auditor: an R package and methodology for validation of any statistical model

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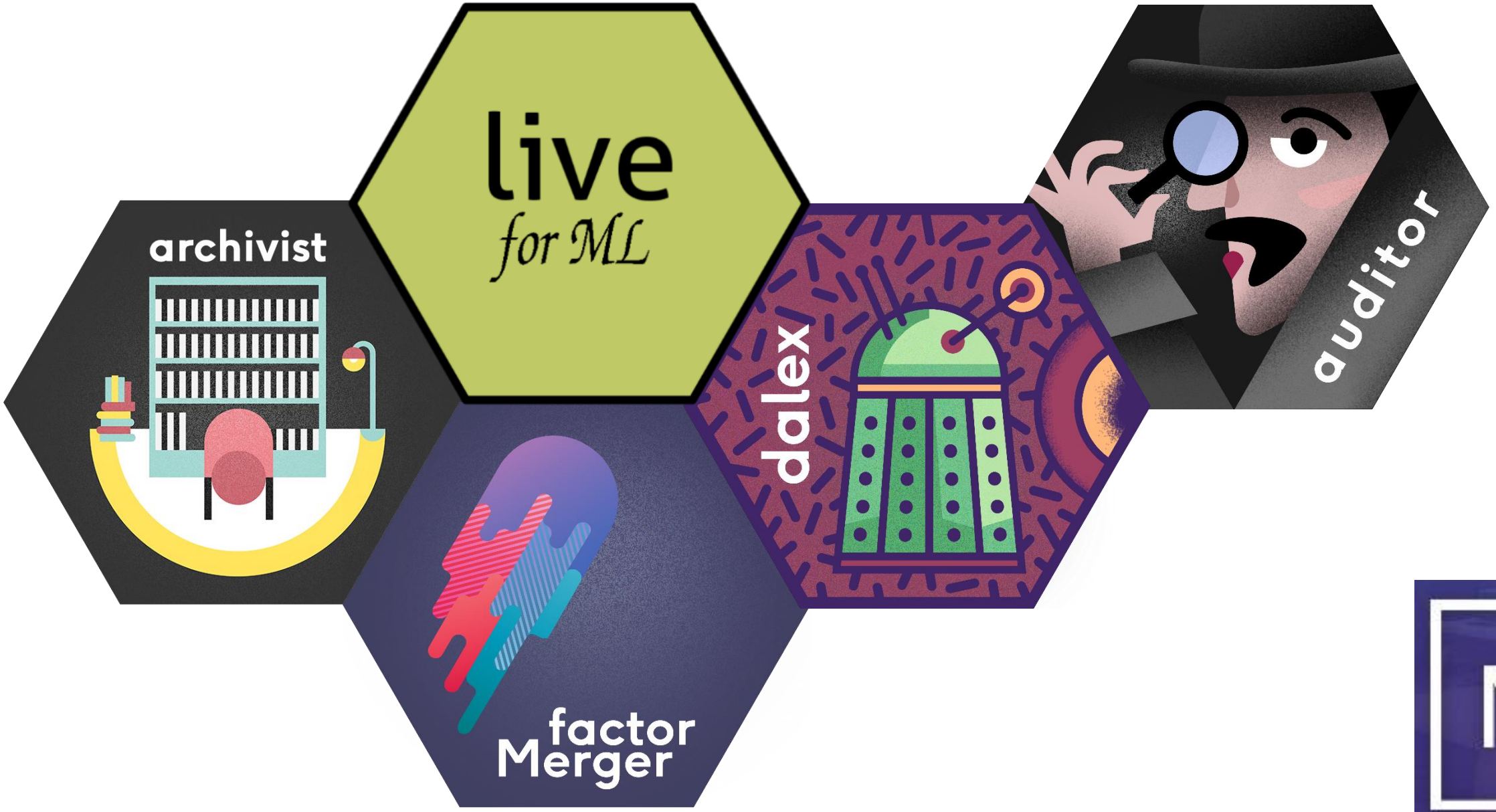
archivist
live
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