Swapnil Jayant Kumar | **160100022**
Mechanical Engineering | **B.Tech.**
Indian Institute of Technology Bombay | **Male**
DOB: 01/03/1999

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2020	8.92
Intermediate/+2	CBSE	Birla School, Kalyan	2016	95.80
Matriculation	CBSE	All Saints High School, Bhiwandi	2014	10.00

Pursuing a **Minor Degree** in **Computer Science and Engineering** (Present)

Work Experience

Research Intern | Cyber-Physical Research & Development Department (May '19 - Jul '19)
JFE Steel Corporation, 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 | Senior Design Engineer (Dec '17 - Present)
*Part of 30 membered diverse team to participate in **URC**, an international competition organized in Utah, USA*

Leadership	• Co-leading and supervising a team of **30** students in mechanical, electrical and bioscience subdivisions working on the next iteration of **prototype** mars **rover**, capable of extra-terrestrial robotics • Secured rank of **31** among 95 participating international teams at **URC 2018, USA** (MDRS, Utah) • Presented the project & explained the attributes to participants in ResTech 2018 and TechConnect
Technical	• Spearheaded the design of an ambitious **4 wheeled dependent suspension system** for the rover to incorporate **control simplicity** in the robust design of **Rocker-Bogie System** • Contrived **Base Rotation Assembly** and optimized design to limit rover's weight under **50 kg** • Developed Universal Robotic Description Format (**URDF**) of the rover to model it in ROS packages • Explored simulation of Rover's **SDF** model on different surfaces created using heightmaps of greyscale images in **Gazebo**, to verify the terrain transversal capabilities and look for possible failures

Key Technical Projects

Human Activity Recognition for Assembly Line | Undergraduate Thesis (Jul '19 - Present)
Guide - Prof. Asim Tewari, ME Department
Objective: To achieve HAR on an assembly line by using different approaches and compare their results
- Creating a custom dataset (Monocular RGB videos) of **4** different assembling activities performed in sequence
- Implementing a **2 Stage** model: Localization of joints by **Human Pose Estimation** Algorithm is fed to a classifier
- Developing a **Spatio-temporal 3D-CNN** to classify activities and comparing it's performance with 2-Stage model

Intelligent Shirt Classifier | NCAIR, IIT Bombay (Dec '18 - Feb '19)
Guide - Prof. Asim Tewari, ME Department
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

Simulation of Resin Flow in Mould (Mar '18 - Jul '18)
Guide - Prof. Abhilash Chandy, ME Department
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 mold
- 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

Institute Technical Summer Project | ITC, IIT Bombay (May '17 - Jun '17)
Zero-G, a prototype bot that moves around by pressure gradient through propellers
- Achieved wireless communication of the bot to an Android device using **HC-05 Bluetooth Module**
- Successfully interfaced Servos and brushless DC motors with the **Arduino UNO** micro-controller package
- Used parts made of **3D Printed PLA** and Aluminium to minimize the overall weight of the bot

Course Projects

Multi-Level Parallelisation of ML algorithms | ME766 (Spring '19)
Course instructor - Prof. S. Gopalakrishnan, ME Department
- 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 *(ongoing)* (Autumn '19)
Course instructor - Prof. P Balamurugan, IEOR Department
- Implementing the **QuaterNet** architecture: Employing **Quaternions** (to represents rotations) with **RNNs**, to address the issue of error accumulation and discontinuities along the kinematic chain in **Human Pose Estimation**
- Addressing the **prediction** (short term) and **generation** (long term) tasks in Pose Estimation using this model

Implementation of learning models | ME781 (Autumn '18)
Course instructor - Prof. Vinay Kulkarni, ME Department
- 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**

Tom Cat Project | ME316 (Spring '19)
Course instructor - Prof. Prasanna S. Gandhi, ME Department
- Designed and manufactured a **machine** with one mechanical input, capable of creating copper loops continuously
- Implemented **gear train** to drive the system and **shear fracturing** technique for wire cutting

Scholastic Achievements

- Awarded **AA** grade in **17** courses for meritorious performance in a span of 6 semesters (2016 - 2019)
- Secured a rank of **2045** in Joint Entrance Examination Advanced among 150,000 candidates (2016)
- Amongst the top **0.1%** in **Mathematics**, All India Senior Secondary Examination by CBSE (2016)
- Secured National Rank **96** and Zonal Rank **11** in 18th SOF-National Science Olympiad (2016)
- Bagged State Rank **55** and All India Rank **869** in **National Science Talent Search Examination** (2014)

Technical Skills

Softwares	STAR-CCM+, ANSYS, Gazebo, git, SolidWorks, AutoCAD
Programming Languages	C++, Python, MATLAB, LaTeX, XML, HTML, CNC
Libraries & Tools	PyTorch, CUDA, OpenCV, and familier with TensorFlow, OpenMP, MPI, ROS

Key Courses

Courses marked with * will be completed by November '19

Core Courses	Computer Science & Data Analysis	Others
Machine Design*	Deep Learning - Theory and Practice*	Computer Graphics and Product Modeling*
Applied Thermodynamics	High Performance Scientific Computing	Microprocessors and Automatic Control
Heat Transfer	Operating Systems	Introduction to Numerical Analysis
Fluid Mechanics	Engineering Data Mining & Applications	Intro. to Electrical & Electronic Circuits
Strength of Materials	Data Structures and Algorithms	Marketing Management
Manufacturing Processes I	Introduction to Machine Learning	Quantum Physics and Application

Position Of Responsibility

Techfest Coordinator (Apr '17 - Dec '17)
Asia's Largest Science and Technology Festival | Footfall: 1,75,000+ | Budget: 74M+
- Managed a workshop on **NAO-Robots** during the fest with **100+** participants from across the country
- Contacted **30+** college ambassadors and Self-Defense institutes for conducting **NIRBHAYA** initiative
- Created question sets for **SOF-Techfest Innovation Challenge** targeting **42,000** school students

Extracurricular Activities

- Mentored a team of freshmen, to build a **RC Plane**, by providing technical assistance and moral support (Sept '17)
- Attended a certified **Annual Training Camp** at 2 Maharashtra Engr Regiment NCC, IIT Bombay (2016)
- Represented school in CBSE **Regional Science Exhibition**, Nagpur (2013)
- Participated in CBSE **West zone skating** competition organized in Vadodara, Gujarat (2011)
- Cleared Maharashtra state government **Elementary drawing examination** (2011)