Omkar Chaudhari

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B.Tech - Chemical Science and Technology
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EDUCATION

Degree/Certificate	Institute/Board	CGPA/Percentage	Year
B.Tech.	Indian Institute of Technology, Guwahati, India	9.02 (Current) (Rank 1)	2020 - Present
Senior Secondary	ISC	90.8 %	2020
Secondary	Milton High School, Atlanta, USA	98.4 %	2018

PUBLICATIONS

2023 **A review of ensemble learning and data augmentation models for class imbalanced problems: combination, implementation and evaluation** - arxiv.org/abs/2304.02858.
Azal Ahmad Khan, Omkar Chaudhari, and Rohitash Chandra
We propose a general framework that evaluates 10 data augmentation and 10 ensemble learning methods for Class Imbalance problems and a Computational Review to evaluate methods used for prominent benchmark CI problems.

EXPERIENCE

- **CSIR - Central Food Technological Research Institute** — Dec 2022 - Feb 2023
  Supervisor: Dr. Usharani Dandamundi — Mysore
  - Built **protein-interaction networks** of **FAD Synthetase**, performed **network analysis** and **shortest path analysis** of the apo and bound forms to identify **topologically important** residues to link the N-ter and C-ter domains.
  - Trajectory analysis using **MDAnalysis**, **Dynetan**, measuring key properties of protein network across snapshots such as **edge betweenness**, **node centrality**, and **length of shortest path** between active site residues of N-ter and C-ter Domains.

- **CSIR - Central Food Technological Research Institute** — Mar 2023 - Present
  Supervisor: Dr. Usharani Dandamundi — Remote
  - Working on Molecular Dynamics using **GROMACS** for targeting Epoxide Hydrolase Enzyme for antihypertensive therapies.
  - Evaluation of binding score of Epoxides of Fatty Acids to the active site region of Soluble Epoxy Hydrolases in **Autodock Vina**.
  - Working on analysis of Water Channels during opening and closing of Cap and Loop Domains for EPHX Enzymes in **Caver**.

- **Computational review of State-of-the-Art techniques for Class Imbalance** — Sept 2022 - Apr 2023
  Machine Learning Intern - University of New South Wales — Remote
  - Evaluated **100** combinations of **data augmentation** and **ensemble techniques** on **30+ imbalanced** datasets.
  - Used **SMOTE, CTGANs, SMOTified-GAN**, and multiple bagging, boosting, voting, and stacking for classification.
  - Investigated the results for multiple metrics like **accuracy, F-1, AUC, time cost**, etc to propose research insights.
  - **Light Gradient Boosting Machine** along with various data augmentation techniques was found to outperform other combinations. Data augmentation techniques were found to be more influential over a dataset than classifiers.

- **CSIR - National Chemical Laboratory** — May 2022 - Jul 2022
  Supervisor: Dr. Amol A Kulkarni — Pune
  - Experimental Study of Impingement Dynamics of **Confined Impinging Jet Reactor** using flow visualization.
  - Used **OpenCV** for quantification of reaction progress of mixtures of solids by measuring red/green color ratio through machine learning.

RESEARCH PROJECTS

- **Undergraduate project** — Apr 2023 - Ongoing
  Supervisor: Prof. Chivukula V. Sastri, Department of Chemistry, IIT Guwahati
  - Study of **C-S Bond formation** by **Cytochrome P450 enzymes** in Microbial sulphur-containing secondary metabolites.
  - Thorough investigation of substrate binding mode, role of key residues in substrate binding as well as catalytic activity of enzyme during the biotransformation using **molecular docking** and **molecular dynamics**.
  - Elucidating underlying C-S bond formation reaction mechanism through **P450 monoxygenase** in the biosynthesis of **sulphur-containing secondary metabolites** in microbes using **Quantum Mechanical (QM) cluster approach**.

