# LOHITAKSHA KOPPADA

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## PROFILE

### Description:

- Resolute and results-oriented being demonstrating expertise in independently designing and executing complex research projects. Proven ability to quickly master new concepts and apply them effectively.

- Possesses a versatile skill set encompassing Python programming (including NumPy, Pandas and Matplotlib for data manipulation and visualization), Sci-Kit Learn, Machine learning using Python, Supervised Learning, Unsupervised Learning, Deep Learning Fundamentals, PyTorch , Keras and TensorFlow for Deep Learning, C, C++, C#, Java, Docker and Kubernetes , and a strong theoretical foundation in nanoscience and technology, photonics, and materials science.

- Demonstrated ability to apply computational methods to investigate scientific problems, analyze complex datasets, and communicate research findings through peer-reviewed publications and presentations, including a contribution to the European Journal of Pharmacology on **"*Eicosanoid Signaling in Neuroinflammation associated with Alzheimer's disease.*"**

- Consistently recognized for academic excellence, including a strong CGPA in the Integrated Master's (IMSc) Program in Chemical Sciences at the University of Hyderabad( IMSc 1$^{st}$ rank holder continuously for two years – 4$^{th}$ and 5$^{th}$ year), and

achieving top scores in competitive examinations like GATE (AIR – 727 in 2025) and CSIR-NET-JRF ( AIR – 37 in Assistant Professor and Admission to Ph.D. category in 2025).

- Effective leadership and communication skills honed through leading a research team, presenting to experts in Alzheimer's research. Eager to leverage skills, interdisciplinary experience, and passion for scientific inquiry to contribute to the success of a dynamic organization that values innovation, collaboration, and professional growth.

- Committed to continuous learning and professional development, with a strong desire to embrace new challenges, contribute meaningfully, and make a significant impact.

# EXPERIENCE

## 1. Master's Project: I$^{st}$ Phase: Investigating the Screened Coulomb Potentials and Confined Hydrogen Atom:

**Guide: Prof. Kalidas Sen, School of Chemistry, University of Hyderabad**

**Year: August – December 2024**

**Duration: 5 months**

- Conducted an in-depth literature survey on the theoretical treatment of screened Coulomb potentials, focusing on their application in multi-electron systems and confined hydrogen atoms.
- Explored the effects of various potential models (e.g., Yukawa and Hulthén potentials) on the electronic structure and properties of hydrogen-like systems under confinement.
- Analyzed the impact of screening effects on the energy spectrum, wavefunctions, and chemical reactivity in confined hydrogen atoms using advanced quantum mechanical approaches.
- Reviewed key papers and recent developments in quantum chemistry, with particular emphasis on potential approximations and computational techniques for multi-electron systems.
- Engaged in theoretical and computational analysis of confined hydrogen atom models to understand modifications in electron behavior under constrained environments.

## 2. Master's Project: II$^{nd}$ Phase: Plasma and Spatially Confined Hydrogen Atom: Application of Comparison Theorem and Statistical Complexity Measure

**Guide: Prof. Kalidas Sen, School of Chemistry, University of Hyderabad**

**Year: December 2024 – March 2025**

**Duration: 4 months**

- This second phase of the Master's project focuses on the theoretical and computational investigation of the electronic properties of confined hydrogen atoms subjected to screened Coulomb potentials. The core objective is to analyze the interplay between quantum mechanical confinement and environmental screening effects, elucidating their influence on the system's electronic structure and information-theoretic measures.

- The project delves into the following key aspects:

### (i) Electronic Structure Analysis:

- Conducted detailed calculations of the energy levels of the hydrogen atom under spatial confinement and in the presence of screened Coulomb potentials [e.g., Hulthén / Yukawa/ Hulthén(2$\lambda$) / Exponential Cosine Screened Coulomb Potential].

- Systematically investigated the combined influence of confinement and varying screening parameters on the electronic properties.

### (ii) Information-Theoretic Measures:

- **Shannon entropy** was computed to quantify the degree of uncertainty or randomness in the electron's spatial distribution.

- **Disequilibrium** was calculated to assess the deviation from a uniform probability distribution, providing insights into the system's degree of order.
- By combining the Shannon entropy and disequilibrium values, me and my guide calculated the **statistical complexity**.
- This measure quantifies the structural organization and pattern formation within the confined hydrogen atom.
- It goes beyond simple measures of randomness or order, capturing the intricate interplay between them.
- The use of these measures allowed for a comprehensive understanding of the information content and structural organization of the confined system.

