Analysis on Clinical and Financial Data of Patients with a Certain Condition

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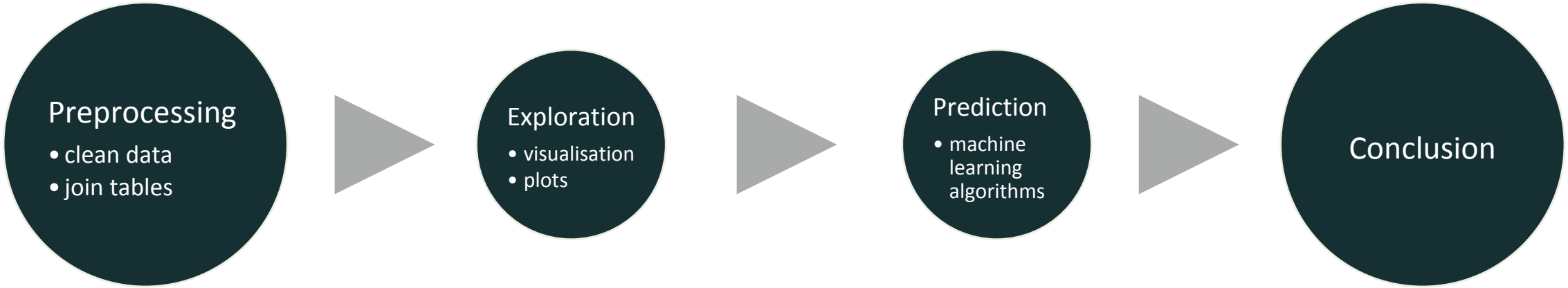
Analysis


Preprocessing
• clean data
• join tables
Exploration
• visualisation
• plots
Prediction
• machine learning algorithms
Conclusion

