Homework 3 (Group 5)

Binary Logistic Regression

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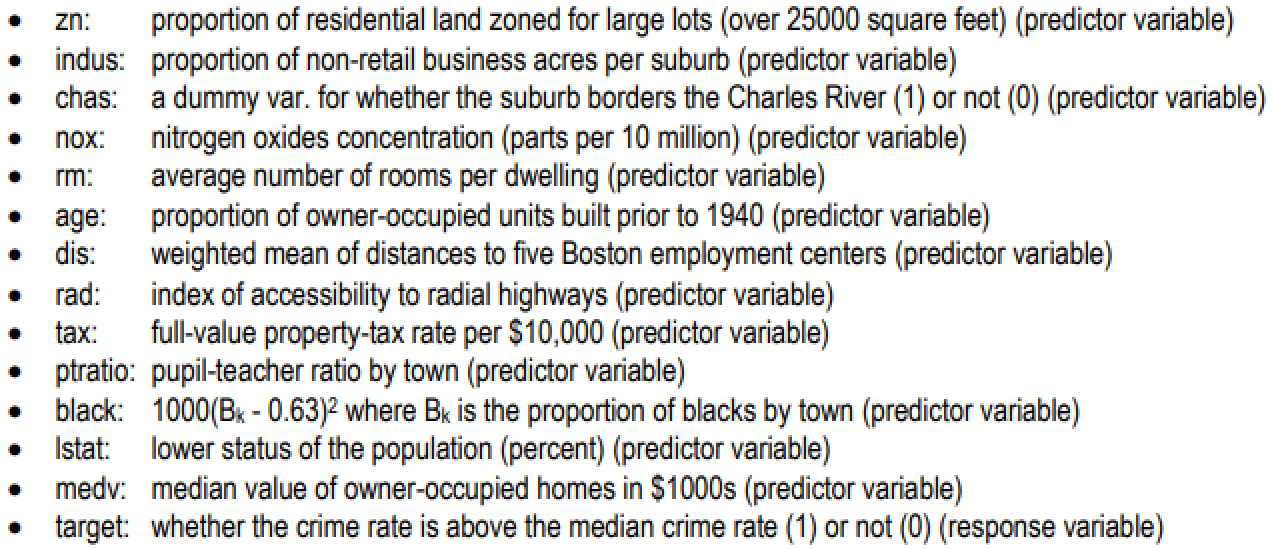
Contents

Dataset



- zn: proportion of residential land zoned for large lots (over 25000 square feet) (predictor variable)
- indus: proportion of non-retail business acres per suburb (predictor variable)
- chas: a dummy var. for whether the suburb borders the Charles River (1) or not (0) (predictor variable)
- nox: nitrogen oxides concentration (parts per 10 million) (predictor variable)
- rm: average number of rooms per dwelling (predictor variable)
- age: proportion of owner-occupied units built prior to 1940 (predictor variable)
- dis: weighted mean of distances to five Boston employment centers (predictor variable)
- rad: index of accessibility to radial highways (predictor variable)
- tax: full-value property-tax rate per $10,000 (predictor variable)
- ptratio: pupil-teacher ratio by town (predictor variable)
- black: $1000(B_k - 0.63)^2$ where B_k is the proportion of blacks by town (predictor variable)
- lstat: lower status of the population (percent) (predictor variable)
- medv: median value of owner-occupied homes in $1000s (predictor variable)
- target: whether the crime rate is above the median crime rate (1) or not (0) (response variable)

Overview

In this homework assignment, you will explore, analyze and model a data set containing information on crime for various neighborhoods of a major city. Each record has a response variable indicating whether or not the crime rate is above the median crime rate (1) or not (0).

Your objective is to build a binary logistic regression model on the training data set to predict whether the neighborhood will be at risk for high crime levels. You will provide classifications and probabilities for the evaluation data set using your binary logistic regression model. You can only use the variables given to you (or variables that you derive from the variables provided). Below is a short description of the variables of interest in the data set:

1. Data Exploration

Objective

- Understand the variables provided
- Build a binary logistic regression model on the training data
- Predict the whether the neighborhood will be at risk for high crime.
- Provide classifications and probabilities for the evaluation data set using logistic regression.

