

# Project 1 Feb 21 Bzhang

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```
#install.packages("xlsx")
#install.packages("dplyr")
#install.packages("caret")
#install.packages("lattice")
# install.packages("caret")
library(caret)
```

```
## Loading required package: lattice
```

```
## Loading required package: ggplot2
```

```
library("lattice")
library("ggplot2")
library("tidyverse")
```

```
## -- Attaching packages -----
----- tidyverse 1.2.1 --
```

```
## v tibble  2.0.1      v purrr  0.3.0
## v tidyr   0.8.2      v dplyr  0.8.0.1
## v readr   1.3.1      v stringr 1.4.0
## v tibble  2.0.1      v forcats 0.4.0
```

```
## -- Conflicts -----
----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## x purrr::lift()   masks caret::lift()
```

```
require(DAAG)
```

```
## Loading required package: DAAG
```

```
data_zhang <- read.csv("file:///L:/Students/JMiao/Zhang/ZhangReport.csv")
dataz <- data_zhang
names(dataz)
```

```
## [1] "Gender" "Age"
## [3] "EDV_Score" "cadm_type_score"
## [5] "LOS_Score" "Charlson_Score"
## [7] "ALC_Score" "Elective_adm_Score"
## [9] "Urgent_adm_Score" "Teach_Score"
## [11] "Male_Score" "Admit_DT"
## [13] "Discharge_DT" "los_days"
## [15] "ADMIT_SOURCE" "dis_from_base_class"
## [17] "loc_name" "DISCH_DISPOSITION"
## [19] "marital_status" "PAT_HOMELESS_YN"
## [21] "zip" "CMS_Readmission_unplanned_flag"
## [23] "Clarity.LACE..Score"
```

```
str(dataz)
```

```
## 'data.frame':    77000 obs. of  23 variables:
## $ Gender          : Factor w/ 6 levels "", "Female", "Male", ...: 3 2 2
2 3 2 3 2 2 2 ...
## $ Age             : int   56 24 58 58 72 42 41 23 25 86 ...
## $ EDV_Score       : int    0 0 0 0 0 0 0 0 0 0 ...
## $ cadm_type_score  : int   15 15 0 0 15 15 15 15 15 15 ...
## $ LOS_Score       : Factor w/ 10 levels "", "0", "2", "3", ...: 2 2 2 2
2 2 2 2 2 3 ...
## $ Charlson_Score   : int    6 0 2 2 0 0 0 0 0 0 ...
## $ ALC_Score        : int    0 0 0 0 0 0 0 0 0 0 ...
## $ Elective_adm_Score : int    0 0 0 0 0 0 0 0 0 0 ...
## $ Urgent_adm_Score  : int   35 0 48 49 18 5 5 0 0 27 ...
## $ Teach_Score      : int    0 0 0 0 0 0 0 0 0 0 ...
## $ Male_Score       : int    3 0 0 0 3 0 3 0 0 0 ...
## $ Admit_DT         : Factor w/ 670 levels "", "1/1/2017", ...: 2 2 2 2
2 2 2 2 2 2 ...
## $ Discharge_DT     : Factor w/ 712 levels "", "01/01/2017", ...: 2 2 2
2 2 2 2 2 2 4 ...
## $ los_days         : Factor w/ 158 levels "", "0", "1", "10", ...: 2 2 2
2 2 2 2 2 2 3 ...
## $ ADMIT_SOURCE     : Factor w/ 23 levels "", "Clinic", "Home", ...: 3 3
3 3 18 13 13 13 13 3 ...
## $ dis_from_base_class : Factor w/ 4 levels "", "Inpatient", ...: 4 4 4 4 2
2 2 2 2 4 ...
## $ loc_name         : Factor w/ 3 levels "", "RONALD REAGAN UCLA MEDIC
AL CENTER", ...: 3 2 2 2 2 3 2 2 2 2 ...
## $ DISCH_DISPOSITION : Factor w/ 46 levels "", "Acute Care Hosp (not Ch
ildrens/Cancer/VA)", ...: 3 24 24 24 24 24 24 24 24 24 ...
## $ marital_status    : Factor w/ 14 levels "", "Dissolved RDP", ...: 12 1
2 12 12 8 12 7 12 3 14 ...
## $ PAT_HOMELESS_YN   : Factor w/ 3 levels "", "N", "Y": 2 2 2 2 2 2 2 2
2 2 ...
## $ zip              : Factor w/ 2740 levels "", "00000", "00725", ...: 13
44 1306 1573 1573 2727 1670 1805 594 2209 1306 ...
## $ CMS_Readmission_unplanned_flag: Factor w/ 3 levels "", "NO", "Y": 2 2 2 2 2 2 2 2
2 2 ...
## $ Clarity.LACE..Score : Factor w/ 92 levels "", "0", "10", "11", ...: 64 8 5
4 54 48 38 41 36 36 44 ...
```

