

# AVIGYAN SINHA

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## 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.

## WORK 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 importance of features, thereby providing key insights to 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 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**

M.S.E, Electrical &amp; Computer Engineering, GPA 3.39/4

**Baltimore, USA****09/2013 – 08/2015****Indian Institute of Technology Kharagpur**B. Tech, Major in Electronics and Electrical Communication Engineering  
Minor in Physics, GPA 8.45/10**Kharagpur, India****07/2009 – 07/2013****ACHIEVEMENTS**

- Reviewer of the 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 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 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-NSA-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.
- **1<sup>st</sup>** (Eastern India) in **National Level Talent Search Examination**, 11/2006.
- **97.17** percentile in **8<sup>th</sup> National Science Olympiad**, 01/2006.
- **Gold Medal** for securing 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**

- Alfred Vinnett, *et al.*, "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.
- **Avigyan Sinha**, *et al.*, "Brain Tumour Detection Using Deep Learning", 2021 Seventh International Conference on Bio Signals, Images, and Instrumentation (ICBSII), **2021**, pp. 1-5.
- **Avigyan Sinha**, *et al.*, "Drowsiness Detection System Using Deep Learning", 2021 Seventh International Conference on Bio Signals, Images, and Instrumentation (ICBSII), **2021**, pp. 1-6.
- **Avigyan Sinha**, *et al.*, "Eye Tumour Detection Using Deep Learning", 2021 Seventh International Conference on Bio Signals, Images, and Instrumentation (ICBSII), **2021**, pp. 1-5.

- **Avigyan Sinha**, *et al.*, “Real-Time Facial Emotion Recognition using Deep Learning”, International Journal of Innovations and Implementations in Engineering (ISSN 2454- 3489), **2019**, vol 1.
- Malavika Suresh, *et al.*, “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, *et al.*, “Automatic Brain Hemorrhage Detection Using Artificial Neural Network”, International Journal of Innovations and Implementations in Engineering (ISSN 2454- 3489), **2019**, vol 1.
- Purnima Rajan, *et al.*, “Autonomous on-board Near-Earth Object detection”, **2015** IEEE Applied Imagery Pattern Recognition Workshop (AIPR), Washington, DC, USA, 2015, pp. 1-10.