

# ETC 2420/5242 Lab 8 2017

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*Week 8*

## Purpose

For this lab we are going to build models based on partitioning, and combine models built on bootstrap samples, using regression trees and forests.

## Reading

Read the code in the lecture notes on regression trees and forests from weeks 7 and 8. We will work with data scraped from property auction reports, collected over the last couple of years. Dr Julia Polak collected the reports, and together we used the `pdfutils` package in R to extract information about each property. We will compare the results from trees and forests with the multiple regression model.

## Warmup

This is a description of the variables:

Variable	Description
id	unique id for property
suburb	suburb location of property
price	Price house sold for in AUD dollars, divided by 100,000
result	S indicates property sold; SP - property sold prior; PI - property passed in; PN - sold prior not disclosed; SN - sold not disclosed; NB - no bid; VB - vendor bid; o res - other residential; w - withdrawn prior to auction
agent	realtor in charge of sale
nbeds	Number of bedrooms
property type	h =house, t =townhouse, u =unit/apartment
day	day of the month of auction
month	month of auction
year	year of auction
nvisits	How many people came to open houses
ncars	Number of parking places
nbaths	Number of bathrooms
land size	Size of the lot, in sq m, units will be 0
house size	Internal size of property in sq m

We have subsetting the data to only use two suburbs, Clayton and South Yarra.

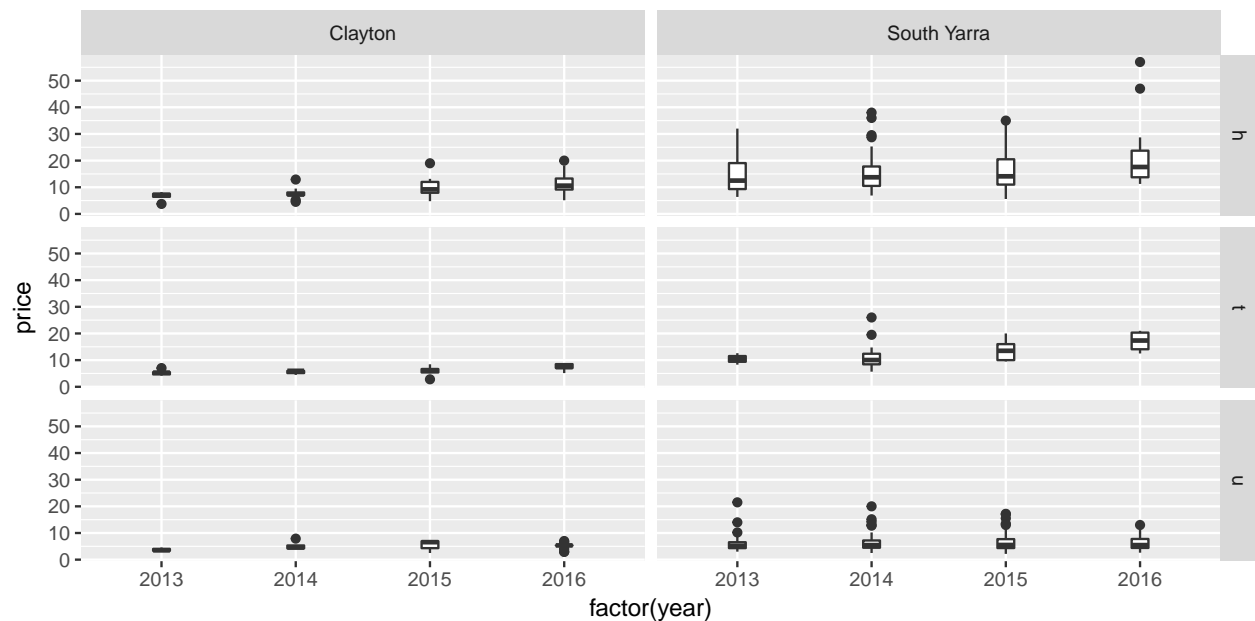
Take a quick glimpse of the data, by making some numerical and visual summaries. What is the average sale price for Clayton and South Yarra, over this period? Is there an increase in price over the four years?

```
#      id      suburb      price      result
# Min.   : 115   Length:614   Min.   : 2.165   Length:614
# 1st Qu.:41830 Class :character 1st Qu.: 4.900   Class :character
# Median :54787 Mode  :character Median : 6.810   Mode  :character
# Mean   :52464          Mean   : 8.695
# 3rd Qu.:64814          3rd Qu.:10.182
```

```

# Max. :75347          Max. :57.000
#   nbeds      property_type      day      month
# Min. :1.00      Length:614      Min. : 1.00      Length:614
# 1st Qu.:2.00      Class :character      1st Qu.: 9.00      Class :character
# Median :2.00      Mode :character      Median :16.00      Mode :character
# Mean :2.27
# 3rd Qu.:3.00
# Max. :8.00
#   year      nvisits      rating      ncars
# Min. :2013      Min. : 7.00      Min. : 0.000      Min. :0.000
# 1st Qu.:2014      1st Qu.: 52.00      1st Qu.: 3.000      1st Qu.:0.000
# Median :2015      Median : 92.00      Median : 5.000      Median :0.000
# Mean :2015      Mean : 93.65      Mean : 4.971      Mean :0.614
# 3rd Qu.:2015      3rd Qu.:137.00      3rd Qu.: 7.000      3rd Qu.:2.000
# Max. :2016      Max. :181.00      Max. :10.000      Max. :3.000
#   nbaths      land_size      house_size
# Min. :1.000      Min. : 0.0      Min. : 70.46
# 1st Qu.:1.000      1st Qu.: 0.0      1st Qu.: 74.70
# Median :1.500      Median : 0.0      Median :152.15
# Mean :1.619      Mean : 238.4      Mean :173.72
# 3rd Qu.:2.000      3rd Qu.: 479.5      3rd Qu.:241.93
# Max. :3.000      Max. :1115.0      Max. :496.00

```



Model building will be done using:

- Response: price
- Explanatory variables: suburb, result, nbeds and property type.

Subset the data to contain just these variables.

Now to correctly evaluate a tree model, you should fit the model to half of the data, and calculate the error on the predictions of the other half. We are going to make the split equally for the two suburbs, so that both are represented

To compare models we will compute the mean square error (MSE):

$$\frac{1}{n} \sum_{i=1}^n (y_i - \hat{y})^2$$

Write a function to compute the MSE.

### Question 1

- Fit a regression tree, to the training data, with the default parameters to the data.
- Plot the tree. How many terminal nodes? What variables are used?
- (2pts) Compute the MSE of the test data.
- Change the `cp` input parameter, try several different values. What `cp` value gives the best model, as measured by the smallest test MSE?

### Question 2

- Fit a generalised linear model to the same set of variables.
- Summarise the variable importance.
- Compute the MSE of the test data.
- Try including some interaction terms to improve the model, by reducing the test MSE.

### Question 3

- Build a random forest model, using the default parameters. what is the reported MSE? (This is the training set MSE.)
- Summarise the variable importance. Which variable is the most important?
- Compute the MSE of the test data.
- Explore the effect of `mtry` and `ntree` parameters, on the MSE.

### Question 4

How do the predicted values compare for the different models? (Use the best model for each method.)

### TURN IN

- Your `.Rmd` file
- Your `html` file that results from knitting the Rmd.