Jay Sawant | Curriculum Vitae

Department of Electrical Engineering, Indian Institute of Technology Bombay, India

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Education

Indian Institute of Technology Bombay, Mumbai, India [Jul '18 - Jun '23]

- Graduated with a Dual Degree (B.Tech + M.Tech) in Electrial Engineering | CGPA - 8.89/10
- Dual Degree Specialization: Communication and Signal Processing

Publications

- Patil, A.; Diwakar, H.; **Sawant, J.**; Kurian, N.C.; Yadav, S.; Rane, S.; Bameta, T.; Sethi, A. Efficient Quality Control of Whole Slide Pathology Images with Human in-the-Loop Training. *J. Pathol. Inform.* **2023**, *14*, 100306

Research and Internship Experience

- **Efficient Quality Control of WSIs with Human in-the-Loop Training** [May '22 - Dec '22]
  DDP Thesis | ***Prof. Amit Sethi***, *Dept. of Electrical Engineering, IIT Bombay*
  - Employed an **active learning** approach to train the HistoROI classifier, effectively categorizing Whole Slide Images (WSIs) into six tissue regions: epithelium, stroma, lymphocytes, adipose, artifacts, and miscellaneous
  - Evaluated by comparing the foreground predictions of our deep learning-based **HistoROI** model against the image processing-based **HistoQC** tool and outperformed the later with a higher dice score on **70%** of the WSIs
  - Enhanced HistoROI model performance for WSI segregation by implementing **Contrastive Learning** methods
- **Cell Detection using Cell-Tissue Interaction: The OCELOT Challenge 2023** [April '23 - Jun '23]
  DDP Thesis | ***Prof. Amit Sethi***, *Dept. of Electrical Engineering, IIT Bombay*
  - Utilized various methods for cell detection and classification, including **YoloV8** object detection and cell segmentation techniques on the OCELOT dataset consisting of small and large Field-of-View patches from WSIs
  - Developed a unified model with **DeepLabV3** architecture for cell and tissue segmentation, leveraging the tissue segmentation model's Large Field-of-View predictions to enhance cell detection and classification
  - Attained a F1-score of **0.67** outperforming the author's baseline of **0.65** F1-score on an undisclosed validation dataset during the Ocelot 2023 Challenge, securing a **global ranking** of **16th** place
- **Development of a Quality Control tool for WSIs using Deep learning** [Jan '23 - Jun '23]
  DDP Thesis | ***Prof. Amit Sethi***, *Dept. of Electrical Engineering, IIT Bombay*
  - Created a robust pipeline for the detection and classification of **artifacts** within Whole Slide Images (WSIs), employing four specialized models for identifying blur level, tissue fold, pen marker, and tissue segmentation.
  - Developed a comprehensive **WSI profiling system** by seamlessly integrating the results from the aforementioned four models, generating a refined and usable mask for analysis
  - Demonstrated exceptional performance by achieving a **dice** score exceeding **0.7** on **74%** of the **11,529** WSIs from the TCGA dataset when comparing our profiler's results to the standardized HistoQC's usable masks
- **Chest X-ray disease classification using Semi-Supervised Learning** [Aug '21 - Dec '21]
  Supervised Research Exposition | ***Prof. Amit Sethi***, *Dept. of Electrical Engineering, IIT Bombay*
  - Compared the Semi-Supervised Learning methods of Ladder Networks, Pi Model and Mean teacher and implemented the **Mean Teacher** SSL method on the **NIH-Chest X-ray** dataset using a pretrained DenseNet121
  - Achieved a AUC score of **0.76** using only **10%** labelled data as compared to the **0.81** AUC of the baseline
- **Opacity Detection in Chest Xrays using Contrastive Learning** [May '22 - Aug '22]
  Qure.ai | *Deep Learning in Healthcare* | *AI Scientist Intern*
  - Trained a vanilla classification model of ResNet50 on **1.2 million**+ Chest X-rays using conventional supervised training for **opacity classification** and achieved an AUC score of **0.80** on the test set of **280K**+ Chest X-rays
  - Outperformed the vanilla baseline by utilizing a backbone trained using the **Supervised Contrastive Learning**
  - Achieved an AUC Score of **0.84** using the above model on the same test set along with a jump of validation AUC to **0.9** from **0.86** leading to more robust classification model and increased sensitivity
- **Timing Path delay prediction using Machine Learning** [May '21 - Jul '21]
  Qualcomm, India | *Machine Learning Intern* | *Received Pre-Placement Interview offer*
  - Predicted the Timing Path delays given a Netlist design of a chip for **1.8 ns** clock period using various **Machine Learning** algorithms and feature engineering
  - Generalized a **linear** model across various Netlist designs to achieve a MAE less than **10%** of the clock period

