IOD Mini Project 2

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- Housing price prediction
  - Linear Regression
  - Lasso and Ridge Regression

- Stroke prediction
  - Logistic Regression
  - Support Vector Machine
  - K-nearest Neighbors

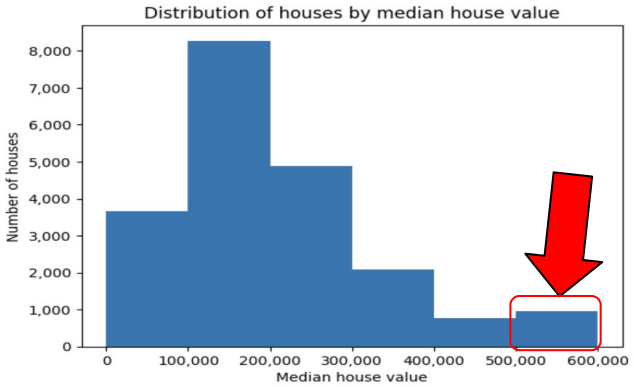
Housing Price Prediction

California Housing Prices Dataset

- Information on houses found in California based on the 1990 census data
  - Location: longitude, latitude, ocean_proximity
  - Property information: total_rooms, total_bedrooms, housing_median_age, median_house_value
  - Demographics: population, households

- Data source
  - https://www.kaggle.com/datasets/camnugent/california-housing-prices

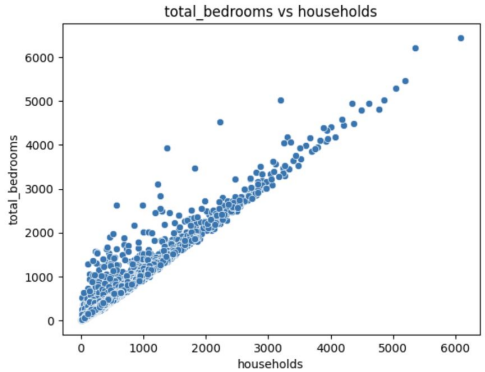
Data Cleaning



1) Remove data with house price at 500,001

965 houses with the same house value of 500,001

Very unlikely for so many houses to have the same median price, especially when it is a high price.