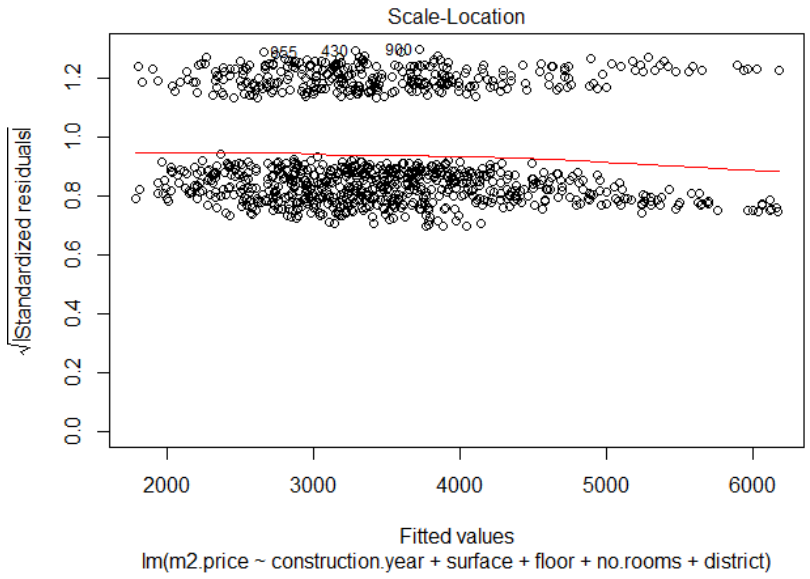
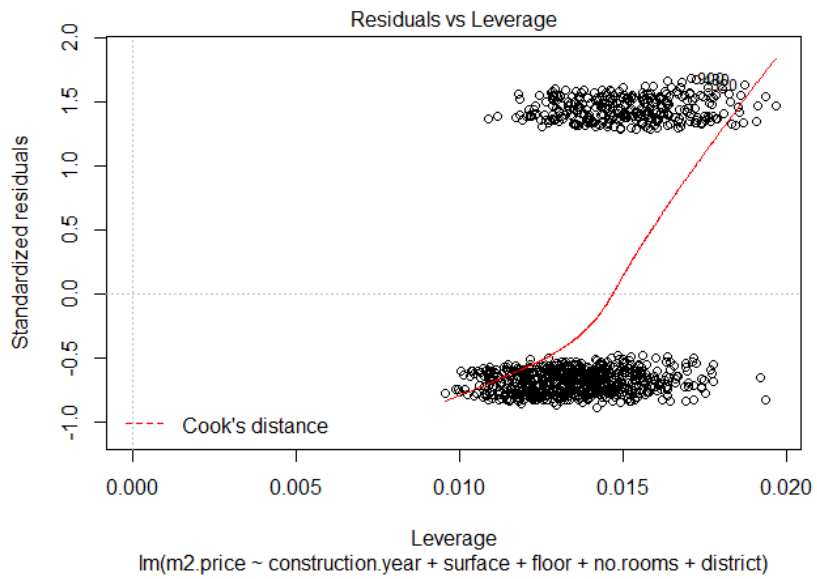
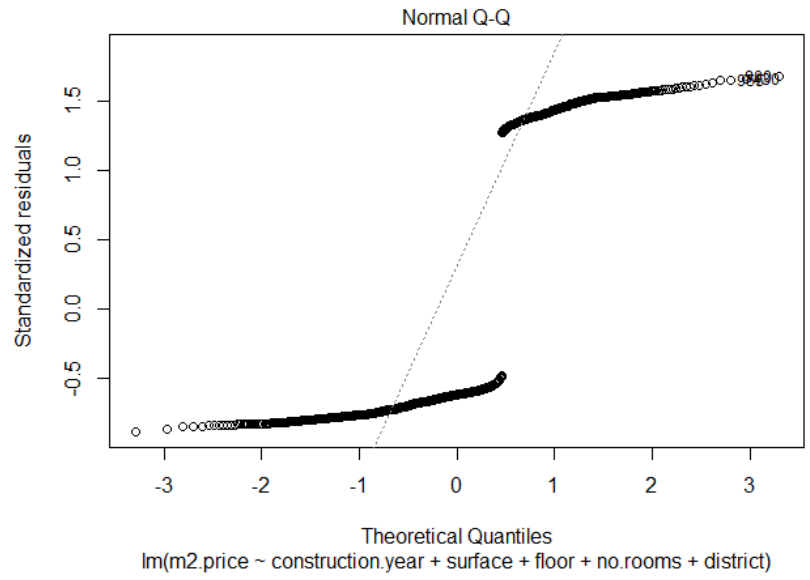
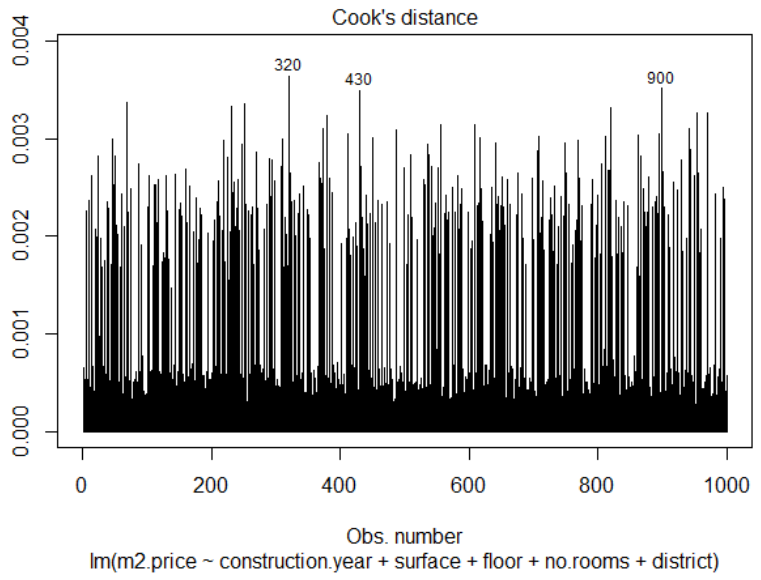
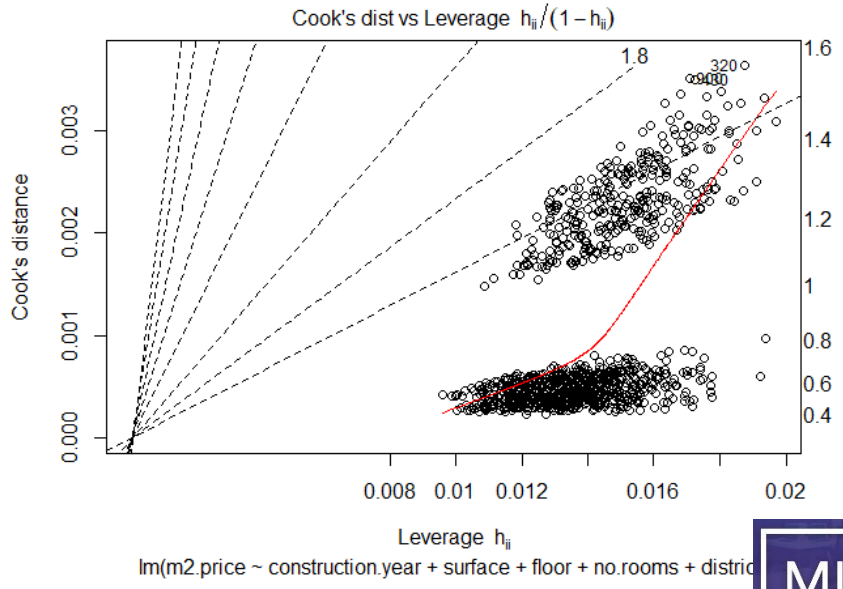
Motivation – linear models