- **Herbal Waste Management** — Sept 22 - Nov 22
  Supervisor: Prof. Ajay Kalamadha, Department of Civil Engineering, IIT Guwahati — rebrand.ly/Herbal-Waste-Management
  - Researched sustainable solutions for managing **1 ton** of herbal waste produced per day by Emami FMCG plant.
  - Characterisation of waste by quantitative analysis to check paramaters like **BOD**, **TKN**, **TGA**, **ammonia** and **nitrate estimation.**
  - Proposed research insights to use waste to produce Briquettes, Vermicomposting by rotary drum composters, and pyrolysis to produce BioChar of calorific value around **4300 kcal/kg.**

- **Job Shop Scheduling Modification** — Oct 22 - Nov 22
  Supervisor: Prof. Prakash Kotecha, Department of Chemical Engineering, IIT Guwahati — shorturl.at/lrG46
  - Modified the Job Scheduling Problem to remove start time from the decision variables and **reducing the search space**.
  - Assigned machine number to different orders using **metaheuristic techniques** such as **Genetic Algorithm, Particle Swarm Optimization, Ant Lion Colony Optimization** and a deterministic method optimized start times for orders.
  - **Multi-Objective Optimization** done using the **eps-constraint method** to optimize cost, makespan, and production time.

- **Oil Mixture Identification** — Dec 22 - Dec 22
  Supervisor: Dr. Usharani Dandamundi, CSIR-CFTRI, Mysore, India — github.com/C-Omkar/Oil_FSSAI_Classification
  - Developed scripts to Identify Oil Compositions upto 5 different oils according to Fatty Acid standards from FSSAI.
  - The python scripts take inputs of Fatty Acid Values from a mass spectrometer, compares them to the permitted values of 20+ oils, and outputs an Excel Sheet containing possible compositions of the Oil Mixture.

- **NIR Spectra Classification** — Aug 23 - Aug 23
  Supervisor: Dr. Usharani Dandamundi, CSIR-CFTRI, Mysore, India — github.com/C-Omkar/NIR-Spectra-MILLET-Classification
  - Classified different Millet Varieties from various Locations using **Principal Component Analysis**.
  - Combined **Principal Component Analysis** and **Linear Discriminant Analysis** to boost accuracy of separating the varieties.

PROJECTS

- **Groww Simplee Route Optimization Problem**   Jan 23 - Feb 23
  Inter IIT Tech Meet 11.0   GitHub (Hyperlink)
  - Employed **Metahueristic Techniques** to arrive to solutions for the **NP-Hard problem Capacitated Vehicle Routing Problem with Mixed Pickup and Delivery (CVRPMPD)**.
  - Created and Designed special **constraints and penalties** to lead the algorithm to certain solutions, considering parameters such as **Location Promiximity, Delivery Dates, Capacity of Delivery Vehicles** etc.
  - Implemented the **sweep clustering algorithm** to break down the search space and solve sections individually, **reducing calculation time from 300 seconds to 60 seconds**, adding scalability to the solver to incorporate orders for large cities.
  - **3D Bin Packing** was implemented for optimal packing of the deliveries in the rider's bag.
- **Campus Rush**   Oct 21 - Mar 22
  Coding Club IITG   https://bit.ly/cmpsrush
  - Created a **3D model** of IITG in **Blender**, along with **Multiplayer Functionality** and Online Leaderboard using **PHP APIs**.
  - Used **UV Unwrapping** to accurately texture models of various buildings of the college, modifying texture parameters like **roughness**, **diffusion**, and **normal maps** to give textures a realistic look while keeping performance requirements low.

ACHIEVEMENTS

- **Institute Merit Scholarship**: Awarded for being the **highest grade scorer** and **Department Rank 1**.
- **Techevince 8.0**: Team project won **Best Overall Project** in college's annual technical exhibition
- **Creative Shock**: Secured an **international rank of 14** in the world's largest social business case study competition.
- **Nexus Hackathon, Techniche IITG**: **Winner**, created an app to address logistic issues faced by hospitals.
- **Respawn**: Runner up of the game development Jam hosted by 3 IITs for developing a tower defence game.
- **Spirit 2022**: Won **gold medal** as part of a water polo team representing our college at inter college event.
- **Spardha 2023**: Won **3 Silvers, 2 Bronze medals** in aquatics in annual college inter hostel sport meet.

