Gaurav Budhwani

Junior Undergraduate
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ACADEMIC DETAILS

Degree	Specialization	Institute	Year	CPI/%
B.Tech. (Dual Majors)	*Chemical and Computer Science Engineering*	IIT Gandhinagar	2022-Present	8.59
Class XII	*Physics, Chemistry, Maths*	All Saints School, Ajmer	2020-2022	94.2
Class X		All Saints School, Ajmer	2006-2022	93.8

INTERNSHIPS

- **Summer Research Intern, PMTL Lab, University of Miami**   [Jun '25 - Jul '25]
  (Advisor - Prof. Yang Wang, University of Miami) | Project Link
  - Built **Random Forest** and **ensemble models (XGBoost, LightGBM, SVM, MLP)** to predict **New Particle Formation (NPF)** events with **ROC-AUC > 0.92**, using **SMOTE** for class balancing and **hyperparameter tuning**.
  - Extracted and ranked atmospheric features (SO_2, solar irradiance, relative humidity) using **feature importance** and **partial dependence plots**; validated findings against NPF literature and known mechanisms.
  - Conducted **algorithm benchmarking** on **SGP datasets**, comparing Random Forest, XGBoost, LightGBM, SVM, and MLP across **training time, accuracy**, and **scalability** to inform future publications.

PUBLICATIONS

- Hao, Weixing, Manisha Mehra, **Gaurav Budhwani**, T. C. Chakraborty, Fan Mei, and Yang Wang. "Employing Machine Learning for New Particle Formation Identification and Mechanistic Analysis: Insights from a Six-Year Observational Study in the Southern Great Plains." **Under Review**

PROJECTS

- **Human Activity Recognition (HAR) Analysis**   [Aug '25 - Sep '25]
  (Advisor - Prof. Nipun Batra, IIT Gandhinagar) | Project Link
  - Analyzed the **UCI-HAR dataset** consisting of time-series sensor data from 30 subjects performing 6 daily activities, and applied **Principal Component Analysis (PCA)** to reduce dimensionality and visualize activity clusters.
  - Utilized the **TSFEL library** to extract diverse statistical, temporal, and spectral features, and trained a **Decision Tree model** on the featurized dataset to classify human activities.
  - Collected real-world activity data using the **Physics Toolbox Suite** app for model validation, achieving **70% precision** and **70% accuracy**, demonstrating the feasibility of deploying the pipeline beyond benchmark datasets.

- **Modeling and Parameter Estimation for Pyrolysis of Wood Particles**   [Mar '25 - Apr '25]
  (Advisor - Prof. Karthik S. Pushpavanam, IIT Gandhinagar) | Project Link
  - Developed a **multiphysics simulation in COMSOL** for wood pyrolysis under inert conditions, coupling **heat transfer, mass transport, and chemical kinetics** using anisotropic material properties.
  - Conducted **parameter estimation using nonlinear least squares** to optimize kinetic and thermal parameters, improving alignment with experimental temperature and mass loss data.
  - Performed **parametric studies** varying porosity, particle size, reaction kinetics, and ambient temperature to analyze their impact on thermal degradation, volatile release, and internal transport mechanisms.

- **Energy-Efficient Process Design and Simulation for Cumene Production**   [Feb '25 - Apr '25]
  (Advisor - Prof. Hari S. Ganesh, IIT Gandhinagar) | Project Link
  - Designed a complete **cumene production process** in **Aspen Plus** and **MATLAB**, integrating reaction, separation, and heat recovery units for sustainable and optimized performance.
  - Modeled a **plug flow reactor** with primary and secondary reactions using **mass and energy balances**, and validated the results against Aspen simulations with **<2% error** for key components.
  - Performed **multi-variable optimization using MATLAB's `fmincon`**, achieving an optimal benzene-to-propylene ratio and inlet temperature that **maximized cumene yield** while minimizing side-product formation.

- **Optimization of Heat Loss and Boundary Layer Thickness in Laminar Airflow**   [Oct '24 - Nov '24]
  (Advisor - Prof. Hari S. Ganesh, IIT Gandhinagar) | Project Link
  - Modeled and optimized **thermal boundary layer thickness** and **heat loss** using **Pyomo** and **MATLAB**, enhancing **convective heat transfer efficiency** for laminar airflow over a heated plate.
  - Analyzed **trade-offs** between **heat dissipation** and **boundary layer** control under constrained flow conditions, demonstrating **optimal configurations** for improving thermal performance in engineering applications.

- **Modeling and Experimental Study of Saffman-Taylor Instability Using Hele-Shaw Cells**   [Oct '24 - Nov '24]
  (Advisor - Prof. Kartik Subramaniam, IIT Gandhinagar) | Project Link
  - Simulated **viscous fingering patterns** through **numerical modeling** (Darcy's Law, Diffusion-Limited Aggregation) to analyze the Saffman-Taylor instability, emphasizing computational approaches at the chemical-engineering interface.
  - Designed and conducted controlled **experiments with Hele-Shaw cells** to validate simulations, investigating the interplay of viscosity, surface tension, and flow dynamics for interfacial instability.

- **Quiz App as Attendance Taking App** [May '24 - Jun '24]
  (Advisor - Prof. Balgopal Komrath, IIT Gandhinagar) | *Project Link*
  - Designed and deployed a **web-based** quiz and attendance system using **Flask, JavaScript, Jinja2,** and **SQLite** to support **real-time quizzes** and **automated attendance** tracking.
  - Implemented **geolocation validation**, **randomized number generation**, and **admin-approval workflows** to prevent cheating and enable secure session management with **automated reporting**.