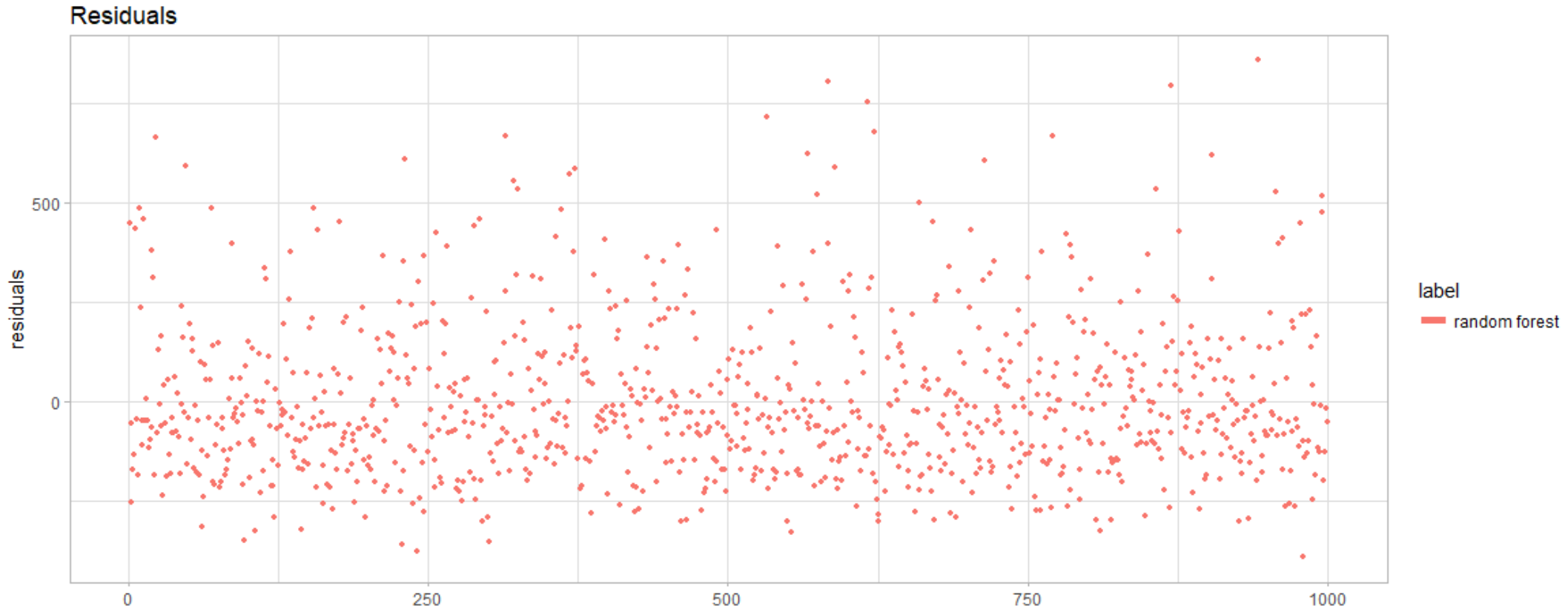
auditor

- Model-agnostic
- Model comparisons
- Consistency

```
model %>% audit() %>% plot(type = )
```

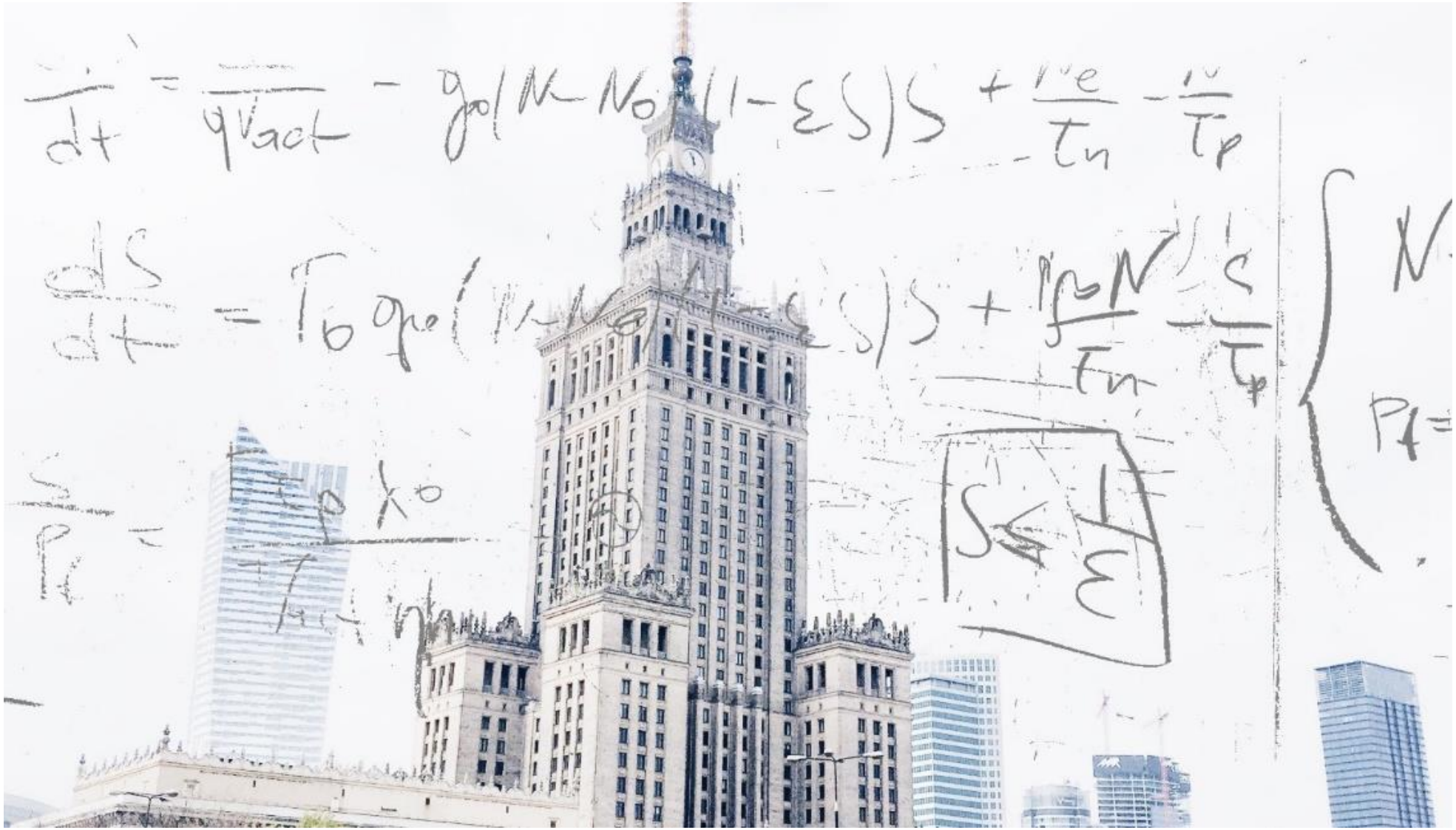
model %>% audit() %>% plot(type =)


```
library(auditor)

apartments_rf_model <- randomForest(m2.price ~ ., data = apartments)

au_rf <- audit(apartments_rf_model, data = apartmentsTets, y = apartmentsTest$m2.price)

plot(au_rf, type = "Residual")
```