```
dataz <- dataz %>% as.data.frame()
```

```
head(dataz, 8)
```

```
##   Gender Age EDV_Score cadm_type_score LOS_Score Charlson_Score ALC_Score
## 1   Male  56         0          15         0           6           0
## 2 Female  24         0          15         0           0           0
## 3 Female  58         0           0         0           2           0
## 4 Female  58         0           0         0           2           0
```

##	5	Male	72	0	15	0	0	0
##	6	Female	42	0	15	0	0	0
##	7	Male	41	0	15	0	0	0
##	8	Female	23	0	15	0	0	0
##	Elective_adm_Score			Urgent_adm_Score	Teach_Score	Male_Score	Admit_DT	
##	1			0	35	0	3	1/1/2017
##	2			0	0	0	0	1/1/2017
##	3			0	48	0	0	1/1/2017
##	4			0	49	0	0	1/1/2017
##	5			0	18	0	3	1/1/2017
##	6			0	5	0	0	1/1/2017
##	7			0	5	0	3	1/1/2017
##	8			0	0	0	0	1/1/2017
##	Discharge_DT			los_days	ADMIT_SOURCE			
##	1	01/01/2017		0	Home			
##	2	01/01/2017		0	Home			
##	3	01/01/2017		0	Home			
##	4	01/01/2017		0	Home			
##	5	01/01/2017		0	Transfer from Emergency Dept Non-UCLA Facility			
##	6	01/01/2017		0	Transfer from Acute Care Non-UCLA Facility			
##	7	01/01/2017		0	Transfer from Acute Care Non-UCLA Facility			
##	8	01/01/2017		0	Transfer from Acute Care Non-UCLA Facility			
##	dis_from_base_class			loc_name				
##	1	Observation		SANTA MONICA	UCLA MEDICAL CENTER			
##	2	Observation		RONALD REAGAN	UCLA MEDICAL CENTER			
##	3	Observation		RONALD REAGAN	UCLA MEDICAL CENTER			
##	4	Observation		RONALD REAGAN	UCLA MEDICAL CENTER			
##	5	Inpatient		RONALD REAGAN	UCLA MEDICAL CENTER			
##	6	Inpatient		SANTA MONICA	UCLA MEDICAL CENTER			
##	7	Inpatient		RONALD REAGAN	UCLA MEDICAL CENTER			
##	8	Inpatient		RONALD REAGAN	UCLA MEDICAL CENTER			
##						DISCH_DISPOSITION		
##	1	Acute Care Hosp (not Childrens/Cancer/VA) w/ planned					Acute IP readmission	
##	2						Home or Self Care	
##	3						Home or Self Care	
##	4						Home or Self Care	
##	5						Home or Self Care	
##	6						Home or Self Care	
##	7						Home or Self Care	
##	8						Home or Self Care	
##	marital_status		PAT_HOMELESS_YN	zip	CMS_Readmission_unplanned_flag			
##	1	Single	N	90064	NO			
##	2	Single	N	90024	NO			
##	3	Single	N	91344	NO			
##	4	Single	N	91344	NO			
##	5	NULL	N	NULL	NO			
##	6	Single	N	91767	NO			
##	7	Married	N	92260	NO			
##	8	Single	N	50313	NO			
##	Clarity.LACE..Score							

```
## 1          66
## 2          15
## 3          57
## 4          57
## 5          51
## 6          42
## 7          45
## 8          40
```

```
dataz_sample <- dataz[1:4000,] %>% as.data.frame()
colSums(is.na(dataz_sample))
```

```
##          Gender          Age
##          0          0
##      EDV_Score      cadm_type_score
##          0          0
##      LOS_Score      Charlson_Score
##          0          0
##      ALC_Score      Elective_adm_Score
##          0          0
##      Urgent_adm_Score      Teach_Score
##          0          0
##      Male_Score      Admit_DT
##          0          0
##      Discharge_DT      los_days
##          0          0
##      ADMIT_SOURCE      dis_from_base_class
##          0          0
##      loc_name      DISCH_DISPOSITION
##          0          0
##      marital_status      PAT_HOMELESS_YN
##          0          0
##          zip CMS_Readmission_unplanned_flag
##          0          0
##      Clarity.LACE..Score
##          0
```

```
is.null(dataz_sample)
```

```
## [1] FALSE
```

```
dim(dataz_sample)
```

```
## [1] 4000  23
```

```
write.csv(dataz_sample,file = "BZhang_sample.csv", row.names = FALSE)
```

```
dataz <- read.csv("Bzhang_sample.csv", header = T)
dataz$los_days <- as.integer(as.character(dataz$los_days))
```