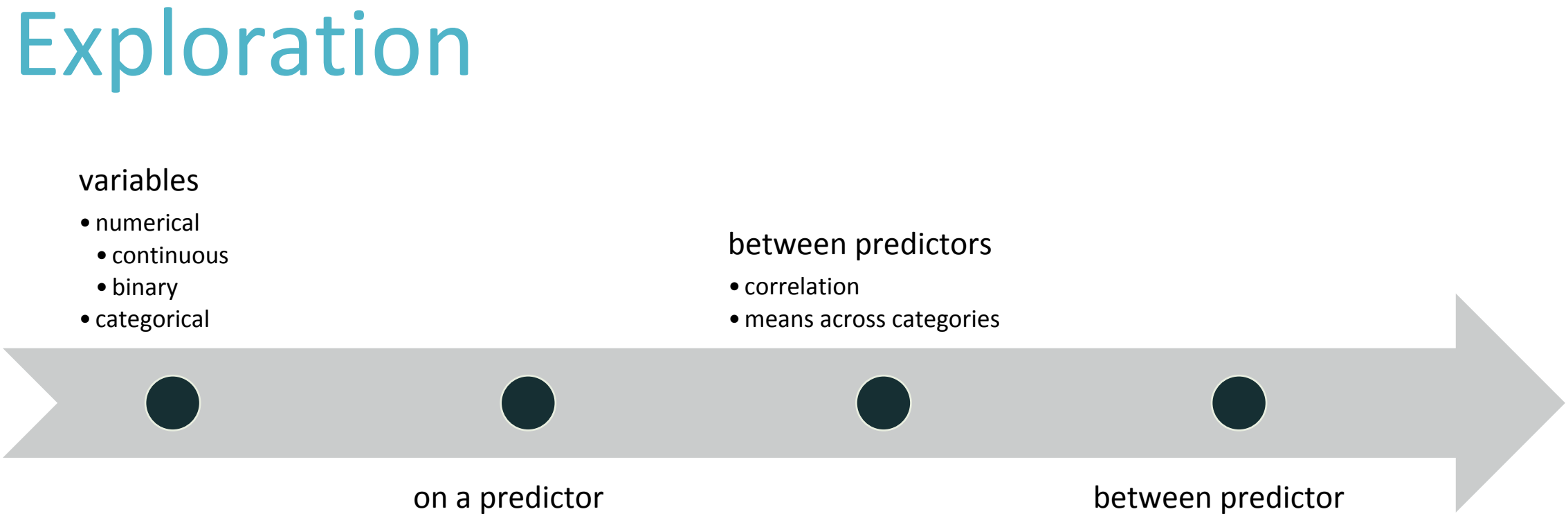
Preprocessing

- bill_amount
- bill_id
- clinical_data
- demographics

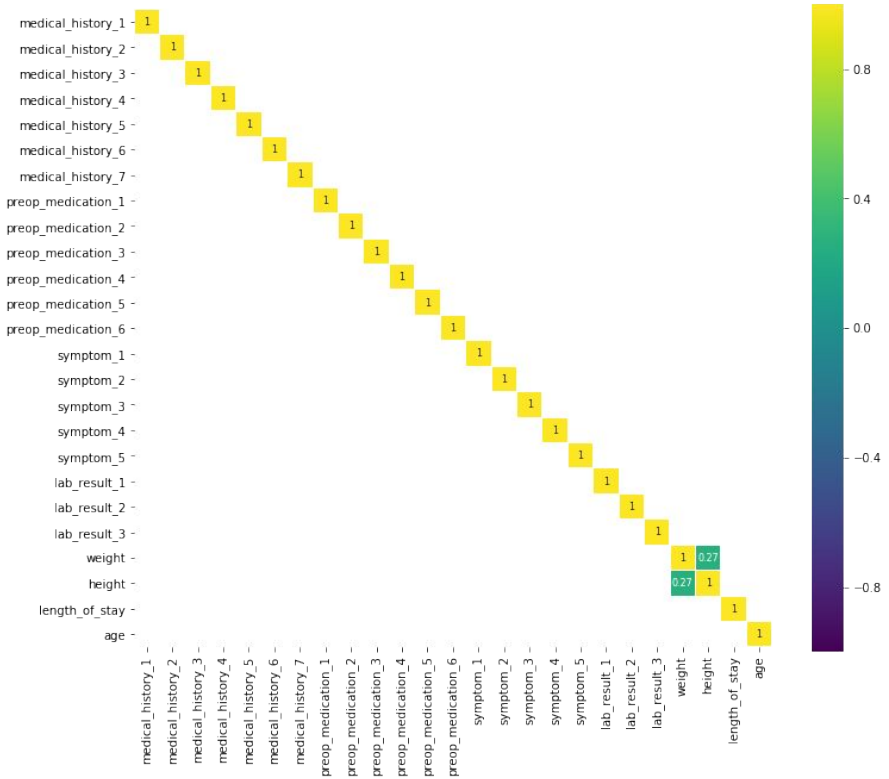
- inconsistent labeling
- wrong formats

- unnecessary information
- new variables

Exploration

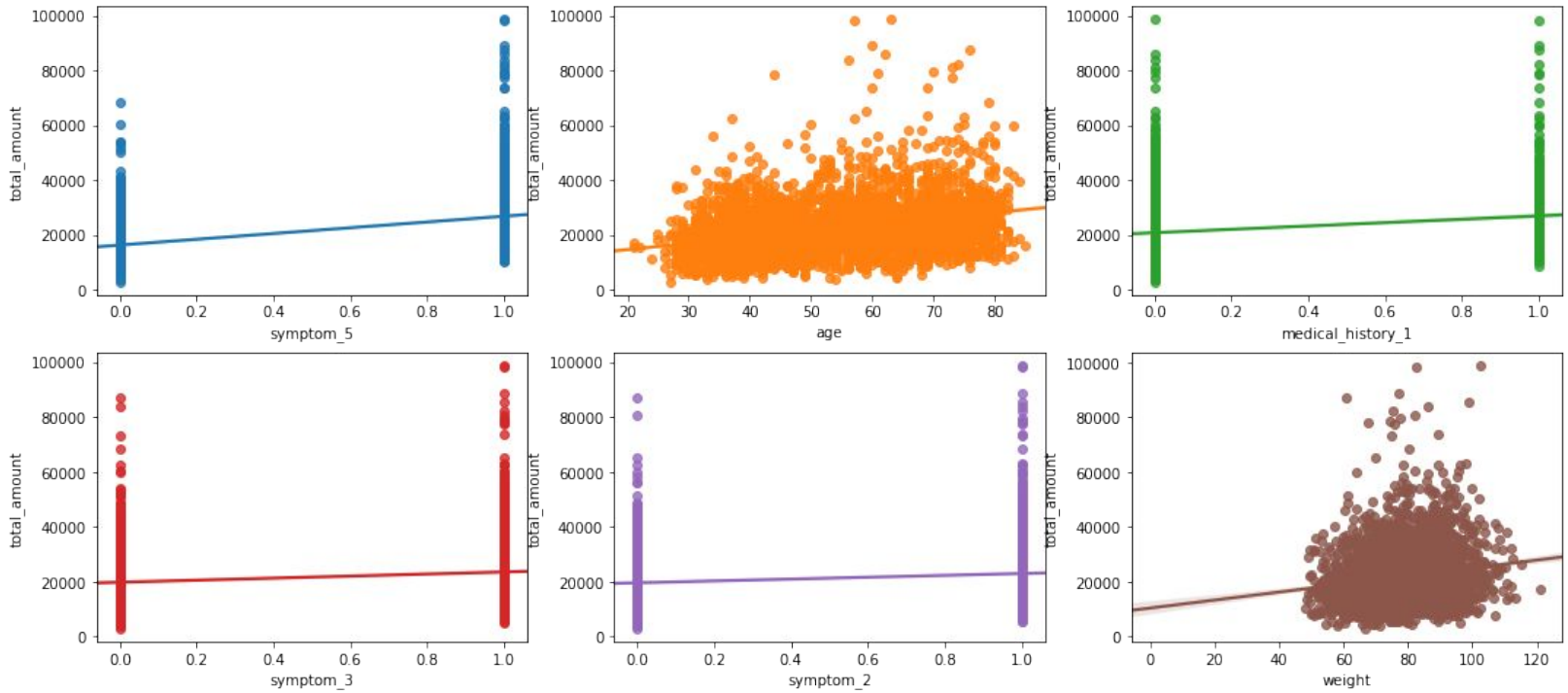