Do we really need model audit?

A story about two models!



Do we really need model audit?

A story about two models!

m2.price	construction.year	surface	floor	no.rooms	district
5897	1953	25	3	1	Srodmiescie
1818	1992	143	9	5	Bielany
3643	1937	56	1	2	Praga
3517	1995	93	7	3	Ochota
3013	1992	144	6	5	Mokotow

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3013	1992	144	6	5	Mokotow

```
apartments_lm_model <- lm(m2.price ~ construction.year + surface + floor +
                          no.rooms + district, data = apartments)


apartments_rf_model <- randomForest(m2.price ~ construction.year + surface + floor +
                        no.rooms + district, data = apartments)
```

Accuracy is not enough!

Root Mean Square error

```
predicted_mi2_lm <- predict(apartments_lm_model, apartmentsTest)
sqrt(mean((predicted_mi2_lm - apartmentsTest$m2.price)^2))
```

```
[1] 283.0865
```

```
predicted_mi2_rf <- predict(apartments_rf_model, apartmentsTest)
sqrt(mean((predicted_mi2_rf - apartmentsTest$m2.price)^2))
```

```
[1] 283.1138
```

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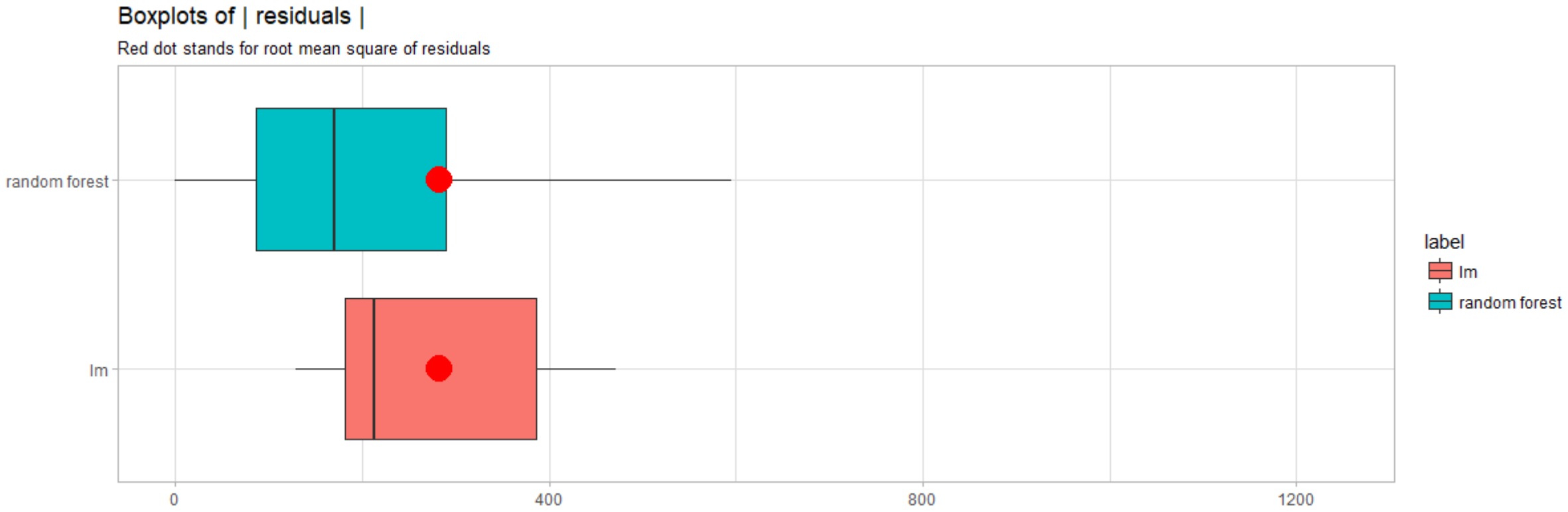
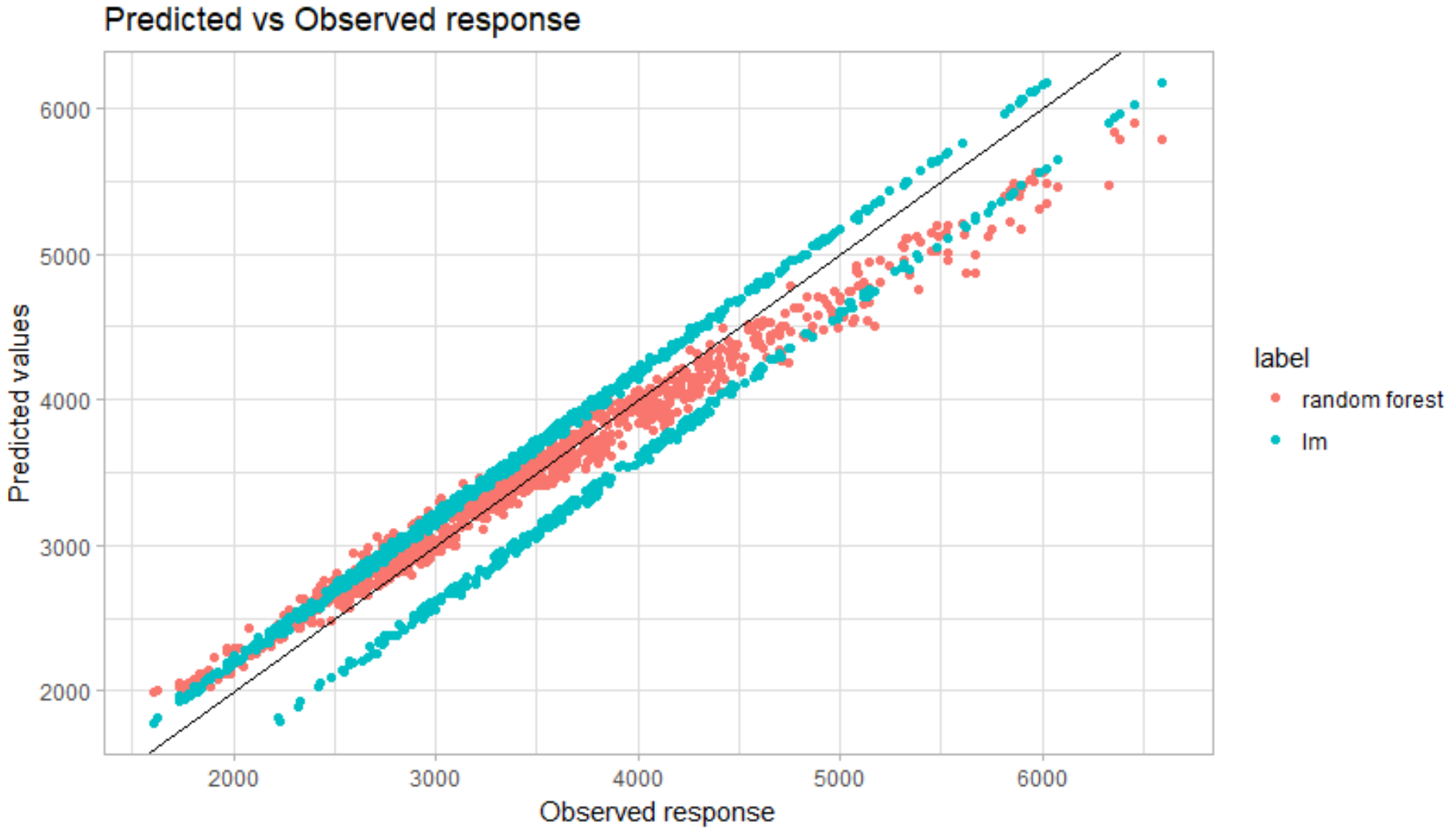
Model Performance