**(iii) Data Analysis and Interpretation:**

- Extensive data analysis was conducted to extract meaningful insights from the computational results.
- This involved visualizing data, performing statistical analysis, and interpreting the results in the context of quantum mechanical principles.
- The impact of the screening parameters on the statistical complexity of the system was analysed and interpreted.

**Skills Developed:**

- Strong understanding of quantum mechanical principles and their application to atomic systems.
- Experience in analyzing and interpreting complex data sets.
- Expertise in calculating and interpreting information-theoretic measures, including Shannon entropy, disequilibrium, and statistical complexity.
- Proficiency in data visualization and statistical analysis using Python, NumPy and Pandas.

## 3. Collaborative Summer Project on Eicosanoids and Their Bio signalling:

**Guide: Prof. Reddanna Pallu, School of Life Sciences, University of Hyderabad**
**Year: April – August 2021**
**Duration: 5 months**

- Explored the intricate biochemical pathways of eicosanoids, focusing on their regulation of inflammation, immunity, and cellular communication during the first phase of the project.
- Unraveled the complex cascades through which these lipid mediators impact diverse physiological processes, with an emphasis on their roles in neuroinflammation.
- Expanded the project scope to investigate the involvement of eicosanoids in neurodegenerative disorders such as Alzheimer's, Parkinson's, and other neurological conditions, identifying their dysregulated signaling pathways.
- Led efforts to explore therapeutic possibilities by examining how eicosanoid signaling contributes to the pathophysiology of neurodegenerative diseases.
- Collaborated in a dynamic, interdisciplinary team, integrating lipid biochemistry and neuroscience to generate valuable insights, setting the stage for further research in this evolving field.

## 4. Collaborative Review Article Writing: "Eicosanoid Signaling in Neuroinflammation Associated with Alzheimer's Disease" :

**Guide: Prof. Reddanna Pallu, School of Life Sciences, University of Hyderabad**
**Year: May 2022- January 2023**
**Duration: 8 months**

- Led the review article examining the role of eicosanoid signaling in neuroinflammation in Alzheimer's disease, emphasizing its biochemical mechanisms and therapeutic potential.
- Managed the balance between academics and research, dedicating 8 months to the project due to ongoing reviews and guidance from the project instructor.
- Coordinated interdisciplinary contributions, synthesizing findings from multiple sources and ensuring a high standard of scientific rigor throughout the manuscript.
- Finalized and submitted the manuscript for publication in a peer-reviewed European Journal of Pharmacology, Elsevier journal (published in May 2024; DOI: 10.1016/j.ejphar.2024.176694), contributing valuable insights to the field of neurodegenerative disease research.

## 5. Summer Internship: Understanding Bio signalling Pathways:

**Guide: Late Prof. Lakshmipati , Kakatiya University**

**Year: May-July 2022**

**Duration : 2 months**

- Engaged in an intensive two-months study focused on understanding the intricate biosignaling pathways that regulate various physiological processes.
- Conducted comprehensive literature reviews to explore the molecular mechanisms underpinning cellular communication, signal transduction, and their role in maintaining cellular homeostasis.
- Gained foundational knowledge of key bio signaling pathways involved in immunity, inflammation, and cellular response to stimuli, with particular focus on their implications in disease progression.
- Developed a deeper understanding of the molecular basis of signal transduction, contributing to a broader awareness of its potential in therapeutic interventions and drug design.
- Collaborated with late Prof. Laksmipathi to discuss emerging trends in biosignaling, enhancing both theoretical knowledge and practical insights.

# SKILLS

## 1. Python Programming :

### (a) Python Programming Language :

- Introduction to Python: Proficient in Python programming, including the structure of programs and fundamental data structures.
- Python for Data Science: Skilled in utilizing Python libraries like NumPy and Pandas for efficient data manipulation and analysis.
- Data Visualization: Experienced in using Python (NumPy modules) for plotting graphs and visualizing data to gain insights from datasets.

### (b) Basics of Machine Learning :

- Gained foundational understanding of machine learning concepts, algorithms, and workflows.

○ **Linear Regression:**

- Studied the fundamentals of linear regression.

○ **Logistic Regression:**

- Implemented multivariate logistic regression using Python for classification problems.

### (iii) Machine Learning Libraries and Deep Learning Frameworks :

- Machine Learning Libraries: Scikit-learn (classification, regression, clustering, model evaluation)
- Deep Learning Frameworks: Keras, TensorFlow (neural networks, CNNs, RNNs, model training & optimization)

## 2. Programming Skills – Machine Learning with Python:

### (a) Programming & Tools:

- Proficient in Python for machine learning applications using Jupyter Notebooks.
- Experienced in data manipulation and preprocessing with NumPy and Pandas.
- Created insightful data visualizations using Matplotlib.
- Built and evaluated machine learning models using scikit-learn.

