Homework 0

My Name

1 Model Building

1.1 Data Preprocessing

Multicollinearity Analysis: Generate a correlation diagram of the covariates to investigate the relationship between variables. As shown in Figure 1a and Table 1, ...
Transformation and Residual Analysis: The next step is to check model assumptions and transformation.

1.2 Model Summary

The estimated model is shown as below. The residual standard error is 0.3 and the AIC value is -67. The detail of the summary is shown in Output 1.

$$\begin{aligned} \tilde{y} &= 12 + 0.2 * V5 \\ &\quad - 0.01 * V15 : V12 \\ y &= (75\tilde{y} + 1)^{2/3} - 20 \end{aligned}$$

2 Important Variables and Reliability Assessment

Combing the result of model comparison, the final model ...

3 Model Comparison

Compare the proposed model **m1** with candidate models: regression tree, random forest, bagging [Faraway(2016)] , ... The optimal lo and gam model are as follows:

```
> mod.lo$call
loess(formula = y ~ V11 + V12 , data = dat2, subset = ss,
    span = 0.5, degree = 2)

> mod.gam$call
gam(formula = y ~ s(V5) + s(V12) + s(V17), data = dat2,
    subset = ss)
```

You can also insert your code using the following code:

```
fib <- function(n) {
if (n < 2)
n
else
fib(n - 1) + fib(n - 2)
}
fib(10) # => 55
```

Problem 1

(a).

```
> # library(oehlert)
>   library(faraway)
>   library(MASS)
> # m<-lm(durability ~ brand, data = ex11.3)
> # boxcox(m)
> # anova(m)
> n<-6;g<-5
> l<-(80.45*qf(0.005,25,4)-1)/n;u<-(80.45*qf(0.995,25,4)-1)/n
> l;u
```

```
[1] 2.606462
```

```
[1] 268.0322
```

I don't believe this interval has 99% coverage because the assumption may not satisfied. Brand 1 is very different form other brands, which means α_1 may not follow a normal distriution.

(b).

```
[1] 0.7930562
```

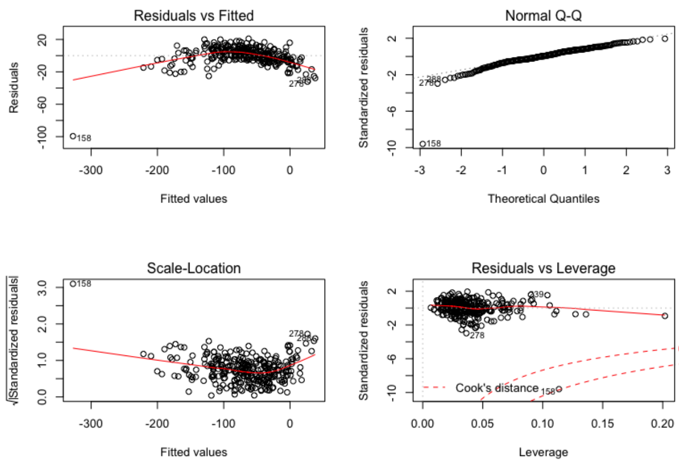
```
[1] 0.9912905
```

References

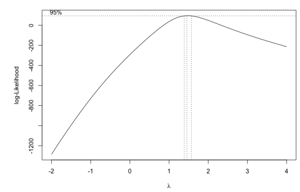
[Faraway(2016)] J. J. Faraway, *Extending the linear model with R: generalized linear, mixed effects and nonparametric regression models.* Chapman and Hall/CRC, 2016.

Appendices

Appendix A: Figures



(a) Residual Plots of lm(y ∼ .)



(b) BoxCox Plot of lm(y ∼ .)

Figure 1: Diagnostics Plots of lm(y ∼ .)