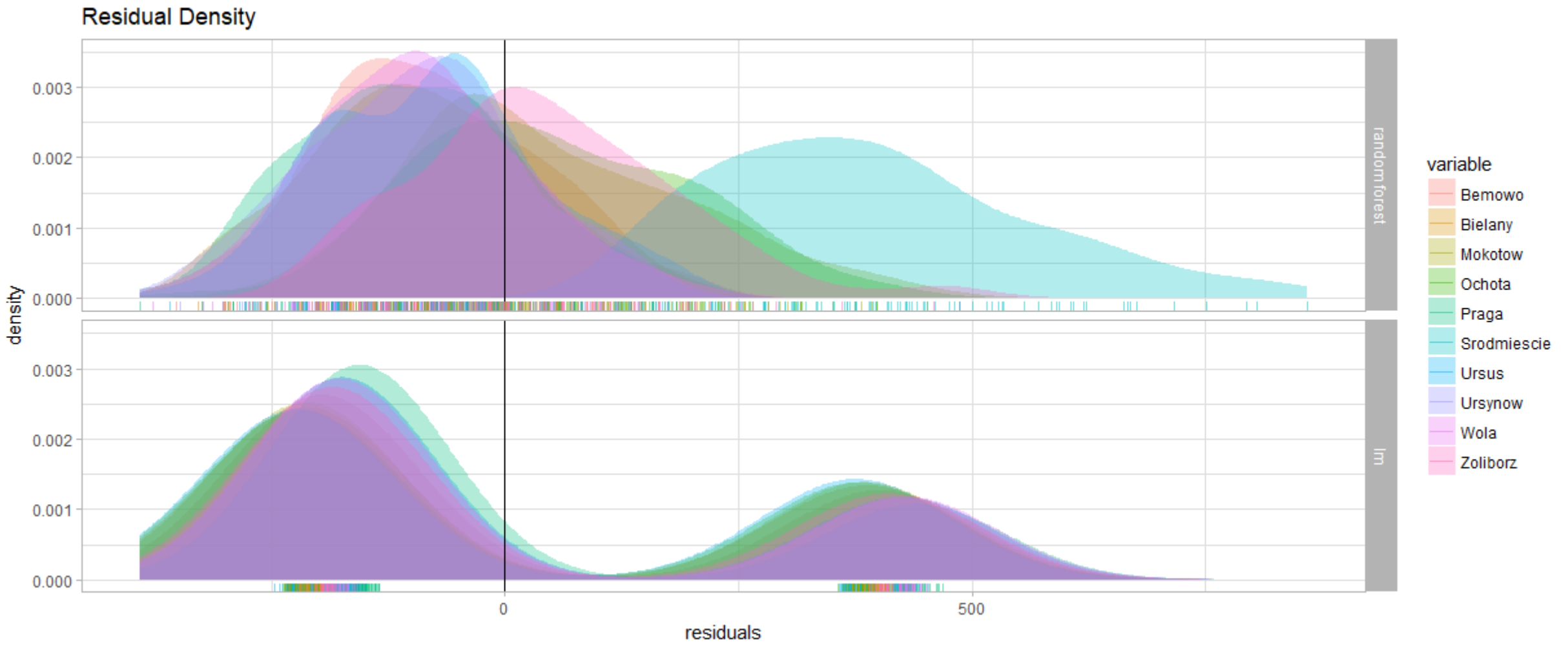

```
au_rf <- audit(apartments_rf_model, data = apartments, y = apartments$m2.price)
au_lm <- audit(apartments_lm_model, data = apartments, y = apartments$m2.price)

plot(au_rf, au_lm, type = "ResidualBoxplot")
```