### (b) Supervised Learning:

- Developed regression models including Simple, Multiple, Polynomial, and Non-linear Regression.
- Implemented Logistic Regression for binary and multi-class classification tasks.
- Applied K-Nearest Neighbors (KNN), Decision Trees, and Support Vector Machines (SVM) in various classification problems.

### (c) Unsupervised Learning:

- Conducted clustering analysis using K-Means, Hierarchical Clustering, and DBSCAN.
- Interpreted cluster outputs and refined hyperparameters for optimal segmentation.

### (d) Model Evaluation & Optimization:

- Utilized evaluation metrics such as Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and $R^2$ Score for regression.
- Assessed classification models with Confusion Matrix, Precision, Recall, F1-Score, and ROC-AUC Curves.

- Practiced cross-validation techniques to mitigate overfitting and ensure model generalizability.

### (e) Recommender Systems:

- Designed and implemented basic Content-Based and Collaborative Filtering recommender systems.
- Gained understanding of user-item matrix construction and similarity computation.

## 3. Supervised Machine Learning :

- Supervised Machine Learning: Solid understanding of supervised learning algorithms including Linear Regression, Logistic Regression, k-NN, Naive Bayes, SVM, Decision Trees, and Ensemble methods.
- Regression Techniques: Applied linear and logistic regression to real-world data using Python, with strong grasp of mathematical formulations, regularization, and model interpretability.
- Classification Algorithms: Proficient in K-Nearest Neighbors, Support Vector Machines, and Naive Bayes for both binary and multi-class classification tasks.
- Model Evaluation & Optimization: Hands-on experience with cross-validation techniques (K-Fold, Time-based splitting), hyperparameter tuning (Grid Search, Random Search), and overfitting/underfitting detection.
- Distance Metrics & Feature Engineering: Knowledge of distance measures (Euclidean, Manhattan, Cosine), feature scaling/standardization, and engineering for non-linear data separability.
- Decision Trees & Ensemble Models: Built decision trees using entropy, Gini impurity, and information gain; implemented ensemble models including Random Forest, XGBoost, AdaBoost, and Gradient Boosting.
- Kernel Methods in SVM: Implemented linear and non-linear SVMs using kernels such as Polynomial and RBF, with practical understanding of dual optimization and hinge loss.
- Probabilistic Learning: Applied Naive Bayes with Laplace smoothing and Gaussian assumptions, interpreted log-probabilities, and dealt with missing/imbalanced data.

- Real-World Case Analysis: Translated theoretical concepts to practical applications across domains like text classification, image data, and structured business data.
- ML Programming & Tools: Implemented models in Python using `scikit-learn`, utilized `GridSearchCV`, `RandomizedSearchCV`, `Pandas`, and visualization libraries for model performance analysis.

# 4. Unsupervised Machine Learning :

### (a) K-Means Clustering :

- Geometric and mathematical understanding of centroid-based clustering.
- Implemented K-Means objective function and iterative algorithm from scratch.
- Applied K-Means++ for smart centroid initialization to improve convergence.
- Identified failure cases (non-convex shapes, varying densities).

### (b) K-Medoids :

- Worked with medoid-based clustering to improve robustness to outliers.

### (c) DBSCAN (Density-Based Spatial Clustering) :

- Deep understanding of core, border, and noise points.
- Worked with hyperparameters: MinPts and Eps.
- Applied density-reachability and density-connected concepts in clustering.
- Evaluated DBSCAN's pros over centroid-based methods in spatial datasets.

### (d) Hierarchical Clustering :

- Implemented Agglomerative and Divisive methods.
- Interpreted and constructed dendrograms for visual hierarchy.
- Compared proximity methods (single, complete, average linkage).
- Analyzed computational complexity and limitations.

### (e) Clustering Evaluation :

- Used metrics: Silhouette Score, Elbow Method, and Inertia.

- Determined the optimal number of clusters (`K`) with diagnostic plots.

## 5. Leadership skills:

### (a) Led a Team of Four in Authoring a Peer-Reviewed Review Article:

- Successfully led a team of four research-oriented students from different disciplines in writing a comprehensive review article titled "Eicosanoid Signaling in Neuroinflammation Associated with Alzheimer's Disease." Managed the entire research and writing process over eight months, coordinating interdisciplinary contributions, ensuring scientific accuracy, and adhering to strict deadlines.
- Oversaw the final manuscript submission, resulting in publication in a peer-reviewed Elsevier journal (May 2024). Demonstrated strong leadership, project cum team management, and collaboration skills while balancing academic commitments.