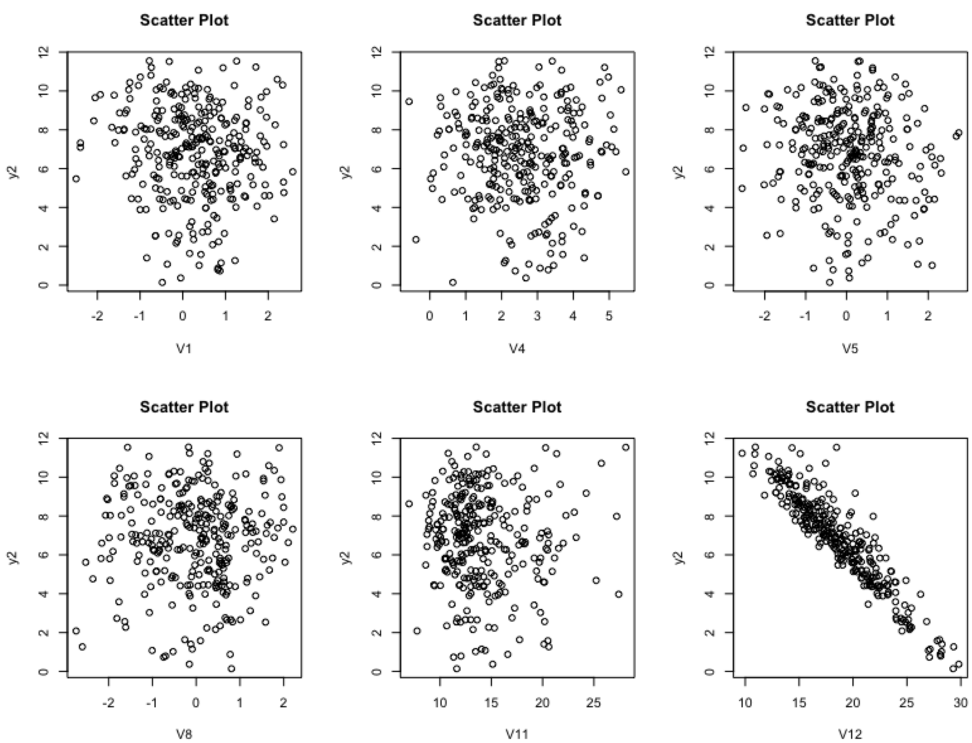


Figure 2: Scatter plot between response and variables

Appendix B: Tables

Table 1: Grouping of Variables

$G0$	1	2	3	4
$G1$	5	6	7	

Table 2: Variables selected and VSD values

method	*Variables*	*ARM*			*BIC*		
		VSD	*VSD_minus*	*VSD_plus*	*VSD*	*VSD_minus*	*VSD_plus*
LASSO	{1 2 3 4}	0	0	0	0	0	0
SCAD	{1 2 3}	0	0	0	0	0	0
MCP	{1 2}	0	0	0	0	0	0

Table 3: Variable Importance

Metric	Importance Order
IncMSE	1 2 3 4
IncNodePurity	1 2 3 4
SOIL	1 2 3 4
	(leftmost is the most important)

Table 4: Uncertainty Assessment

Method		S={1, 2, 3, 4}
Instability	Sequential	0
	Bootstrap	0
	Perturbation	0
ARM	*VSD*	0
	VSD_minus	0
	VSD_plus	0
	F-measure	0
	G-measure	0
BIC	*VSD*	0
	VSD_minus	0
	VSD_plus	0
	F-measure	0
	G-measure	0

Table 5: Model Comparison

Comparison	Winner	Winning Fraction of m1
m1 vs. Regression Tree	m1	1
m1 vs. random forest	m1	1
m1 vs. bagging	m1	1
m1 vs. loess	m1	1
m1 vs. gam	gam	0

Table 6: Cross Validation MSE and Absolute Error

Model	CV MSE	CV Mean Absolute Error
m1	0	0
Regression Tree	0	0
random forest	0	0
bagging	0	0
loess	0	0
gam	0	0

Appendix C: R output

Output 1

```
> summary(m3.1)

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 12.915676   0.502463  25.705  < 2e-16 ***
V5           0.287077   0.108717   2.641  0.00873 **
V8          -0.033139   0.020466  -1.619  0.10649
V11          0.402557   0.042078   9.567  < 2e-16 ***
---

Residual standard error: 0.3505 on 289 degrees of freedom

> extractAIC(m3.1)
[1]   10.0000 -617.0269
```