

# Shruti Sawant

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## EDUCATION

- **Indian Institute of Technology, Bombay** Maharashtra, India  
*Doctor of Philosophy - Applied Machine Learning; GPA: 8.5/10* 2018 - present  
*Thesis: 'Machine learning application in guided wave monitoring of structural health monitoring': Proposed novel machine learning based techniques for damage assessment in composite sandwich structures under varying environmental temperatures*  
*Courses: Statistical signal analysis, Digital signal processing, Image processing, Machine learning*
- **College of Engineering, Pune** Maharashtra, India  
*Master of Technology - Signal Processing; GPA: 8.5/10* 2016 - 2018  
*Thesis: 'Complexity reduction in HEVC video encoder': Developed machine learning based approach for selection of optimum coding unit size resulting in reducing computational complexity of encoder in state of the art video compression standard HEVC.*  
*Courses: Audio processing, Digital video processing, Digital signal processors architecture, Computer vision, Linear algebra*
- **KLS Gogate Institute of Technology, Belgavi** Karnataka, India  
*Bachelor of Engineering - Electronics and Communication Engineering; GPA: 7.6/10* 2011 - 2015  
*Courses: Signals and systems, Wireless Communication, Microcontrollers, Operating systems*

## RESEARCH INTERESTS

Machine learning, Deep learning, Signal processing, Image processing, Structural health monitoring

## TECHNICAL SKILLS

- **Programming languages:** Python, MATLAB, C, C++(Beginner)
- **Libraries:** Numpy, Scipy, Pandas, Matplotlib, Seaborn, OpenCV, Scikit-Learn, Tensorflow, Keras, Pytorch
- **Softwares:** Embedded Hardware, COMSOL Multiphysics, ABAQUS

## RESEARCH EXPERIENCE

- **Machine learning application in guided wave structural health monitoring (SHM)** PhD Thesis  
*Sponsored by Indian Space Research Organization (ISRO)* Ongoing
  - Conducted thorough statistical analysis for large time series dataset to derive insights regarding data cleaning, feature selection strategy and interpretability of classical machine learning models as well as deep learning models
  - Developed two novel deep learning models for robust damage assessment in aeronautical composite structures, capable of operating under varying temperatures and without prior knowledge of material properties
  - Explored compatibility and demonstrated inference of deep learning models on edge devices including microcontrollers, NVIDIA Jetson Nano using novel parameter reduction strategy
  - Designed a physics-informed machine learning method utilizing statistical features to detect damage in the presence of variable temperatures, achieving performance on par with state-of-the-art deep learning algorithms
  - Mentored research assistants to develop a prototype embedded system for data acquisition and damage diagnosis in aeronautical composite structures for field testing in collaboration with ISRO
- **Compressive sensing based lost data recovery for sensing networks in SHM systems**  
*PhD Seminar*
  - Performed feasibility study for data recovery in SHM system utilizing orthogonal matching pursuit
  - Improved damage classification accuracy from 77% to 98% using innovative feature engineering despite data loss
- **Pan organ cancer classification using histopathology images**  
*In collaboration with Tata Memorial Hospital, Mumbai* Ongoing
  - Working in collaboration of team of clinicians to prepare annotations for tumor cells for ten different organs
  - Building deep learning pipelines using histopathology images for classification and segmentation of tumor
- **Email Sentiment Analysis**  
*R&D Project*
  - Developed data loading pipeline including data extraction and various pre-processing steps such as tokenization, stemming, vectorization (comparing two vectorizers : Count and TFDIF) for public domain dataset
  - Developed classification method to handle class imbalance with help of both classical machine learning models as well as state-of-the-art deep learning architectures like SBERT
- **Complexity reduction in HEVC video encoder**  
*MTech Dissertation*
  - Worked on a state-of-the-art video compression standard HEVC and examined effect of coding unit size on performance and proposed SVM classifier based approach for selection of optimum coding unit size which resulted in reducing computational complexity with time saving up to 35%