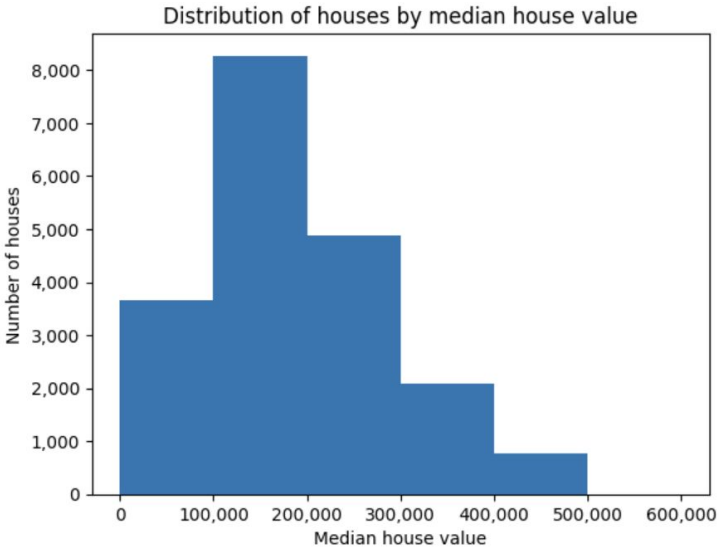


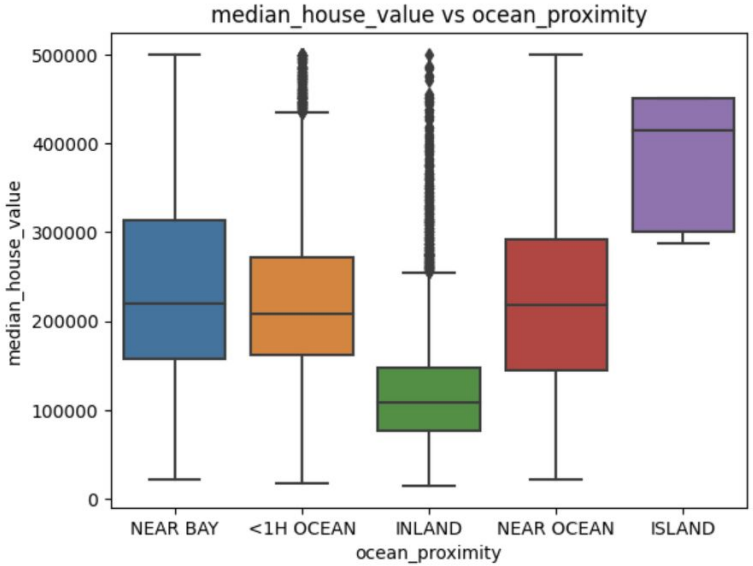
2) Estimate missing total_bedrooms data using linear regression with households

Household has a very strong linear relationship with total_bedrooms

Training result accuracy at 0.96

Exploratory Data Analysis

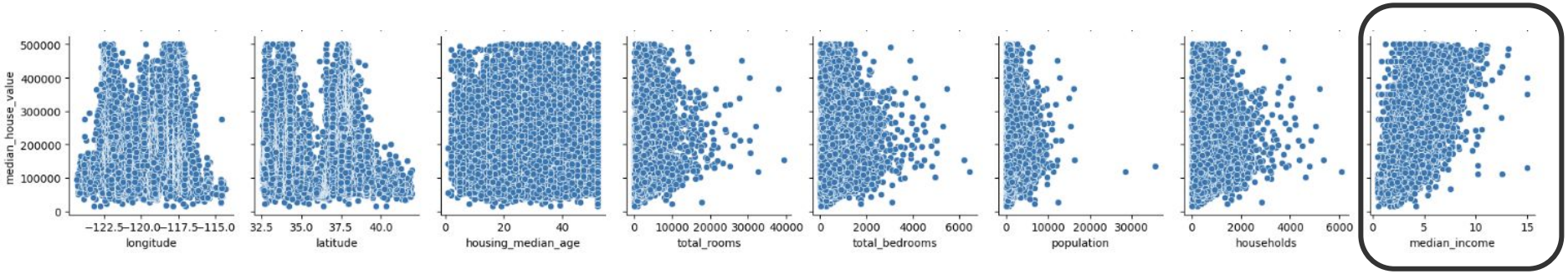




A large proportion of houses have median house value between 100k - 200k

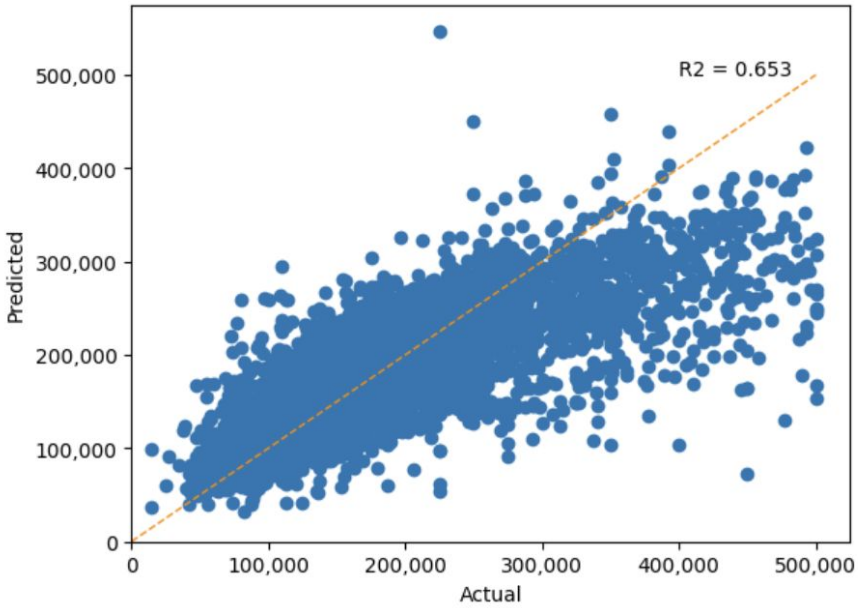
Houses on the island are more expensive while those in the inland are cheaper