Exploration - numerical



Predictors are uncorrelated of each other. Only one predictor pair (weight-height) has correlation more than 0.05!

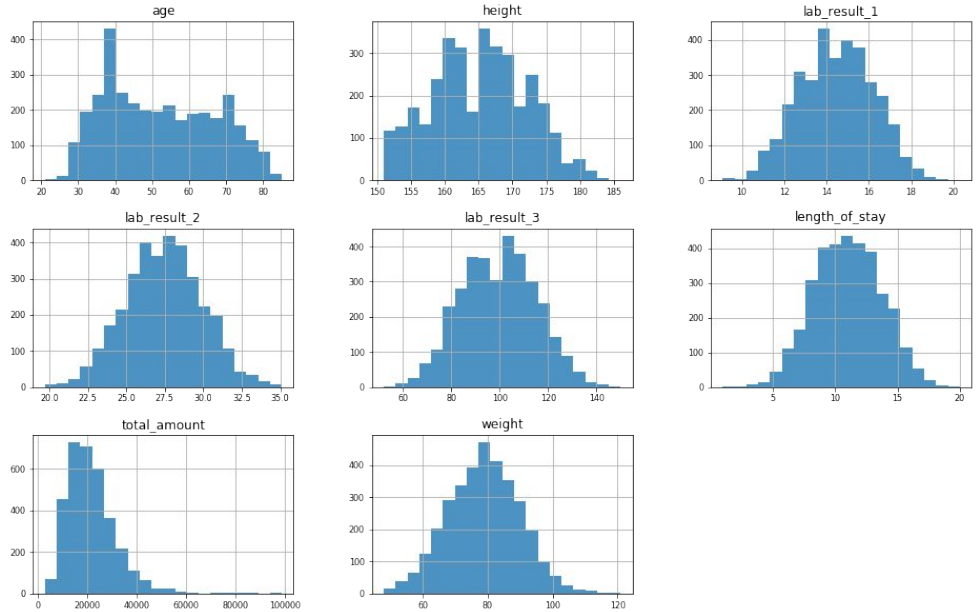
Exploration - numerical



Top 6 predictors with highest correlation with total_amount:

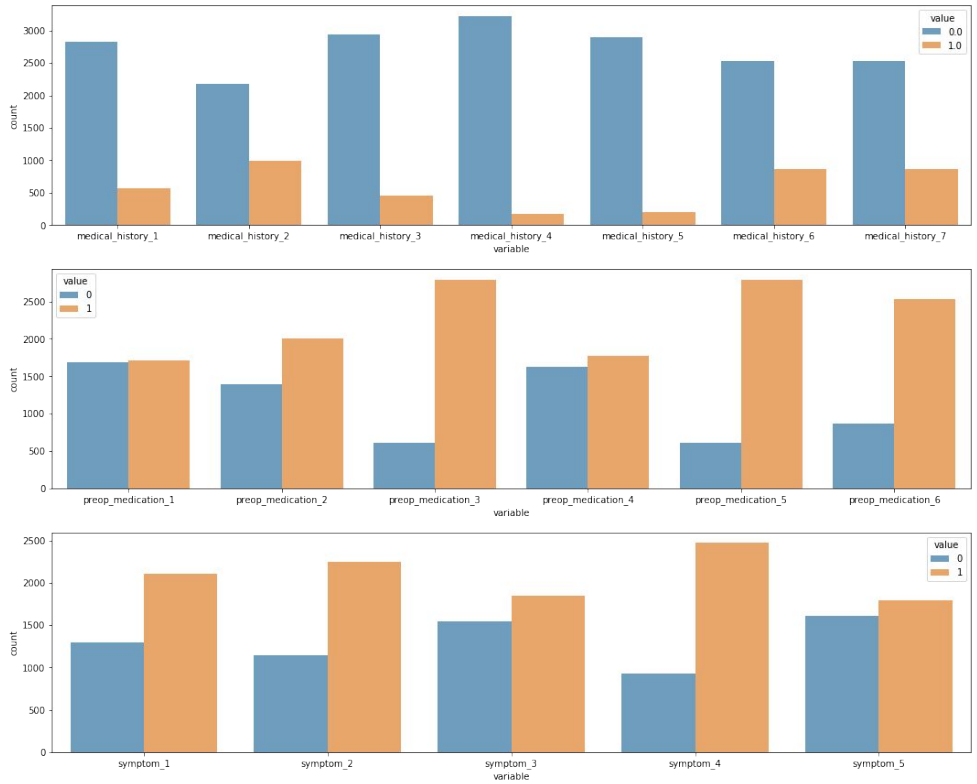
variable	correlation
symptom_5	0.517
age	0.326
medical_history_1	0.227
symptom_3	0.184
symptom_2	0.158
weight	0.158

Exploration - continuous



Most distribution have Gaussian shape, with some following bimodal distributions.

