Name: Jean Baptiste Habyarimana

Fair Tax Estimation for Homeowners

Tech Consulting

09/09/2024

Content

Introduction

Background

Property tax assessment is a critical financial obligation for homeowners, directly impacting their annual budgeting and long-term financial planning

Problem Statement

Discrepancies between taxes charged and what homeowners perceived as fair.
Lack transparency about how their property taxes are calculated, which can lead to confusion and perceived unfairnes.

Objective

1. Build a predictive tool can predict perceived taxes, promoting fairness and transparency.
2. Provide homeowners with a data-driven tool to predict fair tax amounts, assure equitable tax practices.

Features and Model selection

Adopted Algorithms

Classifiers

- Naive Bayes
- Gaussian Naive Bayes
- K Nearest Neighbor (KNN)

Regressors

- Linear regression
- KNN regressor

Selected features

Classification

Explanatories: 'taxes', 'HOA', 'year_built', 'fireplaces', 'longitude', 'garage', 'latitude', 'lot_acres', 'sqrt_ft', 'sold_price'

Target = tax_category

Regression

Explanatories: 'fireplces', 'sold_price', 'sqrt_ft', 'lot_acres', 'HOA', 'garage', 'latitude', 'longitude', 'year_built

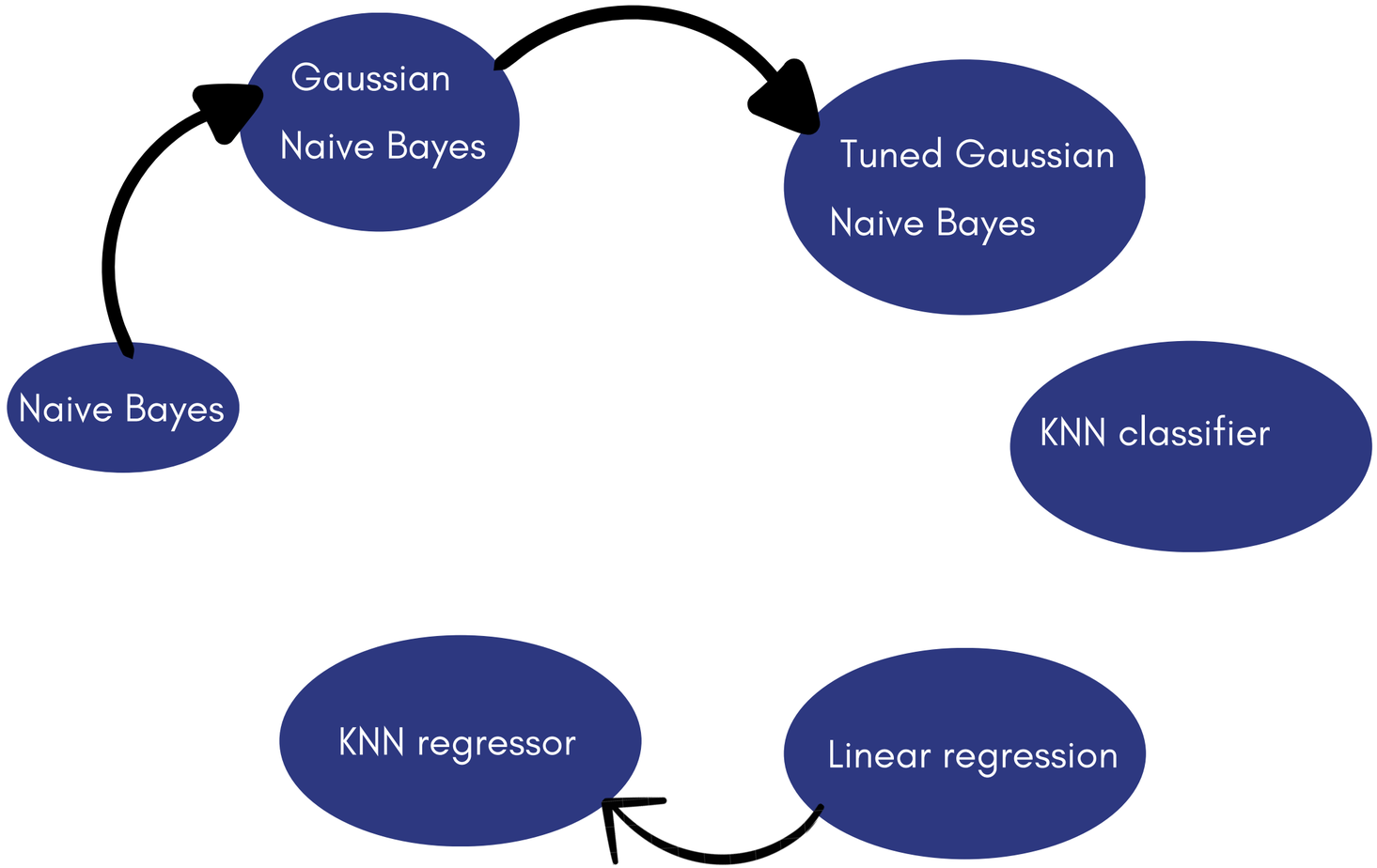
Target = taxes

Methodology

1. Classify properties into different tax rate zones

Target variable (tax category) was created by segmenting taxes into three quantiles using the pd.qcut() function. This divided the data into three equally sized groups, each representing a different tax category: Low, Medium, and High

2. Applied Linear Regression to predict the Fair property tax amount



Results

Base NB	Gaussian NB	Optimized GNB	KNN	Optimized KNN
Accuracy: 0.89 @ epsilon=1e-3	Accuracy: 0.92 @ epsilon=1e-3	Accuracy: 0.93 @epsilon: 0.0077	Accuracy: 0.78 @ K=6	Accuracy: 0.8 @K=12

Linear regression	KNN regressor
MAE: 27 RMSE: 37	MAE: 37 RMSE: 41 @K=20

Conclusion

Current task aimed to develop a machine learning-based tool for fair property tax estimation, addressing issues such as inconsistencies and perceived unfairness in property charged tax. Classification and regression methodologies were used for property tax categorization and precise tax amount predictions.

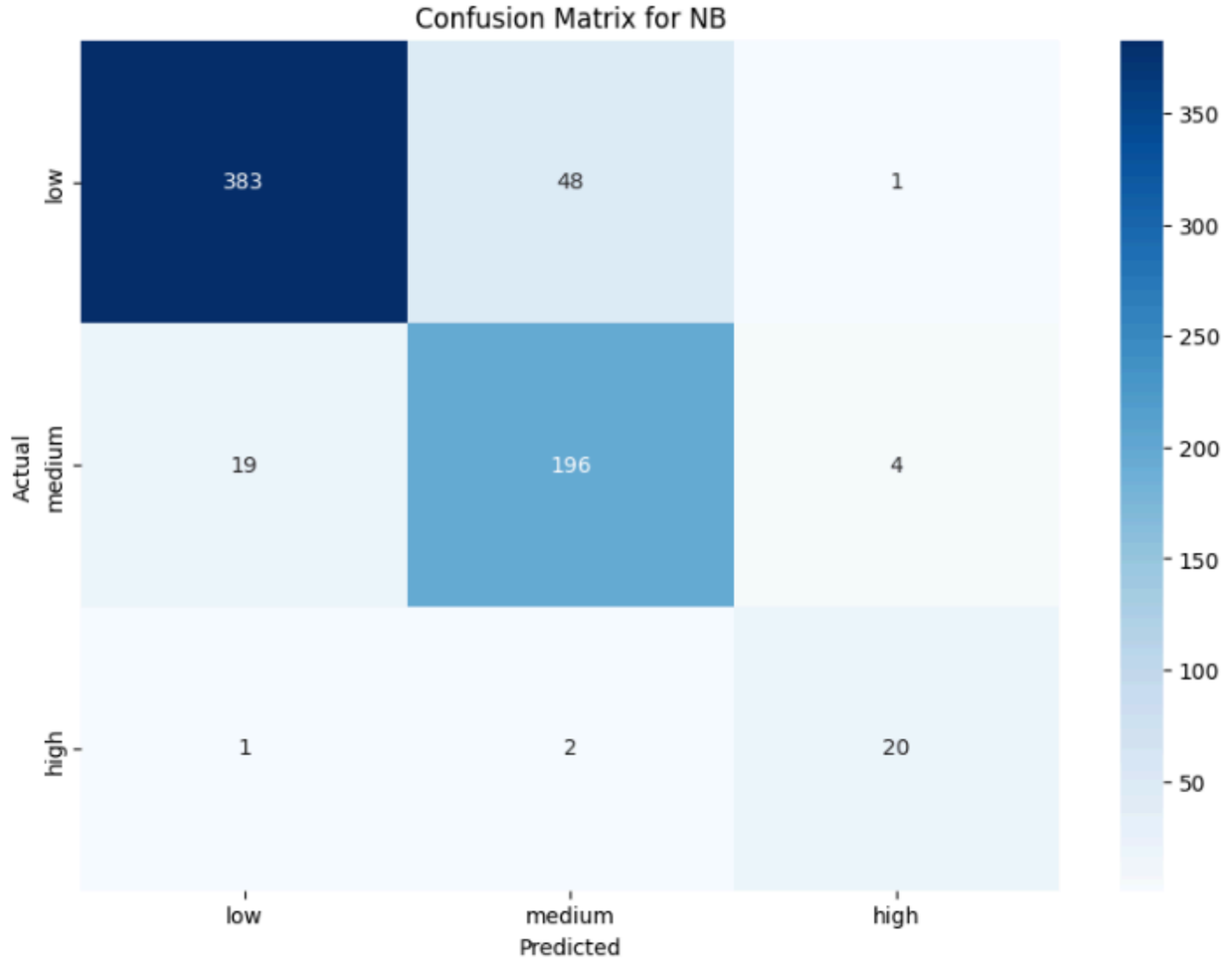
Gaussian Naive Bayes model achieved high classification accuracy, while Linear Regression provided more accurate tax predictions.