## 6. Presentation skills:

### (a) Research Presentation – Eicosanoids in Alzheimer's Disease :

**Presented to Prof. George Perry, University of Texas – A Leading Expert in Alzheimer's Research**

- Delivered an in-depth presentation on the role of eicosanoids in Alzheimer's disease, elucidating their potential pathways, underlying mechanisms, and probable causes of the disease.
- Proposed innovative therapeutic strategies leveraging eicosanoids for Alzheimer's treatment, integrating recent advancements in neuroinflammation and lipid signaling research.
- Engaged in high-level scientific discussions with Prof. George Perry, incorporating expert feedback to refine hypotheses and explore novel research directions.
- Demonstrated strong scientific communication and critical analysis skills, effectively conveying complex biochemical concepts to a global authority in the field.

## (b) Research Contribution – Modified Langevin Equation for Electrophoretic Effects:

- Developed and delivered a novel modification to Langevin's equation to provide a comprehensive explanation of electrophoretic effects, enhancing the theoretical framework for particle dynamics in external fields.
- Included ion-specific mobility term allowing field-responsive behavior.
- Extended applicability to charged particles in electric fields (e.g., capillary electrophoresis).
- Bridges deterministic and stochastic motion in electrokinetic environments.

# 7.

## (a) Communication and Interviewing Skills:

- Conducted in-depth interviews with global experts across leadership, sales, and mindset domains for the podcast, "Lohitaksha's Den".
- Developed questioning strategies to extract valuable insights and facilitate engaging discussions.
- Skilled in synthesizing expert opinions and translating them into accessible content for a wide audience.

## (b) Research and Content Development:

- Conducted thorough research on leadership, motivation, time management, goal-setting and mental health topics to guide interviews and ensure relevancy.

- Developed and curated podcast episodes based on expert contributions, ensuring high-quality content production.

## (c) Networking and Relationship Building:

- Cultivated strong professional relationships with thought leaders in various domains.
- Managed guest communications and collaborated with international experts to schedule and conduct interviews.

# CERTIFICATIONS

## 1. Machine Learning with Python:

**Powered By : IBM Developer Skills Network**

**Issued By : Cognitive Class**

**Issued on : 6th May, 2025**

**Skills Obtained :**

- Completed a comprehensive, hands-on course covering both theoretical foundations and practical implementation of machine learning using Python.
- Gained proficiency in Python programming, with specific focus on data analysis using Pandas and NumPy, and visualization using Matplotlib.
- Built and evaluated machine learning models using scikit-learn, including:
- **Supervised learning:** Simple/Multiple Linear Regression, Polynomial Regression, Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees, Support Vector Machines (SVM).
- **Unsupervised learning:** K-Means Clustering, Hierarchical Clustering, DBSCAN.
- Applied model evaluation techniques such as Mean Squared Error (MSE), Root Mean Squared Error (RMSE), $R^2$ Score, Confusion Matrix, Precision, Recall, F1-Score, and ROC-AUC.
- Gained practical knowledge of cross-validation to reduce overfitting and improve model generalizability.
- Designed basic recommender systems using content-based and collaborative filtering approaches.
- Completed multiple interactive labs and a final capstone project involving real-world data, demonstrating ability to execute a full machine learning pipeline: data preprocessing, model selection, evaluation, and refinement.

## 2. Supervised Machine Learning Course :

**Issued By : Scaler**

**Issued on : 20th May, 2025**

**Skills Obtained :**

- Regression Models: Linear & Logistic Regression, Regularization (L1/L2), Feature Engineering, Model Interpretability.

- Instance-based Learning: K-Nearest Neighbors (KNN), Distance Metrics (Euclidean, Manhattan, Cosine), kd-trees, LSH.

- Probabilistic Learning: Naive Bayes, Bayes Theorem, Laplace Smoothing, Gaussian NB, Log-Probabilities, Text Classification.

- Margin-Based Models: Support Vector Machines (SVM), Kernel Methods (Polynomial, RBF), Hinge Loss, SVM for Regression.

- Tree-Based Models: Decision Trees (Entropy, Gini, Information Gain), Handling Categorical/Numerical Features, Regression Trees.

- Ensemble Learning: Random Forest, Bagging, Boosting (AdaBoost, Gradient Boosting, XGBoost), Stacking, Cascading Classifiers.

- Model Evaluation: Cross-validation, Overfitting & Underfitting, Hyperparameter Tuning (Grid/Random Search), Bias-Variance Trade-off.