Exploratory Data Analysis



Housing price has some linear relationship with median_income

Price Prediction



Linear Regression model could not predict higher value houses well

Training accuracy score: 0.641
Test accuracy score: 0.653

Comparing different models

TRAINING SCORES	r2	mse
lr	0.641114	0.101443
lasso	0.641114	0.101443
ridge	0.641114	0.101443

TEST SCORES	r2	mse
lr	0.652886	0.101138
lasso	0.652887	0.101138
ridge	0.652886	0.101138

All three models have the same predictive power

Possible Improvements: Get data on housing amenities (pool, fitness corner etc)

Stroke Prediction

Stroke Prediction Dataset

- Patients information
  - Basic information: id, gender, age
  - Health-related: stroke, hypertension, heart_disease, avg_glucose_level, bmi
  - Lifestyle: smoking_status, ever_married, work_type, Residence_type

- Data source
  - https://www.kaggle.com/datasets/fedesoriano/stroke-prediction-dataset

Data Cleaning

1) Remove patients without BMI data

4% of total patients

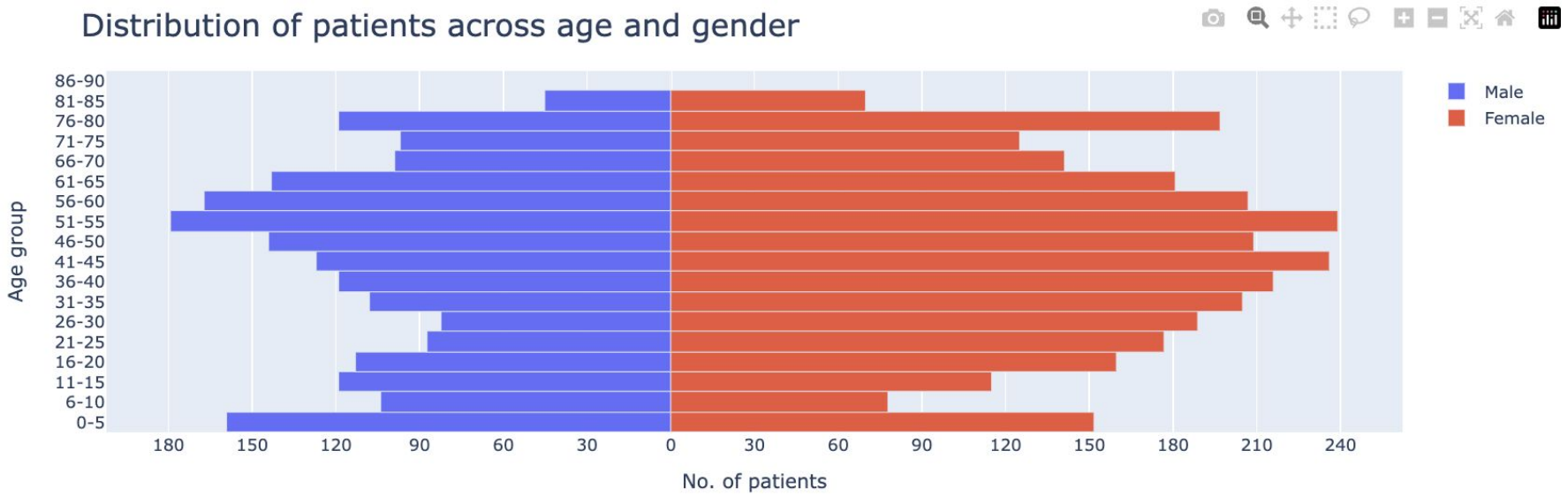
```
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   id                 5110 non-null   int64
 1   gender             5110 non-null   object
 2   age                5110 non-null   float64
 3   hypertension       5110 non-null   int64
 4   heart_disease      5110 non-null   int64
 5   ever_married       5110 non-null   object
 6   work_type          5110 non-null   object
 7   Residence_type     5110 non-null   object
 8   avg_glucose_level  5110 non-null   float64
 9   bmi                4909 non-null   float64
 10  smoking_status     5110 non-null   object
 11  stroke             5110 non-null   int64
```

2) Remove patient with gender 'Other'