TECHNICAL SKILLS

- **Softwares**: Gaussian09, NAPS Network Analysis, PyMOL, Chimera, VMD, Molden
- **Molecular Dynamics**: GROMACS, AMBER, Autodock Vina, Autodock
- **Programming Languages**: C/C++, Python, MATLAB, Fortran
- **Libraries/Frameworks**: Numpy, Pandas, Tensorflow, Scipy, Seaborn, Matplotlib, MDAnalysis, Dynetan
- **Area of Interest**: Computational Chemistry, Theoretical Chemistry, Machine Learning

COURSEWORK

- **Chemistry**: Computational Chemistry, Quantum Chemistry, Group Theory, Advanced Spectroscopy, Organometallic Chemistry, Nanomaterials, Polymer Chemistry, Applied Organic Chemistry, Coordination Chemistry, Chemical Kinetics and Electrochemistry
- **Biology**: Introductory Biology, Fluorescence Techniques in Biotechnology
- **Mathematics**: Linear Algebra, Computer Aided Optimization, Ordinary Differential Equations, Multivariate Calculus
- **Machine Learning and Deep Learning**: Neural Networks, Convolutional Neural Networks, Recurrent Neural Networks

LEADERSHIP ROLES

- **General Secretary**, Chemical Science and Technology Association, IIT Guwahati.   July 2023 - Present
- **Branch Representative**, Department of Chemistry, IIT Guwahati.   July 2021 - Present
  - Bridge between the Professors/Department Officials and the Students for Communication.
  - Managed 60 students, organised internship talks by contacting alumni and professors.
- **Overall Projects Manager**, Coding Club IIT Guwahati.   May 2022 - May 2023
  - Oversaw the successful completion of projects taken up by Coding Club IITG.
  - Supervised 12 mentors across 10 projects.
  - Released projects in domains of Machine Learning, App Development, Web Development, and Cybersecurity for over 400 teams to complete and submit.
- **Coding Forum owner**, Owner of **6000+** member discord server   May 2022 - May 2023
  - Owner and Manager of a Coding Discord Server with 5000 members.
  - Released and conducted online courses and workshops.
- **Aquatics and Water Polo Team Captain**,   Mar 2023 - Apr 2023
  - Captain of the Aquatics and Water Polo team for Spardha Inter Hostel Sports Competition 2023.
  - Managed a team of 14 people getting overall 2nd Place among all hostels in both Aquatics and Water Polo.

EXTRACURRICULARS

- **Community Service**,   July 2022 - Dec 2022
  - Attended workshops and talks on addressing the issues of corporal punishment and cyber bullying.
  - Picked up garbage from campus roads as part of a cleaning drive.
  - Took part in a national unity run organised by the national service cell of my college.
  - Organised a cleanliness drive in a nearby temple.
- **Member of the Consulting and Analytics Club**,   May 2021 - Apr 2022
  - Active member of the club, participated in many consulting national and international hackathons.
  - Part of active discussions and presentations on Neural Networks, applications of CNNs to image classification tasks.
- **Events Executive of Cultural Festival, Alcheringa**,   Dec 2020 - Mar 2022
  - Organised and Planned cultural events for the college cultural festival.
  - Contacted and signed international instrumentalists and theatre troupes for performances.
  - Ideated competitions and exhibitions for the college.
- **Workshops managing Team for Techniche**,   Feb 2021 - Jan 2022
  - Organised workshops in domains for Cybersecurity, Machine Learning, Stock Markets for over 200 people.
  - Contacted and arranged for speakers during workshops.
- **Water Polo Team**,   Oct 2022 - Present
  - Part of the water polo team for Inter college competitions.