```
## Warning: NAs introduced by coercion
```

```
dataz$LOS_Score <- dataz$LOS_Score %>% as.character() %>% as.integer()
```

```
## Warning in function_list[[k]](value): NAs introduced by coercion
```

```
which(is.na(dataz$LOS_Score))
```

```
## [1] 34 3620
```

```
dataz <- dataz[-which(is.na(dataz$LOS_Score)),]
colSums(is.na(dataz))
```

```
##           Gender           Age
##           0           0
##      EDV_Score      cadm_type_score
##           0           0
##      LOS_Score      Charlson_Score
##           0           0
##      ALC_Score      Elective_adm_Score
##           0           0
##      Urgent_adm_Score      Teach_Score
##           0           0
##      Male_Score      Admit_DT
##           0           0
##      Discharge_DT      los_days
##           0           0
##      ADMIT_SOURCE      dis_from_base_class
##           0           0
##      loc_name      DISCH_DISPOSITION
##           0           0
##      marital_status      PAT_HOMELESS_YN
##           0           0
##      zip      CMS_Readmission_unplanned_flag
##           0           0
##      Clarity.LACE..Score
##           0
```

```
dim(dataz)
```

```
## [1] 3998 23
```

```
glimpse(dataz)
```

```
## Observations: 3,998
## Variables: 23
## $ Gender          <fct> Male, Female, Female, Female, M...
## $ Age             <int> 56, 24, 58, 58, 72, 42, 41, 23,...
## $ EDV_Score       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ cadm_type_score <int> 15, 15, 0, 0, 15, 15, 15, 15, 1...
## $ LOS_Score       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2...
## $ Charlson_Score  <int> 6, 0, 2, 2, 0, 0, 0, 0, 0, 0, 4...
## $ ALC_Score       <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ Elective_adm_Score <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ Urgent_adm_Score <int> 35, 0, 48, 49, 18, 5, 5, 0, 0, ...
## $ Teach_Score     <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0...
## $ Male_Score      <int> 3, 0, 0, 0, 3, 0, 3, 0, 0, 0, 0...
## $ Admit_DT        <fct> 1/1/2017, 1/1/2017, 1/1/2017, 1...
## $ Discharge_DT    <fct> 01/01/2017, 01/01/2017, 01/01/2...
## $ los_days        <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1...
## $ ADMIT_SOURCE    <fct> "Home", "Home", "Home", "Home",...
## $ dis_from_base_class <fct> Observation, Observation, Obser...
## $ loc_name        <fct> SANTA MONICA UCLA MEDICAL CENTE...
## $ DISCH_DISPOSITION <fct> Acute Care Hosp (not Childrens/...
## $ marital_status  <fct> Single, Single, Single, Single,...
## $ PAT_HOMELESS_YN <fct> N, N, N, N, N, N, N, N, N, N, N...
## $ zip             <fct> 90064, 90024, 91344, 91344, NUL...
## $ CMS_Readmission_unplanned_flag <fct> NO, NO, NO, NO, NO, NO, NO, NO,...
## $ Clarity.LACE..Score <int> 66, 15, 57, 57, 51, 42, 45, 40,...
```

```
set.seed(123)
sample <- sample(c(TRUE,FALSE),nrow(dataz),replace = T, prob = c(0.7,0.3))
training <- dataz[sample,]
testing <- dataz[!sample,]

# rm(training)
```

```
#age lace.score model1
```

```
model1 <- lm(Clarity.LACE..Score ~ Age , data = training)
summary(model1)
```

```
##
## Call:
## lm(formula = Clarity.LACE..Score ~ Age, data = training)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -40.382 -15.776   2.189  13.648  50.860
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  13.91323    1.08209   12.86  <2e-16 ***
## Age          0.60100    0.01768   34.00  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 18.75 on 2791 degrees of freedom
## Multiple R-squared:  0.2929, Adjusted R-squared:  0.2926
## F-statistic: 1156 on 1 and 2791 DF, p-value: < 2.2e-16
```

```
# while we add more on the model
training$LOS_Score <- as.character(training$LOS_Score) %>% as.integer()
model2 <- lm(Clarity.LACE..Score ~ Age+ cadm_type_score +LOS_Score+Charlson_Score, da
ta = training)
summary(model2)
```

```
##
## Call:
## lm(formula = Clarity.LACE..Score ~ Age + cadm_type_score + LOS_Score +
##      Charlson_Score, data = training)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -43.107  -6.012  -0.386   5.566  48.190
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.83414    0.70445   1.184   0.236
## Age            0.29271    0.01079  27.119  <2e-16 ***
## cadm_type_score 1.78934    0.02975  60.148  <2e-16 ***
## LOS_Score      1.78613    0.08614  20.735  <2e-16 ***
## Charlson_Score  2.78112    0.08224  33.819  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 10.5 on 2788 degrees of freedom
## Multiple R-squared:  0.7784, Adjusted R-squared:  0.7781
## F-statistic: 2449 on 4 and 2788 DF, p-value: < 2.2e-16
```



```
model3 <- lm(data = training, formula = dataz$Clarity.LACE..Score ~ dataz$Age + dataz$EDV_Score + dataz$cadm_type_score + (dataz$LOS_Score) + dataz$Charlson_Score + dataz$ALC_Score + dataz$Elective_adm_Score + dataz$Urgent_adm_Score + dataz$Teach_Score + dataz$Male_Score + dataz$los_days )
```

