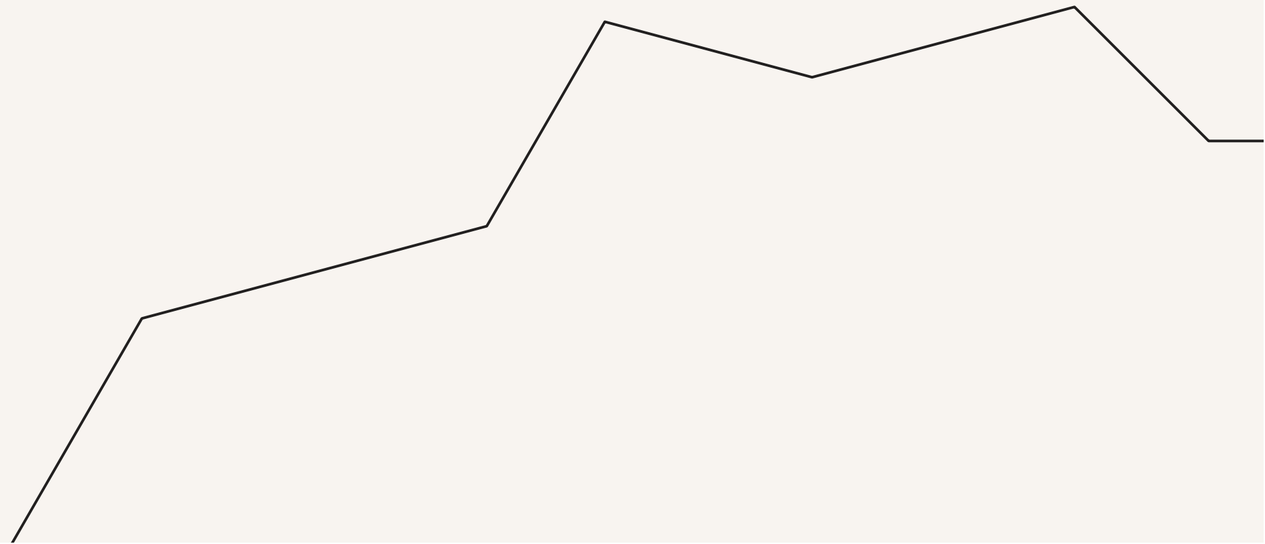
Comparative Analysis of Regression Models:

1. Linear Regression
2. Lasso
3. Ridge
4. Elastic Net
5. Stochastic Gradient Descent



Linear Regression Overview

- **Linear Regression** is a fundamental statistical method used to model the relationship between a dependent variable and one or more independent variables. It assumes a **linear relationship** and is easy to interpret, making it a popular choice for many applications.

Lasso Regression Explained

- **Lasso Regression** incorporates a penalty term to the loss function, promoting **sparsity** in the model. This means it can shrink some coefficients to zero, effectively performing **feature selection**. It is particularly useful when dealing with high-dimensional data.

Ridge Regression Insights

- In contrast to Lasso, **Ridge Regression** adds a penalty to the coefficients but does not force them to zero. This helps to handle **multicollinearity** and reduces model complexity while maintaining all features, making it suitable for many datasets.

Elastic Net: A Hybrid Approach

- **Elastic Net** combines the penalties of both Lasso and Ridge, making it effective for datasets with **high correlations** among features. It balances between feature selection and coefficient shrinkage, providing flexibility in model training.

Stochastic Gradient Descent

- **Stochastic Gradient Descent (SGD)** is an optimization technique used for training various regression models. It updates model parameters incrementally using a single sample, making it efficient for large datasets and enabling faster convergence.

Comparison of Models

- When comparing these models, consider factors such as **interpretability**, **performance**, and **computational efficiency**. Each model has its strengths and weaknesses, making them suitable for different types of data and research questions in **machine learning**.

Conclusion and Recommendations

When to use regression models depends on data characteristics. Use linear regression for linear relationships, polynomial for non-linear trends, and logistic for binary outcomes. Lasso and ridge regression are useful for high-dimensional data and multicollinearity, while elastic net combines both for better regularization in complex datasets.