Exploration - binary

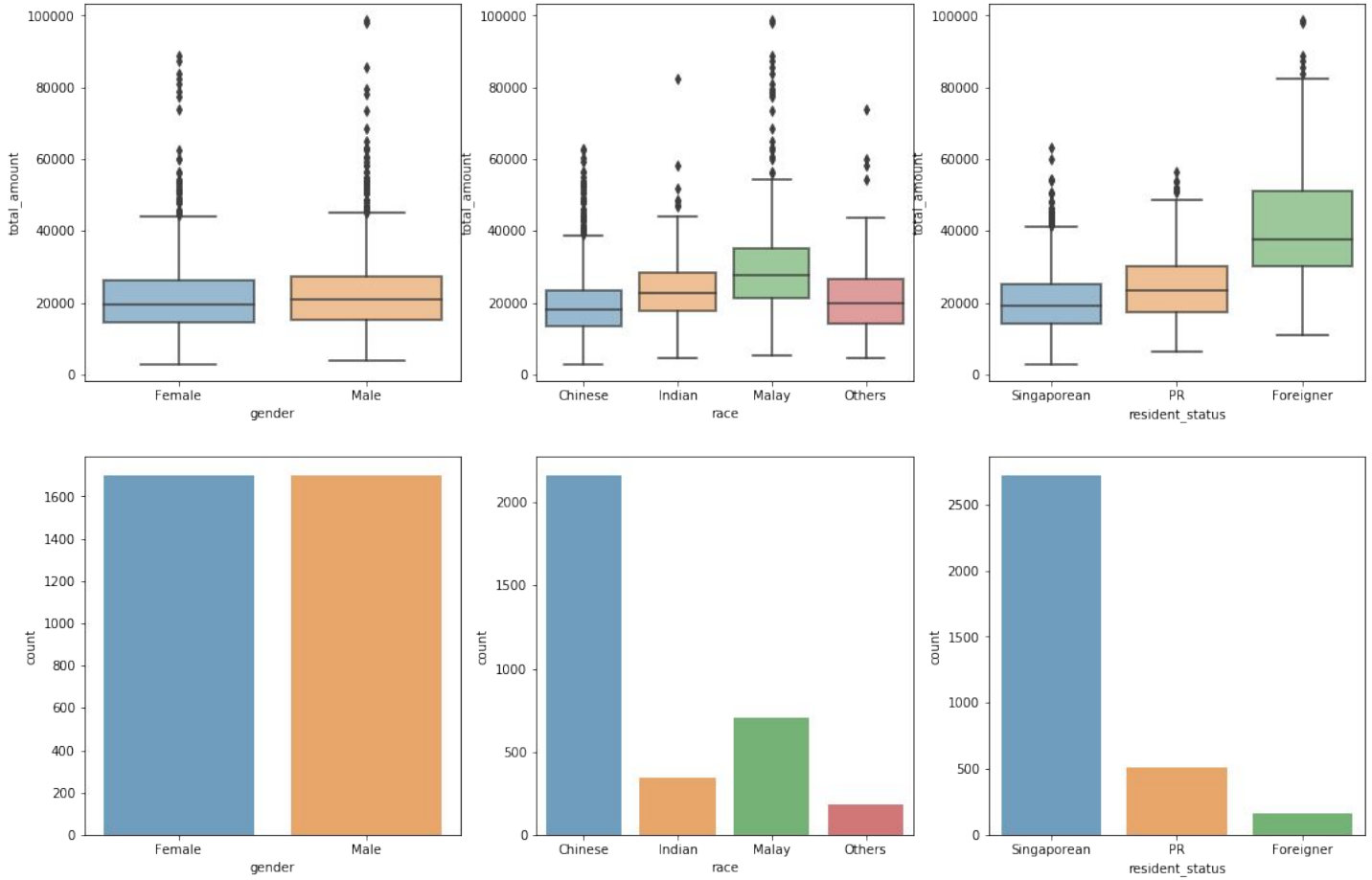


Medical history variables (top row) are unbalanced, but it is expected.

Patients under this condition are more likely to receive certain preop medications.

Some symptoms are more common than the other under this condition.