```
summary(model3)
```

```
##
## Call:
## lm(formula = dataz$Clarity.LACE..Score ~ dataz$Age + dataz$EDV_Score +
##     dataz$cadm_type_score + (dataz$LOS_Score) + dataz$Charlson_Score +
##     dataz$ALC_Score + dataz$Elective_adm_Score + dataz$Urgent_adm_Score +
##     dataz$Teach_Score + dataz$Male_Score + dataz$los_days, data = training)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -49.595  -5.535   1.087   5.262  38.891
##
## Coefficients: (2 not defined because of singularities)
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      5.35741    0.54363   9.855 < 2e-16 ***
## dataz$Age         0.05388    0.00992   5.432 5.91e-08 ***
## dataz$EDV_Score  -1.46405    0.13103 -11.174 < 2e-16 ***
## dataz$cadm_type_score  1.64210    0.02135  76.911 < 2e-16 ***
## dataz$LOS_Score   1.10166    0.11572   9.520 < 2e-16 ***
## dataz$Charlson_Score  0.87670    0.07601  11.534 < 2e-16 ***
## dataz$ALC_Score           NA         NA      NA      NA
## dataz$Elective_adm_Score -0.22245    0.14461  -1.538 0.124072
## dataz$Urgent_adm_Score  0.57369    0.01546  37.103 < 2e-16 ***
## dataz$Teach_Score           NA         NA      NA      NA
## dataz$Male_Score     1.71178    0.09402  18.206 < 2e-16 ***
## dataz$los_days       0.23039    0.06393   3.604 0.000317 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.757 on 3988 degrees of freedom
## Multiple R-squared:  0.846, Adjusted R-squared:  0.8457
## F-statistic: 2434 on 9 and 3988 DF, p-value: < 2.2e-16
```

```
range(dataz$ALC_Score)
```

```
## [1] 0 0
```

```
range(dataz$Teach_Score)
```

```
## [1] 0 0
```

```
mean(data_zhang$ALC_Score, na.rm = T)
```

```
## [1] 0
```

```
range(data_zhang$ALC_Score, na.rm = T)
```

```
## [1] 0 0
```

```
mean(data_zhang$Teach_Score, na.rm = T)
```

```
## [1] 0
```

```
range(data_zhang$Teach_Score, na.rm = T)
```

```
## [1] 0 0
```

```
attach(training)
```

```
model4 <- lm(data = training, formula = Clarity.LACE..Score ~ Age + EDV_Score + cadm  
_type_score + LOS_Score + Charlson_Score + Elective_adm_Score + Urgent_adm_Score + Ma  
le_Score + los_days )
```

```
summary(model4)
```

```
##
## Call:
## lm(formula = Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score +
##     LOS_Score + Charlson_Score + Elective_adm_Score + Urgent_adm_Score +
##     Male_Score + los_days, data = training)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -49.837  -5.441   1.021   5.112  38.648
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.70453    0.64915   8.788 < 2e-16 ***
## Age            0.05087    0.01186   4.289 1.86e-05 ***
## EDV_Score     -1.62711    0.15832 -10.277 < 2e-16 ***
## cadm_type_score  1.64720    0.02514  65.528 < 2e-16 ***
## LOS_Score      1.06160    0.13908   7.633 3.13e-14 ***
## Charlson_Score  0.92700    0.09126  10.158 < 2e-16 ***
## Elective_adm_Score -0.18972    0.17751  -1.069 0.28528
## Urgent_adm_Score  0.56625    0.01856  30.509 < 2e-16 ***
## Male_Score      1.76429    0.11228  15.713 < 2e-16 ***
## los_days        0.26597    0.07772   3.422 0.00063 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.7 on 2783 degrees of freedom
## Multiple R-squared:  0.8483, Adjusted R-squared:  0.8478
## F-statistic: 1728 on 9 and 2783 DF, p-value: < 2.2e-16
```

```
detach(training)
```

```
attach(training, warn.conflicts = F)
step(model4, Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score + Cha
rlson_Score + Elective_adm_Score + Urgent_adm_Score + Male_Score + los_days)
```

```
## Start:  AIC=12094.2
## Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score +
##      Charlson_Score + Elective_adm_Score + Urgent_adm_Score +
##      Male_Score + los_days
##
##              Df Sum of Sq    RSS    AIC
## - Elective_adm_Score  1         86 210724 12093
## <none>                                210637 12094
## - los_days            1        886 211524 12104
## - Age                 1        1392 212029 12111
## - LOS_Score           1        4410 215047 12150
## - Charlson_Score      1        7810 218448 12194
## - EDV_Score           1        7994 218632 12196
## - Male_Score          1       18687 229325 12330
## - Urgent_adm_Score    1       70448 281085 12898
## - cadm_type_score     1      324991 535628 14699
##
## Step:  AIC=12093.35
## Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score +
##      Charlson_Score + Urgent_adm_Score + Male_Score + los_days
##
##              Df Sum of Sq    RSS    AIC
## <none>                                210724 12093
## + Elective_adm_Score  1         86 210637 12094
## - los_days            1        889 211613 12103
## - Age                 1        1492 212215 12111
## - LOS_Score           1        4398 215122 12149
## - Charlson_Score      1        7930 218654 12194
## - EDV_Score           1        8041 218765 12196
## - Male_Score          1       18697 229421 12329
## - Urgent_adm_Score    1       70820 281544 12901
## - cadm_type_score     1      325038 535762 14698
```