Key Technical Projects

- **Brain MRI Tumour Segmentation** | *CS736: Medical Image Computing* [Feb'22 - April'22]
  *Instructor - **Prof. Suyash Awate**, Dept of Computer Science, IIT Bombay*
  - Trained a **U-Net** architecture for segmentation of the **tumor** region using the **soft dice** loss in MRI slices and used a dataset consisting of around **4K** MRI slices from **110** patients from The Cancer Imaging Archive
  - Achieved a mean IOU of **0.77** on the validation set between the predicted and the true segmentation masks of tumor positive MRI slices and an accuracy of **96.8%** on the binary classification of presence of tumor
- **Identity Aware Portrait Generation** | *CS726: Advanced Machine Learning* [Feb'22 - April'22]
  *Instructor - **Prof. Sunita Sarawagi**, Dept of Computer Science, IIT Bombay*
  - Utilized the **CycleGAN** model in Image translation to generate portraits preserving the human facial features
  - Proposed a perceptual loss to preserve facial features that uses **FaceNet** embeddings to guide the generators
  - Achieved an average SSIM of **0.98** using our approach between the human faces and their respective portraits
- **Adversarial Attacks on ASR Systems** | *CS763: Automatic Speech Recognition* [Feb'21 - May'21]
  *Instructor - **Prof. Preethi Jyothi**, Dept of Computer Science, IIT Bombay*
  - Reviewed literature on targeted, imperceptible, white & black-box adversarial attacks on the ASR systems
  - Trained a **Bi-RNN** CTC-based network on the SpeechCommands dataset with a WER of **16%**
  - Implemented Gradient-descent based **adversarial attack** achieving a **0% classification accuracy** along with a Signal-to-Noise Ratio (SNR) of **30dB** in the perturbed audio examples
- **The Vital Extraction Challenge** | *Inter-IIT Tech Meet 11.0* [Jan'23 Mar'23]
  Bagged a Gold Medal among 20+ participating IITs
  - Employed a **YOLOv8** object detection model to extract essential parameters from ECG monitor images
  - Innovatively devised a **classification-based segmentation** approach to detect the screen corner of ECG monitors, enhancing accuracy in subsequent data extraction
  - Conducted in-depth exploration of **OCR** techniques, including parseq, ABINet, and PaddleOCR along with pioneering a novel technique for generating Heart rate and SpO2 graphs from ECG image data
- **Blind Super-Resolution** | *CS663: Digital Image Processing* [Aug'20 - Nov'20]
  *Instructor - **Prof. Suyash Awate**, Dept of Computer Science, IIT Bombay*
  - Trained a SFTMD Network which outputs a Hi-Res image by taking a low-res image & kernel as the inputs
  - Built a separate Predictor Network for Kernel prediction and a Corrector Network for fine-tuning the kernel
  - Low-resolution images were created by blurring HR images by a Gaussian kernel and then downscaling by 4x
- **Iris-based Biometric Security System** | *Institute Technical Summer Project* [Mar'19 - Jul'19]
  Awarded Special Mention Certificate out of 50+ teams for extraordinary performance at the ITSP 2019 Expo
  - Designed a working model using a **Raspberry Pi 3B+** module, IR LED and Hi-Res 5 MP NoIR filter Camera
  - Achieved an accuracy of **95%** by testing the device on 100+ individuals during the ITSP Expo 2019
  - Used an IR LED of a wavelength **810 nm** for safety of the human eye and better illumination of Iris patterns