Exploration - categorical



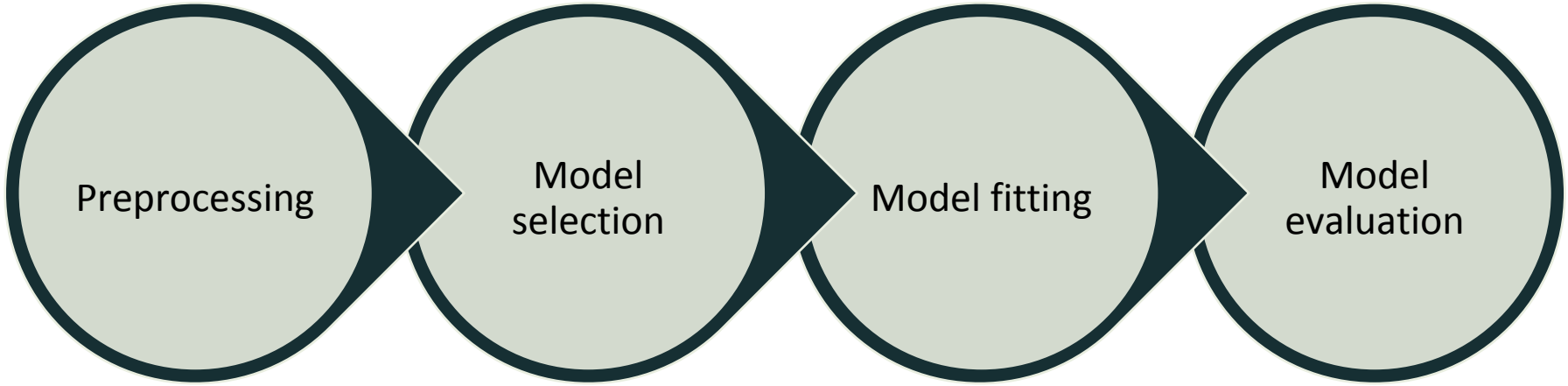
No difference in cost across gender. The condition also affects each gender equally.

Malays and Indians have higher cost. Does this condition affect them more?

Foreigners and PRs pay more than Singaporeans do.

race and resident_status are not distributed equally in our data.

Prediction



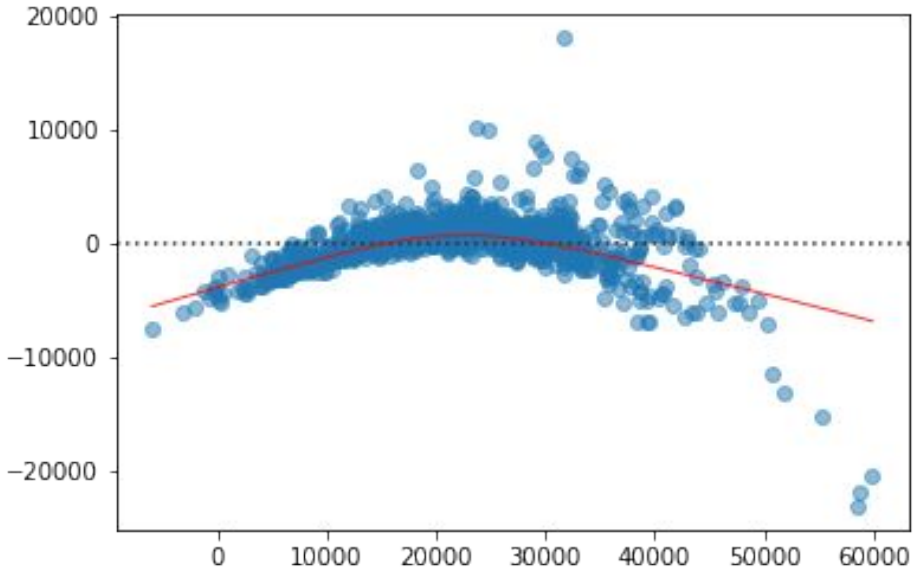
- Variable standardisation
- Dummy variable encoding
- Missing data filling
- Train-test split

- Linear regression
- Polynomial regression
- LASSO
- Regression tree
- Support vector regression
- Neural network