```
##
## Call:
## lm(formula = Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score +
##      LOS_Score + Charlson_Score + Urgent_adm_Score + Male_Score +
##      los_days, data = training)
##
## Coefficients:
##      (Intercept)              Age          EDV_Score  cadm_type_score
##           5.64298           0.05232          -1.63135           1.64731
##      LOS_Score  Charlson_Score  Urgent_adm_Score          Male_Score
##           1.06017           0.93257           0.56397           1.76472
##      los_days
##           0.26634
```

```
# step(model4, direction = "backward")
# AIC(model4)
```

```
step(model4, Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score + Charlson_Score + Elective_adm_Score + Urgent_adm_Score + Male_Score + los_days, direction = "backward")
```

```
## Start: AIC=12094.2
## Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score +
## Charlson_Score + Elective_adm_Score + Urgent_adm_Score +
## Male_Score + los_days
##
```

	Df	Sum of Sq	RSS	AIC
## - Elective_adm_Score	1	86	210724	12093
## <none>			210637	12094
## - los_days	1	886	211524	12104
## - Age	1	1392	212029	12111
## - LOS_Score	1	4410	215047	12150
## - Charlson_Score	1	7810	218448	12194
## - EDV_Score	1	7994	218632	12196
## - Male_Score	1	18687	229325	12330
## - Urgent_adm_Score	1	70448	281085	12898
## - cadm_type_score	1	324991	535628	14699

```
## Step: AIC=12093.35
## Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score +
## Charlson_Score + Urgent_adm_Score + Male_Score + los_days
##
```

	Df	Sum of Sq	RSS	AIC
## <none>			210724	12093
## - los_days	1	889	211613	12103
## - Age	1	1492	212215	12111
## - LOS_Score	1	4398	215122	12149
## - Charlson_Score	1	7930	218654	12194
## - EDV_Score	1	8041	218765	12196
## - Male_Score	1	18697	229421	12329
## - Urgent_adm_Score	1	70820	281544	12901
## - cadm_type_score	1	325038	535762	14698

```
##
## Call:
## lm(formula = Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score +
##     LOS_Score + Charlson_Score + Urgent_adm_Score + Male_Score +
##     los_days, data = training)
##
## Coefficients:
##           (Intercept)              Age          EDV_Score  cadm_type_score
##           5.64298         0.05232         -1.63135           1.64731
##           LOS_Score    Charlson_Score  Urgent_adm_Score           Male_Score
##           1.06017           0.93257           0.56397           1.76472
##           los_days
##           0.26634
```

```
detach(training)
```

```
attach(training, warn.conflicts = FALSE)
model5 <- lm(data= training, Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score
+ LOS_Score + Charlson_Score + Urgent_adm_Score + Male_Score + los_days)
model5 %>% summary()
```

```
##
## Call:
## lm(formula = Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score +
##     LOS_Score + Charlson_Score + Urgent_adm_Score + Male_Score +
##     los_days, data = training)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -50.916  -5.476   1.027   5.100  38.665
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    5.64298    0.64661   8.727 < 2e-16 ***
## Age            0.05232    0.01179   4.439 9.38e-06 ***
## EDV_Score     -1.63135    0.15827 -10.307 < 2e-16 ***
## cadm_type_score  1.64731    0.02514  65.531 < 2e-16 ***
## LOS_Score      1.06017    0.13908   7.623 3.38e-14 ***
## Charlson_Score  0.93257    0.09111  10.236 < 2e-16 ***
## Urgent_adm_Score 0.56397    0.01844  30.588 < 2e-16 ***
## Male_Score     1.76472    0.11228  15.717 < 2e-16 ***
## los_days       0.26634    0.07772   3.427 0.000619 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 8.7 on 2784 degrees of freedom
## Multiple R-squared:  0.8482, Adjusted R-squared:  0.8478
## F-statistic: 1944 on 8 and 2784 DF, p-value: < 2.2e-16
```

```
step(model5, Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score + Ch
arlson_Score + Urgent_adm_Score + Male_Score + los_days)
```

```
## Start:  AIC=12093.35
## Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score +
##     Charlson_Score + Urgent_adm_Score + Male_Score + los_days
##
##              Df Sum of Sq    RSS    AIC
## <none>                210724 12093
## - los_days           1      889 211613 12103
## - Age                1     1492 212215 12111
## - LOS_Score          1     4398 215122 12149
## - Charlson_Score     1     7930 218654 12194
## - EDV_Score          1     8041 218765 12196
## - Male_Score         1    18697 229421 12329
## - Urgent_adm_Score   1     70820 281544 12901
## - cadm_type_score    1    325038 535762 14698
```