- Mathematical Foundation: Probability, Statistics, KL Divergence, Conditional Probability, Objective Function Formulations.

- Tools & Libraries: Python, NumPy, Pandas, Scikit-learn, GridSearchCV, RandomSearchCV, Jupyter Notebooks.

- Practical Applications: Real-world case studies, interpretability techniques, performance tuning on real datasets.

## 3. Unsupervised Machine Learning Course :

**Issued By : Scaler**

**Issued on : 15th May, 2025**

**Skills Obtained :**

### (b) K-Means Clustering :

- Geometric and mathematical understanding of centroid-based clustering.
- Implemented K-Means objective function and iterative algorithm from scratch.
- Applied K-Means++ for smart centroid initialization to improve convergence.
- Identified failure cases (non-convex shapes, varying densities).

### (b) K-Medoids :

- Worked with medoid-based clustering to improve robustness to outliers.

- **DBSCAN (Density-Based Spatial Clustering) :**

- Deep understanding of core, border, and noise points.
- Worked with hyperparameters: MinPts and Eps.
- Applied density-reachability and density-connected concepts in clustering.
- Evaluated DBSCAN's pros over centroid-based methods in spatial datasets.

- **Hierarchical Clustering :**

- Implemented Agglomerative and Divisive methods.
- Interpreted and constructed dendrograms for visual hierarchy.
- Compared proximity methods (single, complete, average linkage).
- Analyzed computational complexity and limitations.

- **Clustering Evaluation :**

- Used metrics: Silhouette Score, Elbow Method, and Inertia.
- Determined the optimal number of clusters (`K`) with diagnostic plots.

# ACHIEVEMENTS

## 1. Master's Research Thesis – Published:

- Computed and analyzed energy spectra and information-theoretic measures (Shannon entropy, disequilibrium, and statistical complexity) to characterize the system's quantum behavior.
- Results provide novel insights into quantum confinement effects and were validated through comprehensive theoretical and computational analysis.

## 2. Lead author, published review article:

- Led a collaborative review article titled "Eicosanoid signaling in neuroinflammation associated with Alzheimer's disease", which was published in Elsevier journal in May 2024; DOI: 10.1016/j.ejphar.2024.176694.
- Managed the research process, coordinated interdisciplinary contributions, and contributed significantly to the manuscript's writing.

## 3. Author of the book – It's Your Life : Make it Happen

- Published on 9th April, 2025 by Amazon.
- A self-development book aimed at inspiring readers to take charge of their lives, overcome challenges, and achieve their personal and professional goals.

## 4. Author of the book – Brainwaves of The Bold : Harnessing the Power of the Mind for Effective Leadership

- Published on 19th May, 2025 by Amazon.
- A transformative leadership book that empowers individuals to lead courageously and authentically.

## 5. Author of the book – Studies on Shell Confined Atoms :

- Published on 12th June, 2025 by LAMBERT Academic Publishing.
- Authored a book exploring quantum mechanical behavior of atoms under spatial confinement and screened Coulomb potentials, employing variational and numerical methods to analyze hydrogen atom with practical relevance to nanoscience and high-pressure physics.

## 6. Highest Academic Performer, Years 4 and 5 – Integrated Master's in Chemical Sciences :

- Recognized for academic excellence in the Integrated Master's program at the University of Hyderabad, achieving the 1st rank in the cohort for two consecutive years.
- Secured 2nd rank overall among combined Master's and Integrated Master's students in the 5th year.

## 7. GATE : 2025 – AIR 727

## 8. CSIR-NET-JRF : 2025 – AIR 37 in Assistant Professor and Admission to Ph.D. category.

## 9. Academic Achievements :

- Featured in the school magazine for securing a position in the toppers list of the 10th-grade board exams, 2018 at Jindal School.

# EDUCATION

1. **Integrated Master's Program in Chemical Sciences – Master's**

   **University : University of Hyderabad , 2025:**

- **10th Sem: 9.05 C.G.P.A**
- **9th Sem: 8.57 C.G.P.A.**
- **8th Sem: 8.28 C.G.P.A**
- **7th Sem: 8.16 C.G.P.A**

2. **Integrated Master's Program in Chemical Sciences – Bachelor's**

   **University : University of Hyderabad , 2023:**

- **1st to 6th Sem : 8.06 C.G.P.A**

3. **12th Grade:**

   **School : D.A.V. Public School , 2020**

- **94.25%**

4. **10th Grade:**

   **School : Jindal School, 2018**

- **90.2%**