

# Swapnil Jayant Kumar

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## EDUCATION

**Indian Institute of Technology Bombay**, Mumbai, India

(July '16 - Jul '20)

- Bachelor of Technology in Mechanical Engineering with Honours | **CPI: 8.89/10**
- Minor in Computer Science and Engineering
- Awarded **AA** grade in **21** courses for meritorious performance in a span of **8** semesters

## WORK EXPERIENCE

**Graduate Software Engineer Trainee** | Connected Diagnostics

(Sept '20 - Present)

*Jaguar Land Rover*

*Bengaluru, India*

- Developed a **Deep Learning** model to perform fault diagnostics on vehicle engines by analyzing the recordings of **in-car microphone**, thus automating the process and significantly **reducing** warranty costs
- Adopted **MLOPs** for deploying the model and provided necessary support for integrating it with an **android app**
- Defined a **system of JSON** files to label the audio data unifying the **labelling** used by models in the ensemble
- Spearheaded the **development** of **Angular**-based front-end of a companywide **web application** used by the employees to book office spaces, view ongoing projects, apply to them, view other's profile, and update their own
- Contributed to the development of company's human capital by **interviewing** and **mentoring** the new recruits

**Research Intern** | Cyber-Physical Research & Development Department

(May '19 - Jul '19)

*JFE Steel Corporation*

*Kawasaki, Tokyo, Japan*

- Developed an **implicit** transient, multi-phase **STAR-CCM+** model to simulate steel refining process in a converter
- Pioneered the **model simplifications** to limit the **convective-courant** number below **1**, resulting in **solutions** with significantly **improved** computational time and accuracy in line with the experimentally observed values
- Researched key **factors** like converter aspect ratio, outlet design parameters, surface tension, rotation rate, threshold angle and their **effects** on **efficiency** and **time** of the process
- Improved converter and outlet design, effecting **60%** reduction in process time & **10%** increment in output efficiency

**IITB Mars Rover Team**

(Dec '17 - Jul '20)

*Part of 30-membered diverse team to participate in **URC**, an international competition organized in Utah, USA*

Leadership	<ul style="list-style-type: none"> <li>• Co-lead and supervised a team of <b>30</b> students in mechanical, electrical and bioscience subdivisions working on the next iteration of a <b>prototype Mars rover</b>, capable of extra-terrestrial robotics</li> <li>• Secured rank of <b>31</b> among 95 participating international teams at <b>URC 2018, USA</b> (MDRS, Utah)</li> <li>• Presented the project &amp; explained the attributes to participants in ResTech 2018 and TechConnect</li> </ul>
Technical	<ul style="list-style-type: none"> <li>• Spearheaded the design of an ambitious <b>4-wheeled dependent suspension system</b> for the rover to incorporate <b>control simplicity</b> in the robust design of <b>Rocker-Bogie System</b></li> <li>• Contrived <b>Base Rotation Assembly</b> and optimized design to limit rover's weight under <b>50 kg</b></li> <li>• Developed Universal Robotic Description Format (<b>URDF</b>) of the rover to model it in ROS packages</li> <li>• Explored simulation of Rover's <b>SDF</b> model on different surfaces created using heightmaps of greyscale images in <b>Gazebo</b>, to verify the terrain transversal capabilities and look for possible failures</li> </ul>

## KEY TECHNICAL PROJECTS

**2-Stage Human Activity Recognition** | Undergraduate Thesis

(Jul '19 - Jul '20)

*Guide: Prof. Asim Tewari*

*Dept. of Mechanical Engineering, IIT Bombay*

*Objective: To achieve Human Activity Recognition in monocular videos using an efficient 2-Stage approach*

- Developed a **2-Stage approach** for Human Activity Recognition using **skeletal features** generated by pose estimation model as input to a **recurrent spatio-temporal** classifier
- The model achieved **98.19%** accuracy on **KTH** dataset at a lower computational cost than state-of-the-art methods
- Worked on extending the model for **multiple agents** and explored its applications in **assembly line safety**

**Intelligent Shirt Classifier** | NCAIR, IIT Bombay

(Dec '18 - Feb '19)

*Guide: Prof. Asim Tewari*

*Dept. of Mechanical Engineering, IIT Bombay*

*Objective: Create an intelligent system capable of classifying wearables, with a potential of use in the fashion industry*