Only one patient with 'Other' gender

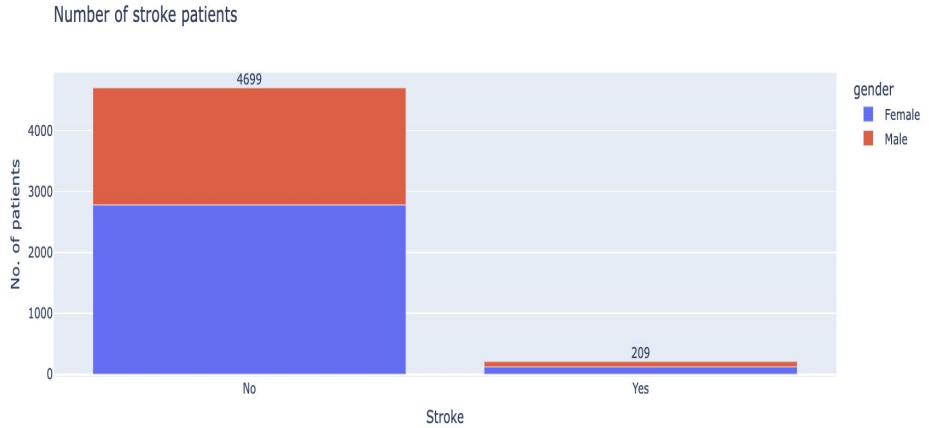
```
gender
Female    2897
Male      2011
Other        1
Name: count, dtype: int64
```