Work Experience

- **Test Automation Engineer** | *Enphase Energy, Bangalore, India* [Jul '23 - Present]
  - Part of 9-member Test Automation team responsible for maintaining a **Python test framework** and composing test scripts to **automate** hardware test cases for ensuring the **pre-compliance** of Enphase products
  - Employed **Object-Oriented Programming** (OOP) techniques in Python to create test suites and write test scripts for hardware test automation of Enphase Energy system products

Academic Achievements

- Achieved a percentile score of **99** in the **JEE Advanced** Examination among **0.23 million+** candidates '18
- Secured 1^{st} place in the **Maharashtra HSC Board** Examination among all the streams at Institute level '18
- Excelled by securing **Rank 4** at the State Level in the NSTSE Exam held by the Unified Council, India '18
- Awarded Urban Special Prize for Meritorious performance in the Maharashtra Talent Search Examination '18

Technical Skills

Programming languages	Python, C++, Bash, MATLAB, VHDL
Frameworks & Libraries	PyTorch, PyTorch-Lightning, Tensorflow, Numpy, Pandas, Robot, Conda
Miscellaneous	GNU Radio, Quartus, AutoCAD, SolidWorks, Eagle, Raspberry Pi, LaTeX

Relevant Coursework

- **Machine Learning:** Machine Learning I and II, Advanced Machine Learning, Automatic Speech Recognition
- **Probability and Statistics:** Probability and Random Process, Data Analysis and Interpretation, Markov Chains and Queuing System
- **Mathematics:** Calculus, Linear Algebra, Ordinary & Partial Differential Equations, Complex Analysis
- **Computer Science:** Data Structures and Algorithms, Computer Programming and Utilization, Medical Image Computing, Advanced Image Processing

Teaching and Leadership Experience

- **Graduate Teaching Assistant** [Jul'22 - May'23]
  *Instructor-in-charge - **Prof. Amit Sethi**, Dept of Electrical Engineering, IIT Bombay*
  - Assisted the instructor in the EE610: Image Processing course and the EE769: Introduction to Machine Learning course in conducting the tutorial, grading and invigilation of **200**+ students in each course
- **Aavhan Sports Head - Table Tennis** | *IIT Bombay* [Mar'22 - April'22]
  Annual Sports festival of IIT Bombay, witnessing a footfall of 6000+ athletes
  - Planned and executed a League-cum-Knockout Table Tennis tournament with **80+** players and 6 managers
- **Junior Design Engineer** | *Accumulator Subsystem* | *IIT Bombay Racing* [Jul'19 - Dec'19]
  A 3-tier cross-functional team of 70+ students to build an electric vehicle for Formula Student
  - Designed the components of a **400V** carbon fibre Kevlar-covered accumulator container by iterative design process consisting of 96 Li-ion pouch cells having a energy capacity of **7.8kWh** using a High Voltage Safety Kit

Extracurricular Activities

Sports
- Won the **Racketlon '23** tournament by excelling in all 4 racquet sports (Table Tennis, Squash, Baminton, Tennis)
- Bagged a **Gold** medal in the Table Tennis team event held at KJ Somaiya Institute, Mumbai
- Secured **Silver** Medal for Hostel 15/16 team and a Bronze Medal for Hostel 3 team in the Table Tennis General Championship held at IIT Bombay in 2018 and 2019 respectively
- Secured **Bronze** Medal in Badminton Mixed Doubles tournament conducted by EESA, IITB

Technical
- Built an obstacle manoeuvring Bluetooth controlled Bot using HC05 module and L293D Motor Driver Module, completing all the tasks in the XLR8 Competition
- Ranked **58** in the Flipkart Grid 2.0 Robotics Challenge (Level 1) with **6000**+ participants

Cultural
- Represented Hostel 3 in the Gyrations 2019 (Inter-Hostel Dance General Championship)

Misc.
- Nominated for an exchange semester to **Czech Technical University** in Prague
- Recipient of **Best Student** Award for scholastic achievements at High School
- Awarded as the **Best Manager** in the Institute Table Tennis League 2019