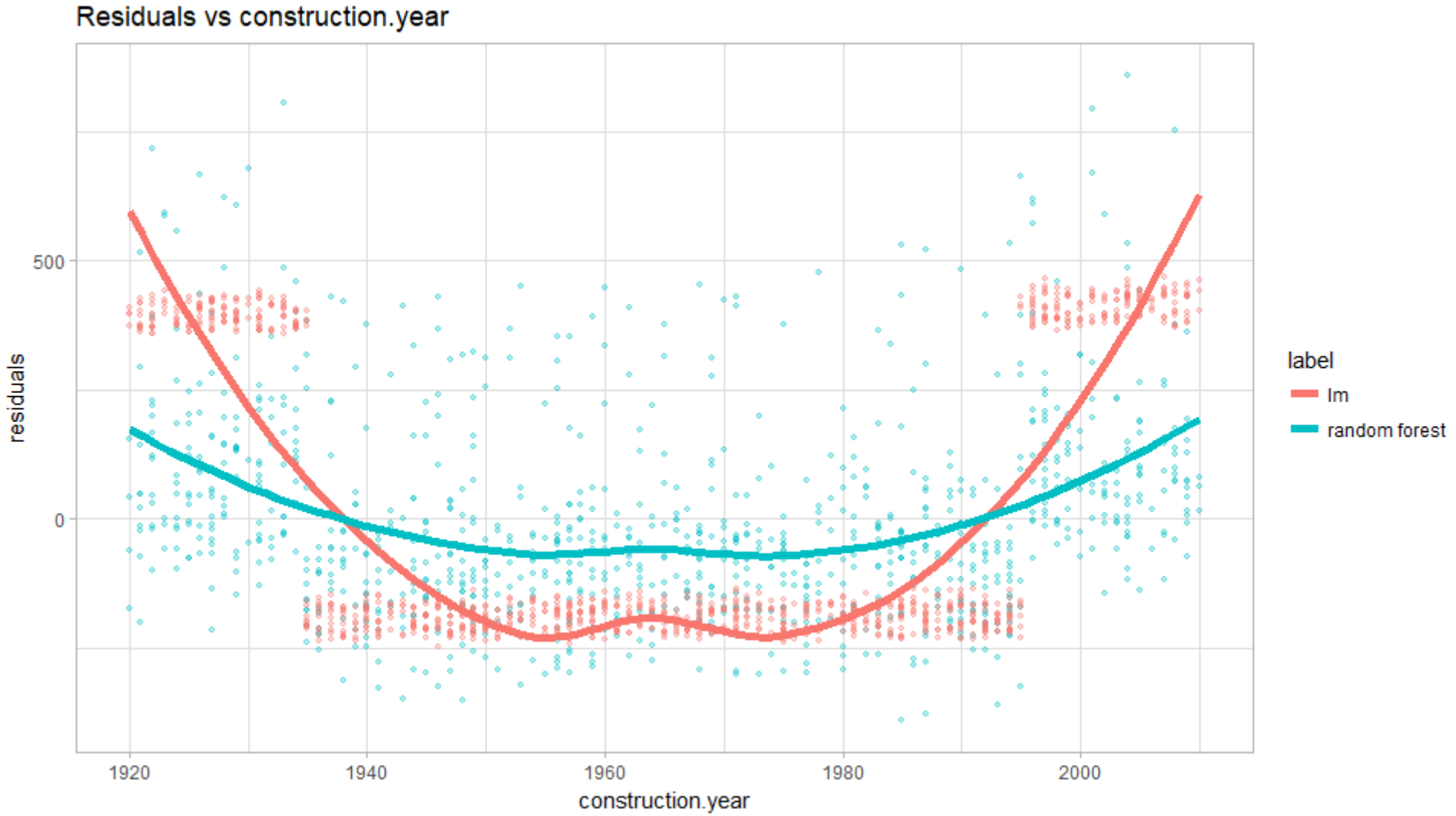
```
plot(au_rf, au_lm, type = "Performance")
```



```
plot(au_rf, au_lm, type = "ResidualDensity", variable = "district")
```