Exploratory Data Analysis

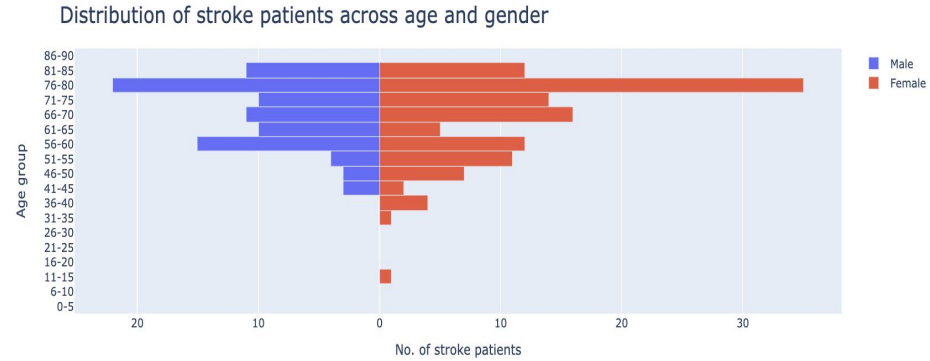


Distribution of patients across age group look similar for both genders

Exploratory Data Analysis

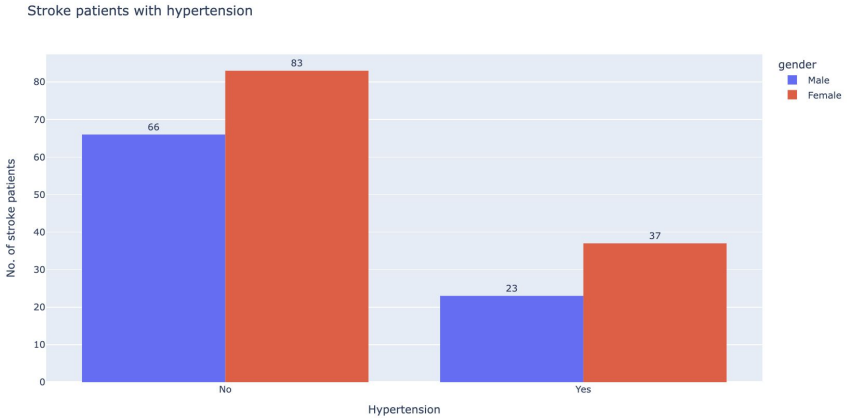


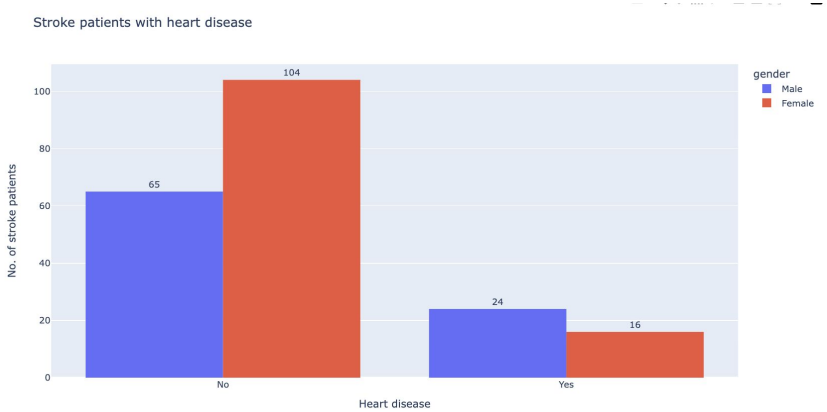
Very small number of stroke patients in dataset (4%)