```
##
## Call:
## lm(formula = Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score +
##     LOS_Score + Charlson_Score + Urgent_adm_Score + Male_Score +
##     los_days, data = training)
##
## Coefficients:
##      (Intercept)           Age      EDV_Score  cadm_type_score
##      5.64298      0.05232      -1.63135      1.64731
##      LOS_Score   Charlson_Score  Urgent_adm_Score      Male_Score
##      1.06017      0.93257      0.56397      1.76472
##      los_days
##      0.26634
```

```
anova(model5,model4)
```

```
## Analysis of Variance Table
##
## Model 1: Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score +
##     Charlson_Score + Urgent_adm_Score + Male_Score + los_days
## Model 2: Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score +
##     Charlson_Score + Elective_adm_Score + Urgent_adm_Score +
##     Male_Score + los_days
##   Res.Df    RSS Df Sum of Sq    F Pr(>F)
## 1     2784 210724
## 2     2783 210637   1    86.451 1.1422 0.2853
```

```
AIC(model4)
```

```
## [1] 20022.39
```

```
AIC(model5)
```

```
## [1] 20021.54
```

```
BIC(model4)
```

```
## [1] 20087.67
```

```
BIC(model5)
```

```
## [1] 20080.89
```



```
predicmodel5 <- predict(model5,testing)
```

```
predicmodel5_2 <- data.frame(cbind(actuals= testing$Clarity.LACE..Score, predicted = predicmodel5))
```

```
correlation_accuracy_model5 <- cor(predicmodel5_2) %>% print()
```

```
##           actuals predicteds
## actuals      1.0000000  0.9167119
## predicted 0.9167119  1.0000000
```

```
mim_max_accuracy <- mean(apply(predicmodel5_2,MARGIN = 1,min)/apply(predicmodel5_2,MARGIN = 1,max)) %>% print()
```

```
## [1] 0.8283324
```

```
mape <- abs(predicmodel5_2$predicted-predicmodel5_2$actuals)/predicmodel5_2$actuals

mape <- mape[!is.infinite(length(mape))]
mape <- mape[-162]
sum(is.infinite(mape))
```