Data Overview

Lets first look at the raw data values by using the skim package

Table 1: Data summary

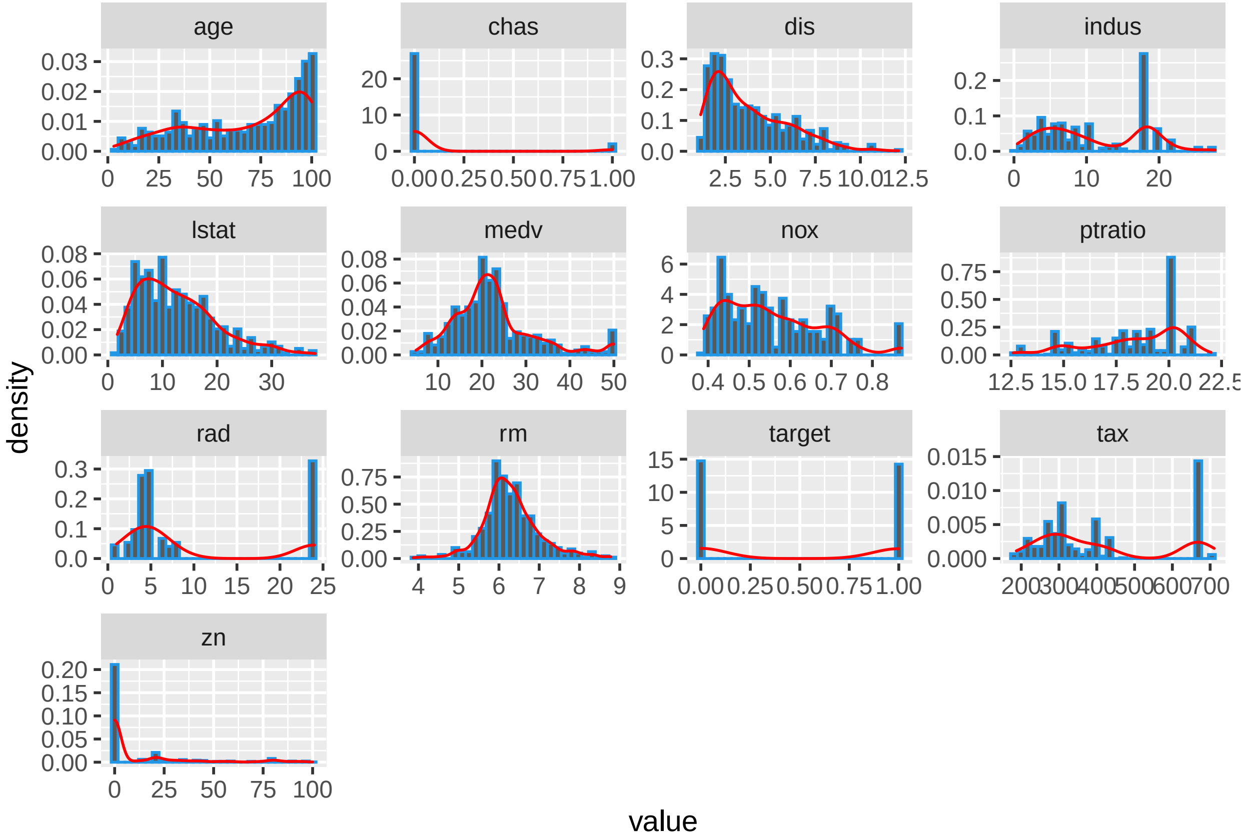
Name	crime_train
Number of rows	466
Number of columns	13
Column type frequency:	
numeric	13
Group variables	None

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
zn	0	1	11.58	23.36	0.00	0.00	0.00	16.25	100.00	
indus	0	1	11.11	6.85	0.46	5.15	9.69	18.10	27.74	
chas	0	1	0.07	0.26	0.00	0.00	0.00	0.00	1.00	
nox	0	1	0.55	0.12	0.39	0.45	0.54	0.62	0.87	
rm	0	1	6.29	0.70	3.86	5.89	6.21	6.63	8.78	
age	0	1	68.37	28.32	2.90	43.88	77.15	94.10	100.00	
dis	0	1	3.80	2.11	1.13	2.10	3.19	5.21	12.13	
rad	0	1	9.53	8.69	1.00	4.00	5.00	24.00	24.00	
tax	0	1	409.50	167.90	187.00	281.00	334.50	666.00	711.00	
ptratio	0	1	18.40	2.20	12.60	16.90	18.90	20.20	22.00	
lstat	0	1	12.63	7.10	1.73	7.04	11.35	16.93	37.97	
medv	0	1	22.59	9.24	5.00	17.02	21.20	25.00	50.00	
target	0	1	0.49	0.50	0.00	0.00	0.00	1.00	1.00	

From the description seen by the skim package we can observe we have two variables that should be transformed into factors since they have (1) or (0) values. `chas & target.`

Distributions



2. Data Preparation

3. Building Models

Model # 1

Model #2

Model #3

4. Select Models

Model_1 Testing

Model_2 Testing

Model_3 Testing

Final Selection

References

Apendix