

Final Project Report

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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.