```
## [1] 0
```

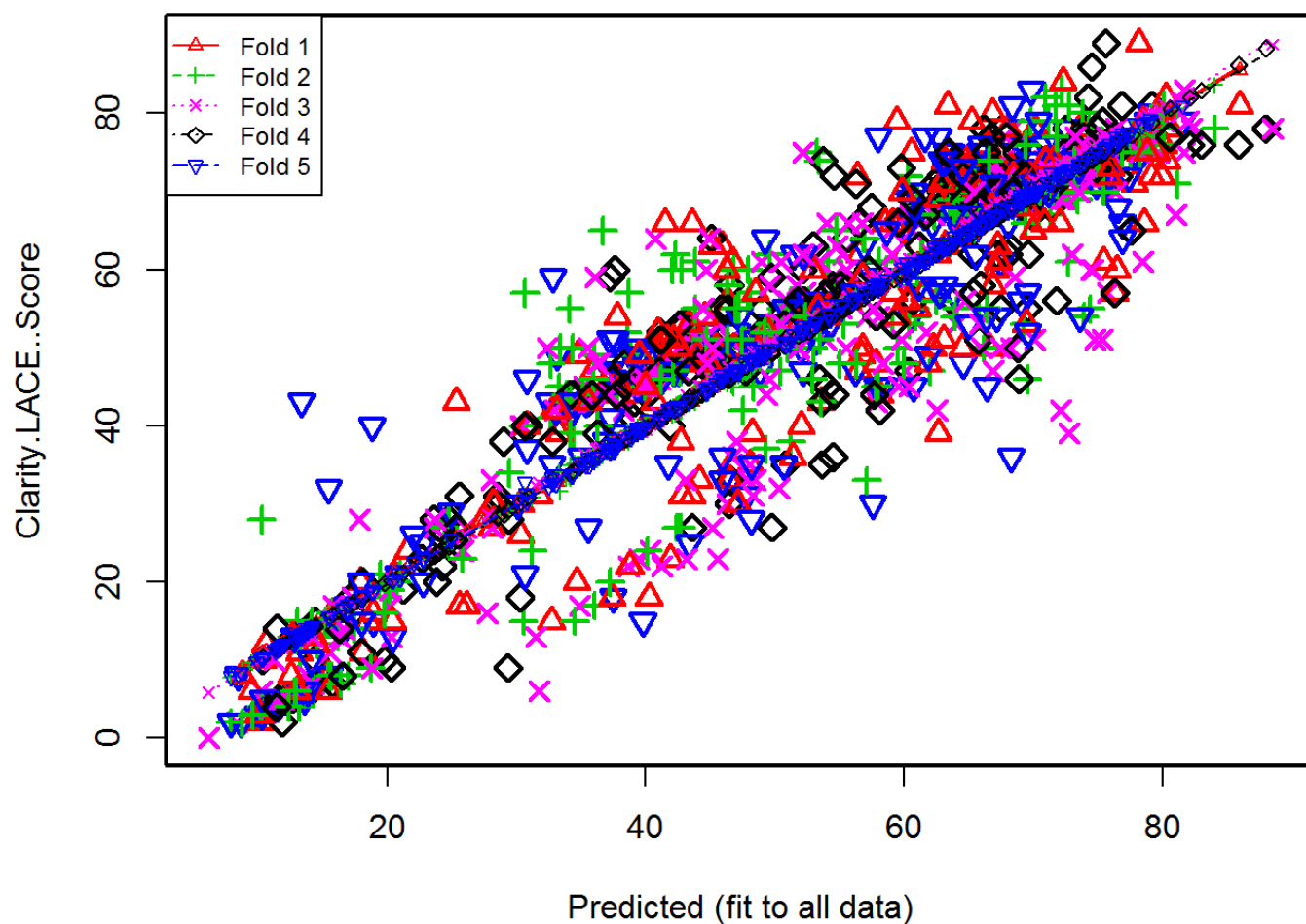
```
mean(mape)
```

```
## [1] 0.2993076
```

```
library(DAAG)
set.seed(1)
cvmodel5 <- suppressWarnings(CVlm(data=testing,form.lm = Clarity.LACE..Score ~ Age + EDV_Score + cadm_type_score + LOS_Score + Charlson_Score + Urgent_adm_Score + Male_Score + los_days,m=5,dots = FALSE))
```

```
## Analysis of Variance Table
##
## Response: Clarity.LACE..Score
##
      Df Sum Sq Mean Sq F value Pr(>F)
## Age      1 190466   190466  2411.63 <2e-16 ***
## EDV_Score 1  14531    14531   183.98 <2e-16 ***
## cadm_type_score 1 174161   174161  2205.17 <2e-16 ***
## LOS_Score  1  30198    30198   382.36 <2e-16 ***
## Charlson_Score 1  49241    49241   623.48 <2e-16 ***
## Urgent_adm_Score 1  37130    37130   470.13 <2e-16 ***
## Male_Score  1   6723     6723    85.12 <2e-16 ***
## los_days    1    198      198     2.51   0.11
## Residuals 1196  94458      79
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

**Small symbols show cross-validation predicted values**



```
##
## fold 1
## Observations in test set: 241
##
      5    31    32    35    51    54    69    85    88
## Predicted 48.99 44.81 43.4 65.78 56.81 59.52 63.254 43.64 63.75
## cvpred    49.57 45.36 43.7 65.62 57.08 59.39 63.499 43.91 63.57
```