- **Efficiency and effectiveness calculation of Helical Fins in a Double Heat Exchanger** [Jan '24 - May '24]
  (Advisor - Prof. Biswajit Saha, IIT Gandhinagar) | *Project Link*
  - Conducted comprehensive calculations to determine the **heat transfer coefficient of circular finned pipes**, taking into account various parameters such as fluid properties, flow rates, and temperature gradients.
  - Evaluated the **thermal efficiency** and **effectiveness** of the fin by analyzing its ability to enhance heat transfer and improve overall system performance.
  - Developed a detailed **comparative analysis** between the circular finned pipe and a standard double heat exchanger.

- **Transient Thermal Analysis of a Car Brake System** [Aug '23 - Nov '23]
  (Advisor - Prof. Dilip Srinivas Sundaram and Prof. Akshaa Vatwani, IIT Gandhinagar) | *Project Link*
  - Executed detailed **numerical simulations** to assess the transient thermal behavior of a car brake system during braking, **analyzing heat distribution** and **temperature changes** over time to evaluate system performance.
  - Utilized **advanced computational tools** and **finite element analysis (FEA)** to model the heat distribution and dissipation patterns across brake components, including the rotor, pads, and calipers.

- **Increasing Efficiency of Rankine Cycle** [Oct '23 - Nov '23]
  (Advisor - Prof. Atul Bhargav, IIT Gandhinagar) | *Project Link*
  - Implemented **thermodynamic analysis** and **simulation techniques** to identify and **adjust key cycle parameters**, such as turbine inlet temperature and condenser pressure, to maximize thermal efficiency and overall power output.
  - Developed **graphical representations** to illustrate the relationship between cycle adjustments and performance metrics, providing clear visual insights into how different parameters influence efficiency and steam quality.

- **Analysis of Datasets using Probability, Machine Learning, and Statistics** [Jan '23 - Apr'23]
  (Advisor - Prof. Shanmugathan Raman, IIT Gandhinagar) | *Project Link*
  - Conducted analysis of Airbnb hosts' data, implementing comprehensive **data cleaning** to ensure dataset accuracy. Extracted valuable insights into host performance and guest interactions.
  - Applied **advanced statistical techniques**, including **correlation analysis**, **regression** models, and **clustering**, to uncover significant trends related to pricing, location, and guest reviews.

- **Personal Portfolio Website** [May '24 - Jun '24]
  (Self Initiated) | *Website Link*
  - Designed and developed a personal **portfolio website** using **HTML, CSS,** and **JavaScript** to showcase projects, skills, and achievements, featuring a **responsive design** for optimal viewing on various devices.
  - Conceptualised **dynamic elements** and **user-friendly navigation**, including interactive project galleries, animated elements, and contact forms to enhance user engagement and experience.

- **Developing Games and Puzzles with C and C++ Using DSA** [Jan '24 - Apr '24]
  (Self Initiated) | *Website Link*
  - Designed and implemented **Connect4** and **Up-it-Up games** utilizing optimal move strategies and **graph traversal algorithms** for strategic gameplay and decision-making.
  - Developed **Sudoku Solver** and **2x2x2 Rubik's Cube Solver**, employing **advanced algorithms** to enhance solving efficiency and optimal move calculations.

TECHNICAL SKILLS

- **Programming Languages:** Python, C, C++, Matlab, HTML, CSS, Javascript, Sql, Rust.
- **Tools:** Git, LaTeX, Quarto, GitHub, Adobe Illustrator, Arduino IDE, Autodesk Inventor, Tableau, Data Modelling.
- **Libraries & Frameworks:** PyTorch, NumPy, Pandas, Scikit-learn, SciPy, Plotly, Seaborn, Flask, SQLite, SMOTE, XGBoost, LightGBM, SVM, MLPClassifier.

ACHIEVEMENTS

- Received the **Academic Excellence** Award for achieving the highest CPI in AY 2023-24.
- Felicitated with **Dean's List Award** IITGN for **Semester II** for excellent academic performance.
- Secured a grade of **A+** (11/10) for outstanding performance in the course of Numerical Methods by successfully doing the project and simulation on **"Transient Thermal Analysis of a Car Brake System."**
- Completed **Deloitte Australia Data Analytics** Virtual Internship (Forage, Jun 2025), involving **Tableau dashboards, Excel-based classification**, and **business insight generation**. *Certificate*
- Earned the Specialist rank on Codeforces, highlighting strong competitive programming skills.

RELEVANT COURSES

- Thermodynamics, Chemical Process Calculations, Process Fluid Mechanics, Chemical Reaction Engineering, Heat Transfer, Data Structure and Algorithms, Discrete Mathematics, Numerical Methods, Theory of Computing, Process Dynamics and Control, Engineering Optimization, Separation Process, Chemical Engineering Lab (s), Process Synthesis, Design, and Simulation, Transport Phenomena, Design of Experiments, Operating Systems.

POSITIONS OF RESPONSIBILITY

- **Design Team Member, Amalthea '23** *(Annual Technical Summit of IIT Gandhinagar)*   [Dec '22 - Feb '24]
  - Created engaging social media designs for diverse platforms, utilizing Adobe Illustrator, Canva, and other graphic design software.
  - Developed and executed visually compelling social media content for various platforms using Adobe Illustrator, Canva, and other graphic design tools.

- **Team Member, Vinteo** *(Film Making Club of IIT Gandhinagar)*   [Jul '24 - May'25]
  - Contributed to a short film's production, handling concept development, and filming. Ensured smooth execution.

- **Team Member, MAPRC** *(Media and Public Relations Committee of IIT Gandhinagar)*   [Jul'24 - May'25]
  - Designer for "ETHEREAL," IIT Gandhinagar's official monthly magazine, crafting visuals to showcase campus life, student achievements, events, and engaging stories.