSII), **2021**, pp. 1-6.
- **Avigyan Sinha**, Aneesh R P, Nazneen N. S, "Eye Tumour Detection Using Deep Learning", 2021 Seventh International Conference on Bio Signals, Images, and Instrumentation (ICBSII), **2021**, pp. 1-5.
- **Avigyan Sinha**, Aneesh R P, "Real-Time Facial Emotion Recognition using Deep Learning", International Journal of Innovations and Implementations in Engineering (ISSN 2454- 3489), **2019,** vol 1.
- Malavika Suresh, **Avigyan Sinha**, Aneesh R P, "Real-Time Hand Gesture Recognition Using Deep Learning", International Journal of Innovations and Implementations in Engineering (ISSN 2454- 3489), **2019**, vol 1.
- Mohammed Thanveersha N, Shihabudeen A S, Alifkhan A S, Jino Jayni, Thasni Fathima, **Avigyan Sinha**, Aneesh R P, "Automatic Brain Hemorrhage Detection Using Artificial Neural Network", International Journal of Innovations and Implementations in Engineering (ISSN 2454- 3489), **2019,** vol 1.
- Purnima Rajan, Philippe Burlina, M Chen, D Edell, Bruno Jedynak, N Mehta, **Avigyan Sinha**, Gregory Hager, "Autonomous on-board Near-Earth Object detection", **2015** IEEE Applied Imagery Pattern Recognition Workshop (AIPR), Washington, DC, USA, 2015, pp. 1-10.

RESEARCH PRESENTATIONS

- **Avigyan Sinha**, Anchana Pisharody, Sushma Tejwani, Abhijit Sinha Roy, Edmund Arthur, Wen-Hsiang Lee, Delia Cabrera DeBuc, Abhishek Rege, "Variation of ocular blood flow dynamics with progression in the stage of diabetic retinopathy", Invest. Ophthalmol. Vis. Sci. **2025**;66(8):4757.
- **Avigyan Sinha**, Yash Porwal, Mary Ventimiglia, Renad Alhabashi, Shaiza Mansoor, Ria Kapoor, He Eun Forbes, Amrik Gill, Saige Oechsli, Lily Im, Sarah Ullah, Abhishek Rege, Osamah Saeedi, "Hyperoxia-induced reactivity of ocular blood flow is altered in glaucoma", Invest. Ophthalmol. Vis. Sci. **2024**;65(7):1236.
- **Avigyan Sinha**, Jayanth Kandukuri, Wen-Hsiang Lee, Elizabeth Crocco, Rajesh Garg, Rishav Sapahia, Carlos Mendoza-Santiesteban, William Smiddy, Maja Kostic, Barry S. Baumel, Delia Cabrera DeBuc, Abhishek Rege, "Dynamic ocular blood flow metrics are altered in diabetes and diabetic retinopathy patients", Invest. Ophthalmol. Vis. Sci. **2023**;64(8):2689.