## SELECTED PUBLICATIONS

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### Journal articles

1. **Sawant Shruti**, Sauvik Banerjee, and Siddharth Tallur. *Performance evaluation of compressive sensing based lost data recovery using OMP for damage index estimation in ultrasonic SHM*. Ultrasonics 115 (2021): 106439
2. **Sawant Shruti**, Patil Sheetal, Thalapil Jeslin, Sauvik Banerjee, and Siddharth Tallur. *Temperature variation compensated damage classification and localisation in ultrasonic guided wave SHM using self-learned features and Gaussian mixture models*. Smart Materials and Structures 31.5 (2022): 055008
3. **Sawant Shruti**, Amit Sethi, et al., *Unsupervised learning framework for temperature compensated damage identification and localization in ultrasonic guided wave SHM with transfer learning*, Ultrasonics (2023): 106931.

### Conference proceedings

1. **Sawant Shruti**, Siddharth Tallur and Animesh Kumar. *Feasibility assessment of location-unaware sensing for estimation of non-bandlimited measurements*. 2019 IEEE SENSORS. IEEE, 2019
2. **Sawant Shruti**, and Shilpa P. Metkar. *Analysis of coding unit size and coding depth for class a sequence in HEVC*. Soft Computing and Signal Processing. Springer, Singapore, 2019. 463-470

### Communicated journal articles

1. **Sawant Shruti**, Sauvik Banerjee, Amit Sethi et al, *Feature engineering for classification of various types of damages in honeycomb composite sandwich structure using guided wave structural health monitoring*.
2. **Sawant Shruti**, Sauvik Banerjee, Amit Sethi, *Physics-Informed Machine Learning Approach for Damage Identification in Guided Wave Structural Health Monitoring System under Variable Temperature*

## SELECTED COURSE PROJECTS

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- **Detection and Segmentation of Anomalies on Road Surfaces**: Preparing public domain dataset for multi class segmentation (Resnet50-Segnet architecture) of various types of anomalies, using various image processing tools
- **Precision Liquid Dispenser**: Built embedded system consisting micro-controller, IR sensor, solenoid and load cell to dispense precise quantity of water irrespective of water level in tank including various provisions such as avoiding overflow by considering flow rate of solenoid, detecting presence of broken glass, etc.
- **Object Tracking in Videos**: Object detection and tracking in videos using (a) optical flow method by computing the optical flow vectors (b) Kalman filter method – motion is detected by background subtraction and Kalman filter is used for tracking
- **Analysis of block matching algorithm for motion estimation in video codec**: Conducted comparative study of seven different block matching algorithms, popularly used in video compression standards H.261 to H.263

## AWARDS AND GRANTS

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- **Indian Space Research Organization (ISRO) fellowship for pursuing doctoral studies**: 2018 - present
- **MHRD GATE fellowship for pursuing masters studies** : 2016 - 2018
- **Science and Engineering Research Board (SERB) grant**: for setting up environmental chamber to conduct research on damage diagnosis in composite panels under varying environmental temperatures and humidity conditions
- **IIT Bombay travel grant**: for attending premier international conference in the field of SHM

## TEACHING & REVIEWER EXPERIENCE

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- **Teaching assistant as a part of MHRD scheme**: Administered various course components such as assignments, tutorials and mentored teams of students for course projects throughout the semester. Courses: Digital signal processing, Probability and random processes, Introduction to machine learning, Advanced machine learning
- **Reviewer**: for IEEE sensors Conference 2023, Areas: Sensor systems, Signal processing, Sensor networks, IOT

## REFERENCES

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### Prof. Amit Sethi

Department of Electrical Engineering  
Indian Institute of Technology, Bombay  
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### Prof. Sauvik Banerjee

Department of Civil Engineering  
Indian Institute of Technology, Bombay  
✉ sauvik@civil.iitb.ac.in