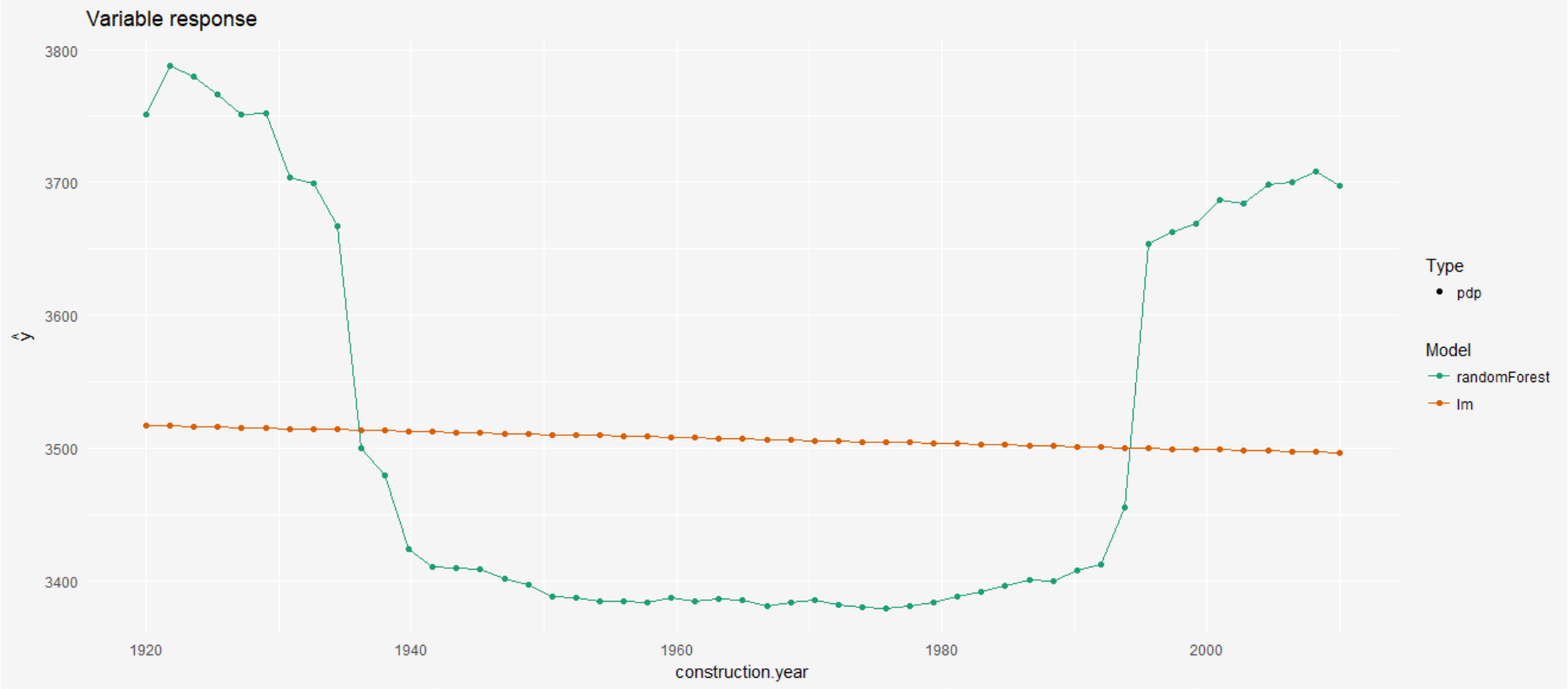


```
plot(au_rf, au_lm, type = "Residual", variable = "construction.year")
```



Partial Dependence Plot

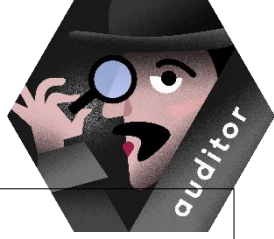
```
library(DALEX)

exp_rf <- explain(audit(apartments_rf_model, data = apartments, y = apartments$m2.price)
exp_lm <- explain(audit(apartments_lm_model, data = apartments, y = apartments$m2.price)


plot_model_performance(exp_rf, exp_lm, type = "pdp", variable = "construction.year")
```



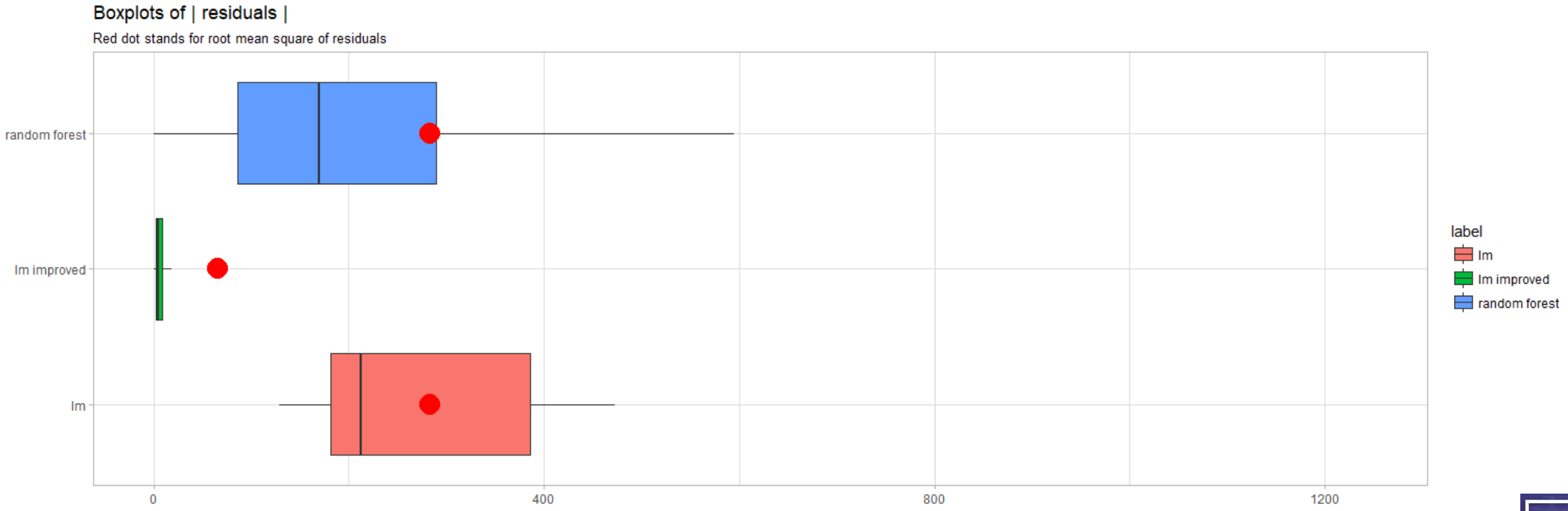
Let's sum up!

