

# Final Project Report

**Name:** Pratiksha Varawate  
**Roll No:** 252221008  
**Subject:** IALM

## Project Title: Regression Explorer (MLE & MAP – OLS, Ridge, LASSO, Elastic Net)

This project presents an advanced interactive regression analysis system that clearly maps Maximum Likelihood Estimation (MLE) and Maximum A Posteriori (MAP) concepts to modern regression techniques. The application is implemented using Streamlit and provides rich visualizations, numerical results, and theoretical explanations.

### ***Models Implemented***

- OLS (MLE based)
- Ridge Regression (MAP with Gaussian prior)
- LASSO Regression (MAP with Laplace prior)
- Elastic Net (Combined MAP prior)

### ***Key Features***

- Interactive dataset upload and selection
- MLE vs MAP theoretical mapping
- Coefficient shrinkage comparison
- 2D and 3D regression visualizations
- Advanced 3D regression planes with residuals
- Residual diagnostics and Gaussian validation
- Automatic best model recommendation

### ***Conclusion***

This project demonstrates both theoretical understanding and practical implementation of regression models. The integration of statistical estimation theory with advanced visualization makes the system suitable for real-world analytical applications.