A large percentage of stroke patients are between the age 76-80 for both genders

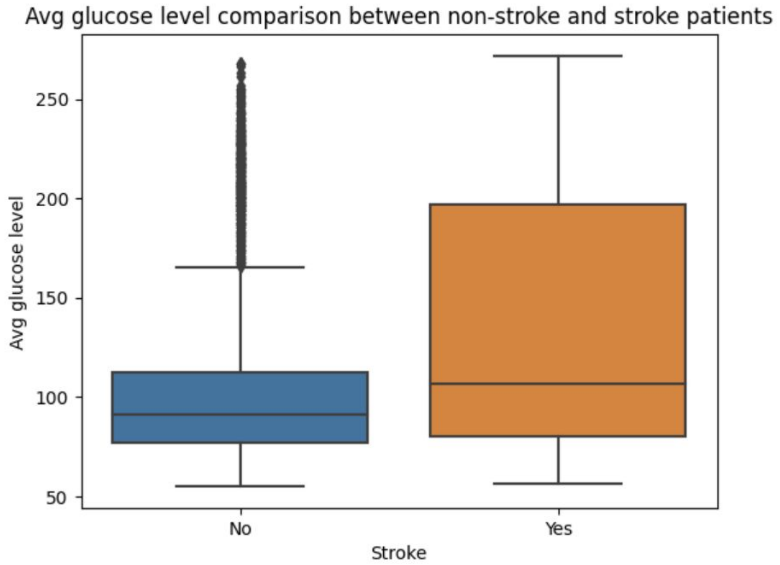
Exploratory Data Analysis

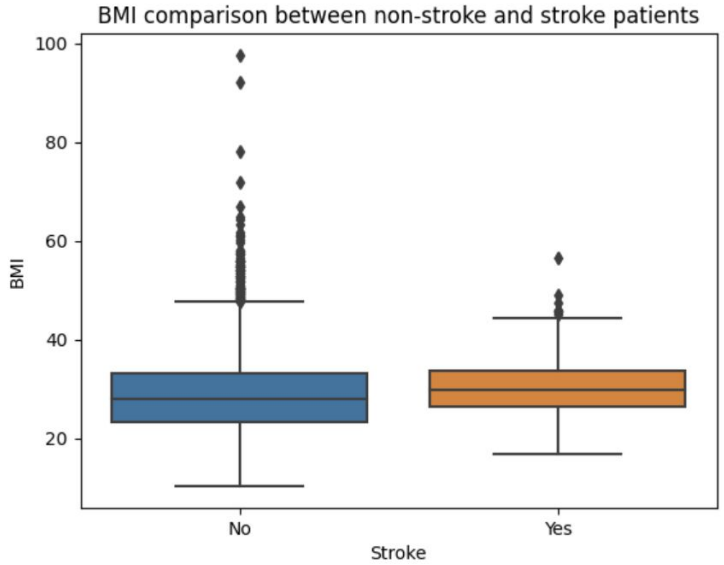




Majority of stroke patients do not have hypertension or heart disease

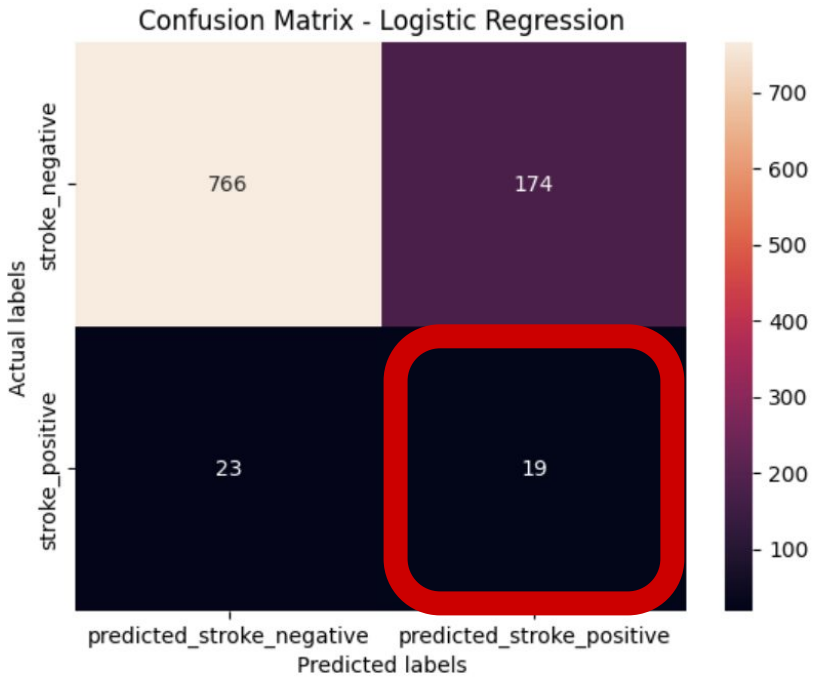
Exploratory Data Analysis





Stroke patients have higher avg glucose level and BMI

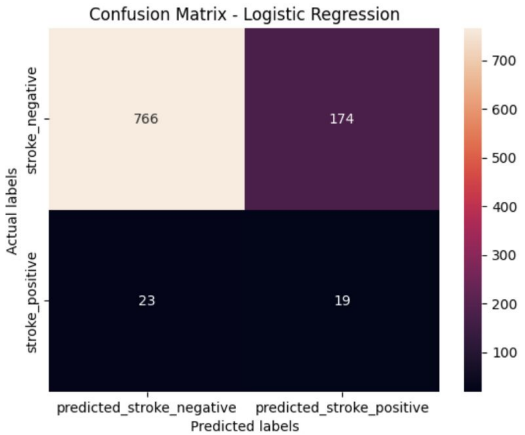
Stroke prediction



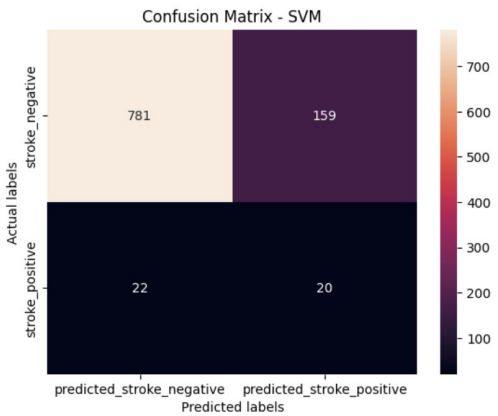
Logistic Regression model could not predict stroke patients well

Training F1 score: 0.843
Test F1 score: 0.162

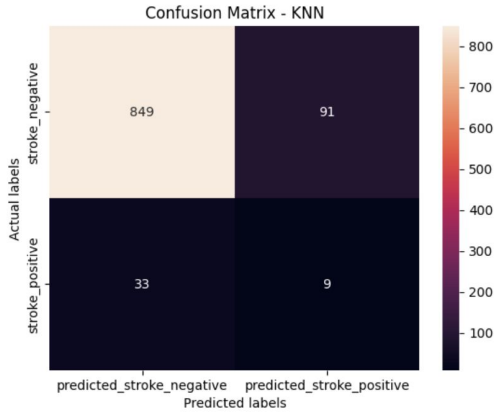
Comparing different models



Training F1 score: 0.843
Test F1 score: 0.162



Training F1 score: 0.861
Test F1 score: 0.181



Training F1 score: 1.000
Test F1 score: 0.127

All three models are poor at predicting stroke patients

How to improve models

Try different methods of handling imbalanced data

Models are likely overfitting training data

- Training score high but low test score
- Current model uses oversampling method to tackle imbalanced data

Get more stroke patients data

Real data is better than using algorithms to fix class imbalanced

- Model will be more trustworthy

End