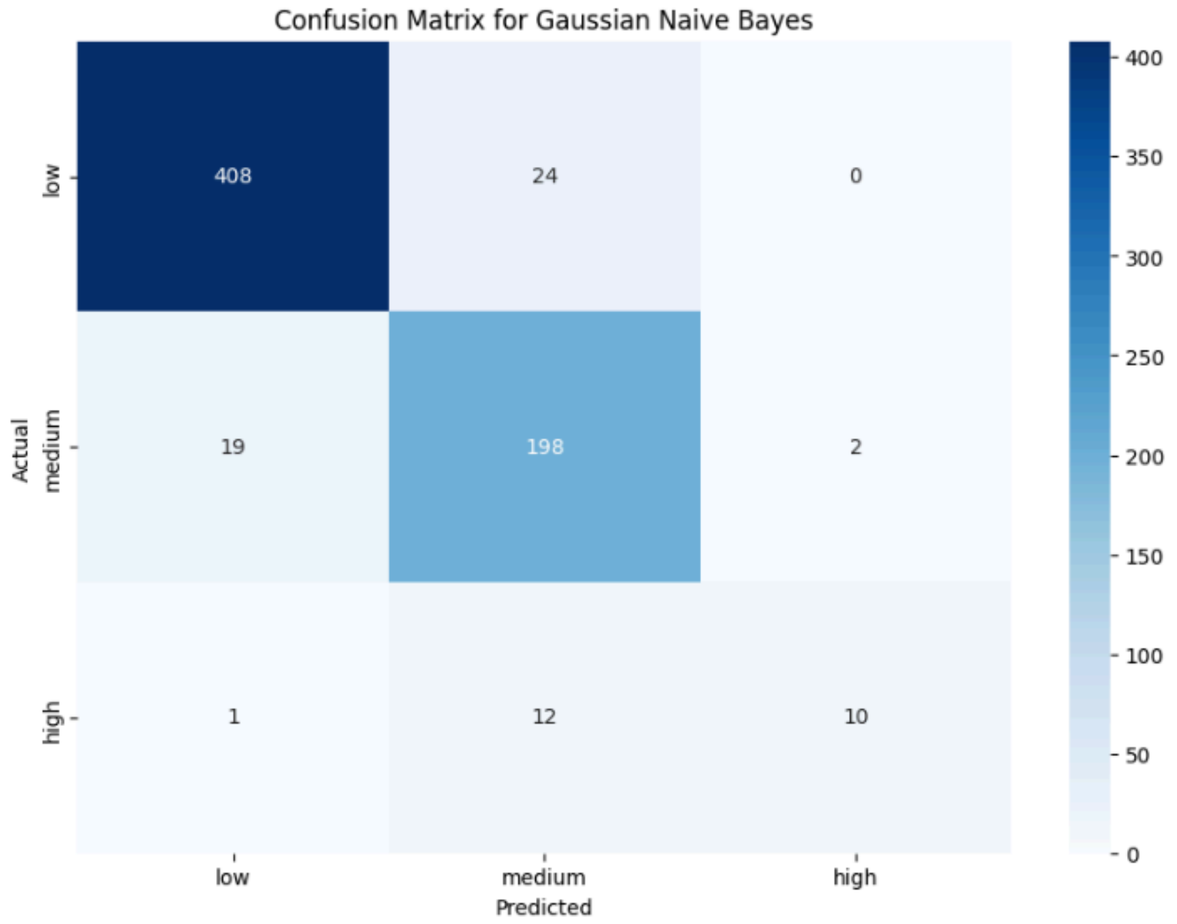
This tool addresses the problems of tax discrepancies and lack of transparency by offering a clear, data-driven estimation approach, thereby improving fairness and trust in the property tax system.