- Developed an end-to-end Convolutional Neural Network from **scratch** in **PyTorch**, to classify shirts worn by people
- Trained it on a **custom dataset** (shirt trials images), pre-processed in **OpenCV** to achieve test accuracy of **82%**
- Explored human image extraction from CCTV using **YOLO**, to be pre-processed and fed to the CNN in real-time

## Multiphase Modeling of mould filling in Epoxy Resin casting process (Mar '18 - Jul '18)

Guide: Prof. Abhilash Chandy

Dept. of Mechanical Engineering, IIT Bombay

Objective: To simulate the process of Resin injection for the casting of an insulation layer on a transformer core

- Involved in the development and meshing of **cast geometries** from raw CAD files of the mould
- Simulated resin flow in **2D** cast geometries on **ANSYS Fluent** using **implicit VOF multiphase criteria**
- Analyzed simulation data to gain useful insights regarding volume fraction and mass flow rate of the resin phase
- Resolved the **divergence issues** and optimized solving time for simulations of flow in **3D** geometries
- The project work was presented in Paper No. 490 of **Fluid Mechanics and Fluid Power** (FMFP) conference, 2018

## COURSE PROJECTS

### Multi-Level Parallelisation of ML algorithms | ME766

(Spring '19)

Course instructor: Prof. S. Gopalakrishnan

Dept. of Mechanical Engineering, IIT Bombay

- Parallelized the **k-fold cross-validation** and **Hyper-parameter tuning** for ML algorithms on **CUDA**
- Achieved **2.55x** and **3.7x speedup** for linear and logistic regression (classification) respectively, compared to the counterpart serial codes in C++, using NVIDIA GEFORCE 940MX GPU

### Quaternion-based Model for Human Motion | IE643

(Autumn '19)

Course instructor: Prof. P Balamurugan

Dept. of IEOR, IIT Bombay

- Addressed the **prediction** and **generation** of **3D human poses** by improving **QuaterNet** (which is a recurrent network that models human motion using Quaternions-based representations of joint angles)
- Adopted a modified architecture inspired by **seq2seq** models to improve **computational efficiency** and reduce training time (by **53.6%**) of QuaterNet, without significant loss in accuracy

### Implementation of learning models | ME781

(Autumn '18)

Course instructor: Prof. Vinay Kulkarni

Dept. of Mechanical Engineering, IIT Bombay

- Performed and evaluated **data imputation** capabilities of **Regression Trees** and **KNNs** using different statistics
- Studied and verified effects of **Bagging**, **Random Forest** and **Adaboost** on overfitting of the Regression Trees
- Trained a Neural Network (1 hidden layer) and compared its weights to the one created using **scikit-learn library**

## TECHNICAL SKILLS

<b>Programming Languages</b>	C++, Python, Javascript, LaTeX, HTML, CSS
<b>Libraries &amp; Tools</b>	Numpy, Pandas, PyTorch, TensorFlow, OpenCV, Angular, Git, Jira
<b>3D CAD &amp; Simulation</b>	ANSYS, Solidworks, STAR-CCM+

## KEY CREDITED COURSES

These courses were completed as part of the *degree at Indian Institute of Technology Bombay*

Computer Science	Data Science	Mechanical Engineering
Operating Systems	Advanced Topics in Deep Learning	Machine Design
High Performance Scientific Computing	Deep Learning - Theory and Practice	Heat Transfer
Data Structures and Algorithms	Engineering Data Mining & Applications	Strength of Materials
System Dynamics: Modeling & Simulation	Introduction to Machine Learning	Fluid Mechanics
Logic for Computer Science	Data Analysis and Interpretation	Manufacturing Processes

## CERTIFIED MOOCs

These are certified non-credited Massive Open Online Courses offered by renowned institutions

- Natural Language Processing (NLP), offered by Microsoft, edX, [Verified Certificate](#)
- Introduction to Git and GitHub, offered by Google, Coursera, [Verified Certificate](#)
- Agile Software Development, offered by University of Minnesota, Coursera, [Verified Certificate](#)

## REFERENCES

- Prof. Asim Tewari**, Department of Mechanical Engineering, IIT Bombay, Email: [asim.tewari@iitb.ac.in](mailto:asim.tewari@iitb.ac.in)
- Prof. Abhilash Chandy**, Department of Mechanical Engineering, IIT Bombay, Email: [achandy@iitb.ac.in](mailto:achandy@iitb.ac.in)
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