- Parameter tuning with cross-validation
- Model fitting

- MSE
- Residual plot

Prediction – linear regression



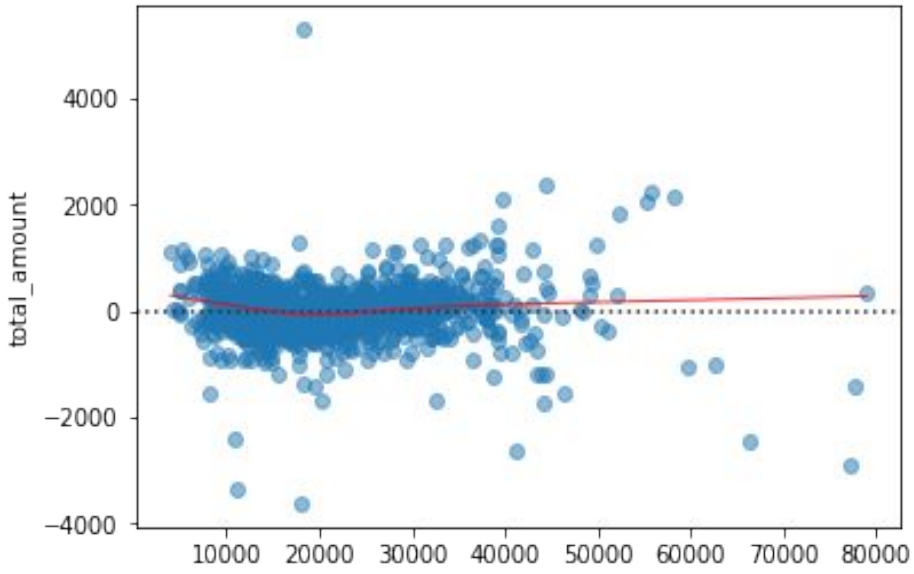
Baseline model

MSE = 2473.793

Important variables:

- symptom_5, symptom_3, symptom_2
- medical_history_1, medical_history_6
- race and resident_status

Prediction – polynomial regression

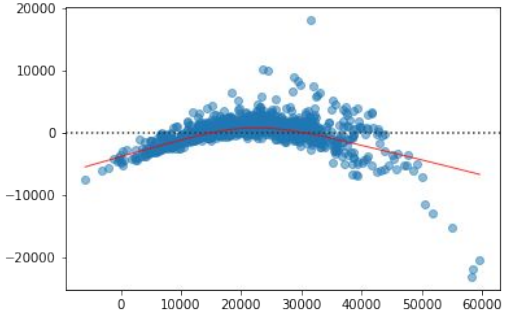


Best model

MSE = 520.633

Higher performance, more variables. May be difficult to explain.

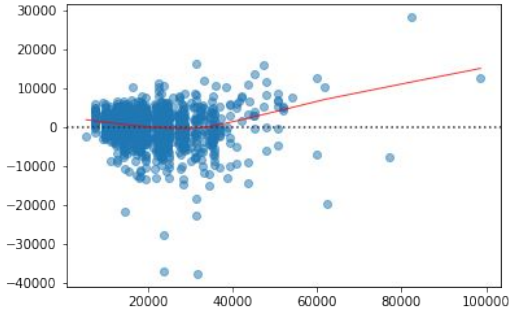
Prediction – other models



LASSO

- Small penalty from CV
- Similar to OLS

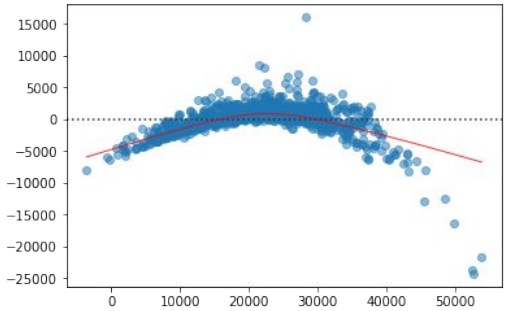
MSE: 2466.897



Regression Tree

- Worst model, even with deep tree

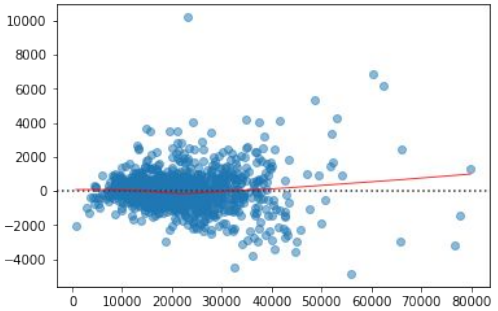
MSE: 4868.979



Support Vector Regression

- CV chose linear kernel
- Similar to OLS

MSE: 2555.064



Neural Network

- Better than OLS, but worse than polynomial regression

MSE: 1122.375

Conclusion

Important cost drivers	Less relevant variables	Model selection
• symptom variables • race, residential status • age, weight • some medical history variables	• preop medication variables • lab results • some medical history variables	• simple models with regularized parameter perform poorly