Thank You

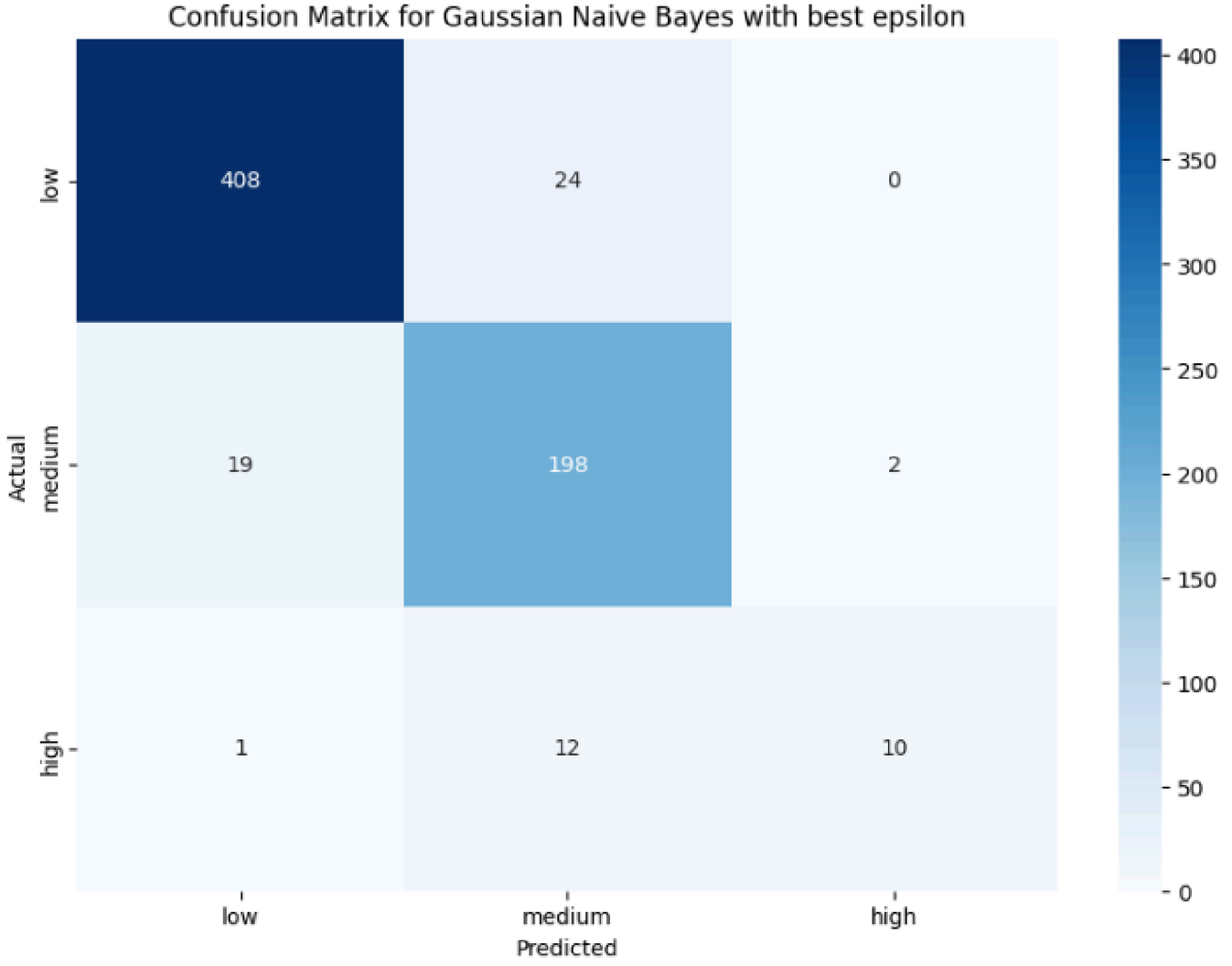
September, 09, 2024

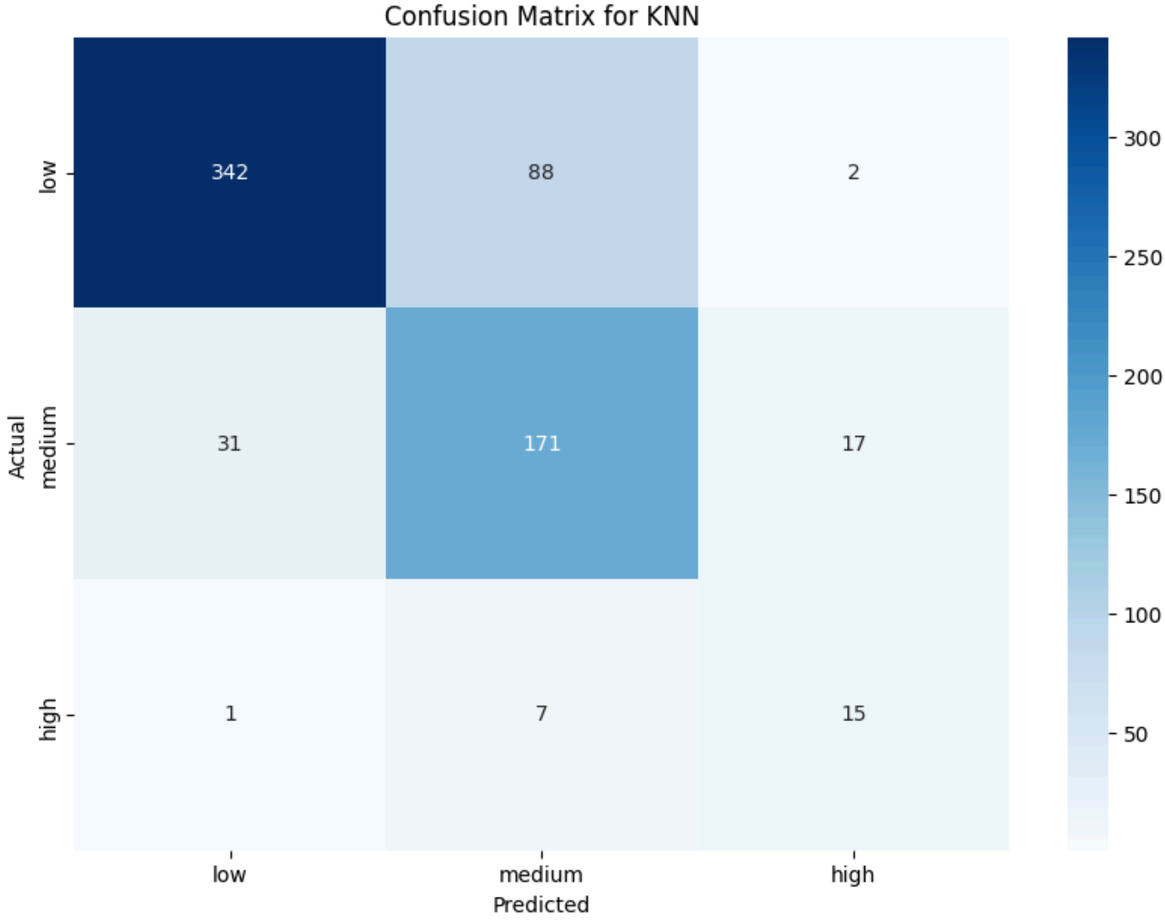
Classifiers performance





Classifiers performance Cont.'s.





```
Best K value: 12
```