- Both models have similiar performance.
- Random forest model has smaller residuals than the linear model but there is a small fraction of very large residuals.
- Random forest model under-predicts expensive apartments. It is not a model that we would like to employ.
- The relation between construction year and the price of square meter is non linear.

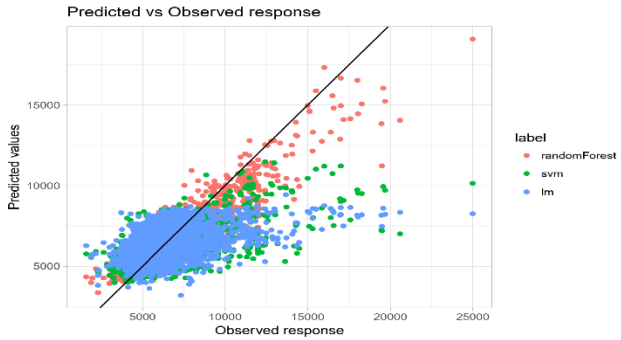
Let's improve our model!

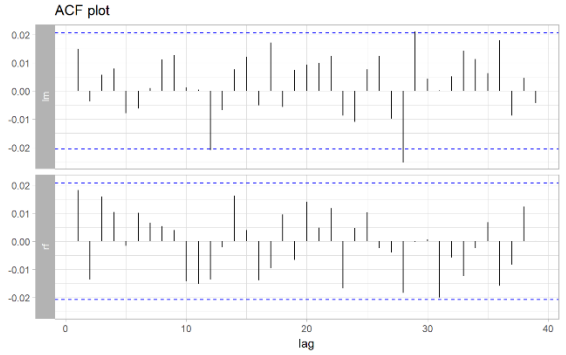


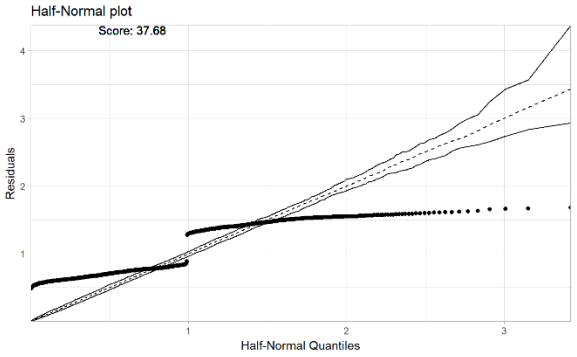

```
apartments_imp_model <- lm(m2.price ~ I(construction.year < 1935 | construction.year > 1995) +
                                      surface + floor + no.rooms + district, data = apartments)

au_imp <- audit(apartments_imp_model, label = "lm improved", data = apartments, y = apartments$m2.price)

plot(au_lm, au_rf, au_imp, type = "ResidualBoxplot")
```

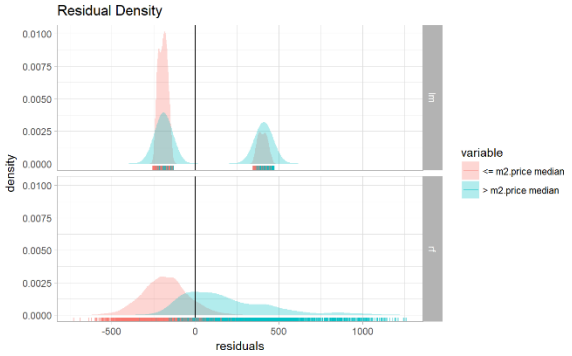


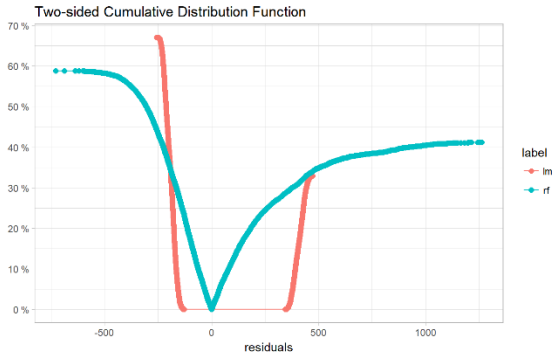
What's more?

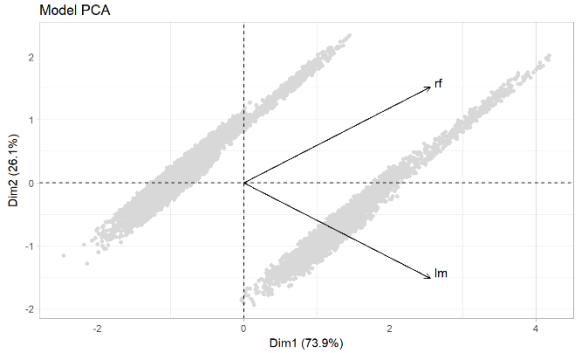


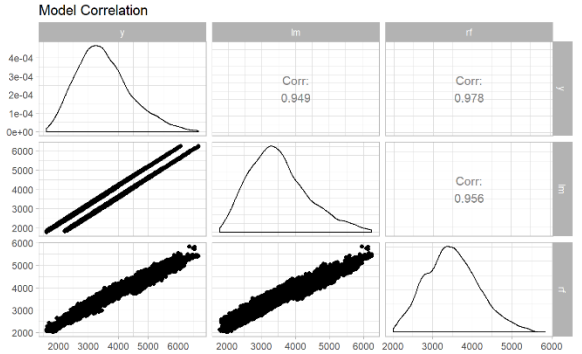


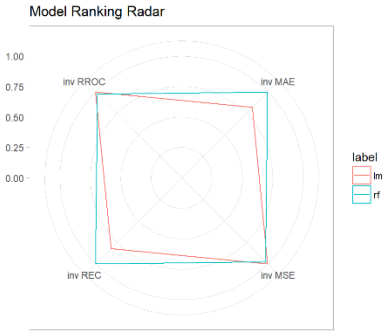












GitHub https://github.com/mi2-warsaw/auditor

Thank you!

auditor

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