## Clarity.LACE..Score	51.00	48.00	49.0	69.00	50.00	66.00	63.000	48.00	68.00
## CV residual	1.43	2.64	5.3	3.38	-7.08	6.61	-0.499	4.09	4.43
##	89	90	108	133	175	184	231	239	249
## Predicted	55.247	58.1	59.58	46.6	48.1	17.95	35.57	73.63	77.88
## cvpred	55.889	58.3	59.94	46.8	48.3	18.24	35.98	73.34	77.13
## Clarity.LACE..Score	56.000	44.0	66.00	35.0	35.0	20.00	43.00	78.00	71.00
## CV residual	0.111	-14.3	6.06	-11.8	-13.3	1.76	7.02	4.66	-6.13
##	263	272	295	302	314	325	328	341	348
## Predicted	45.9	64.73	65.88	56.5	27.403	39.60	53.6	74.732	34.8
## cvpred	45.5	65.15	65.95	56.5	27.687	40.09	53.7	74.711	34.8
## Clarity.LACE..Score	63.0	74.00	68.00	62.0	28.000	45.00	43.0	74.000	49.0
## CV residual	17.5	8.85	2.05	5.5	0.313	4.91	-10.7	-0.711	14.2
##	367	374	381	385	394	473	481	539	549
## Predicted	38.8	74.80	43.07	32.7	30.30	37.79	10.26	56.47	66.6
## cvpred	38.9	74.97	43.11	32.7	30.67	37.95	10.34	56.33	66.7
## Clarity.LACE..Score	22.0	73.00	51.00	15.0	26.00	45.00	3.00	47.00	50.0
## CV residual	-16.9	-1.97	7.89	-17.7	-4.67	7.05	-7.34	-9.33	-16.7
##	555	597	622	632	633	644	653	657	715
## Predicted	26.15	73.590	46.7	62.2	72.149	48.63	15.4	66.74	15.721
## cvpred	26.42	73.399	46.5	62.2	71.972	48.55	15.5	66.81	15.892
## Clarity.LACE..Score	17.00	73.000	61.0	50.0	72.000	51.00	8.0	70.00	16.000
## CV residual	-9.42	-0.399	14.5	-12.2	0.028	2.45	-7.5	3.19	0.108
##	724	725	735	751	792	816	838	858	
## Predicted	51.36	78.6	21.52	56.68	55.3108	66.8	20.510	40.93	
## cvpred	51.64	78.6	21.76	56.54	55.9576	66.4	21.197	40.76	
## Clarity.LACE..Score	53.00	66.0	24.00	49.00	56.0000	80.0	21.000	47.00	
## CV residual	1.36	-12.6	2.24	-7.54	0.0424	13.6	-0.197	6.24	
##	876	893	902	904	966	972	986	1005	1008
## Predicted	64.5	8.771	13	39.41	66.89	34.6	44.7	37.81	9.49
## cvpred	65.6	8.923	13	39.16	66.47	34.7	45.3	37.45	9.52
## Clarity.LACE..Score	50.0	8.000	6	44.00	71.00	20.0	48.0	46.00	6.00
## CV residual	-15.6	-0.923	-7	4.84	4.53	-14.7	2.7	8.55	-3.52
##	1042	1051	1072	1075	1134	1137	1155	1203	1213
## Predicted	38.05	33.39	75.21	10.19	76.3	32.82	36.51	18.48	33.30
## cvpred	38.22	33.43	74.79	10.27	76.2	32.82	36.24	18.51	33.33
## Clarity.LACE..Score	45.00	40.00	73.00	2.00	57.0	42.00	44.00	15.00	39.00
## CV residual	6.78	6.57	-1.79	-8.27	-19.2	9.18	7.76	-3.51	5.67
##	1240	1273	1316	1338	1340	1347	1397	1407	1422
## Predicted	62.597	64.78	78.14	44.1	72.17	11.30	72.3	59.5	79.34
## cvpred	62.974	64.85	77.84	44.6	71.91	11.28	72.2	59.3	79.19
## Clarity.LACE..Score	62.000	73.00	76.00	33.0	69.00	4.00	84.0	79.0	76.00
## CV residual	-0.974	8.15	-1.84	-11.6	-2.91	-7.28	11.8	19.7	-3.19
##	1430	1434	1435	1459	1467	1491	1494	1498	1514
## Predicted	78.2	46.5	71.712	69.55	60.6	70.2	69.680	12.8018	10.33
## cvpred	78.3	46.7	72.193	69.42	60.2	69.9	69.221	13.0264	10.51
## Clarity.LACE..Score	89.0	33.0	72.000	70.00	75.0	78.0	70.000	13.0000	10.00
## CV residual	10.7	-13.7	-0.193	0.58	14.8	8.1	0.779	-0.0264	-0.51
##	1522	1526	1571	1632	1636	1641	1684	1691	1695
## Predicted	56.4	44.40	41.35	11.69	67.41	30.299	45.2	43.6	61.0
## cvpred	56.5	44.86	41.22	11.79	67.25	30.498	44.9	43.8	61.2

## Clarity.LACE..Score	72.0	48.00	51.00	5.00	69.00	30.000	63.0	31.0	55.0
## CV residual	15.5	3.14	9.78	-6.79	1.75	-0.498	18.1	-12.8	-6.2
##	1707	1715	1720	1749	1784	1799	1808	1822	1829
## Predicted	12.61	59.4	37.8	41.9	59.96	10.568	69.04	64.55	67.11
## cvpred	12.82	59.5	38.1	42.1	59.85	11.061	68.93	63.81	67.09
## Clarity.LACE..Score	5.00	54.0	54.0	23.0	62.00	12.000	70.00	69.00	60.00
## CV residual	-7.82	-5.5	15.9	-19.1	2.15	0.939	1.07	5.19	-7.09
##	1850	1852	1887	1924	1947	1962	1973	1976	2037
## Predicted	63.84	14.28	45.03	11.88	46.4	61.9	59.1	80.57	41.0
## cvpred	63.45	14.21	45.03	11.99	46.5	61.9	58.9	80.21	41.1
## Clarity.LACE..Score	70.00	13.00	49.00	5.00	33.0	48.0	66.0	78.00	52.0
## CV residual	6.55	-1.21	3.97	-6.99	-13.5	-13.9	7.1	-2.21	10.9
##	2041	2045	2063	2105	2126	2128	2139	2167	2181
## Predicted	67.33	43.6	25.54	18.87	60.26	69.35	79.69	13.05	69.17
## cvpred	67.08	43.1	25.57	18.93	60.12	68.87	79.62	13.07	68.62
## Clarity.LACE..Score	73.00	66.0	17.00	16.00	56.00	71.00	77.00	6.00	71.00
## CV residual	5.92	22.9	-8.57	-2.93	-4.12	2.13	-2.62	-7.07	2.38
##	2186	2189	2245	2252	2278	2283	2293	2301	2372
## Predicted	72.810	48.22	14.46	11.95	41.73	62.93	30.79	68.26	37.4
## cvpred	72.639	48.42	14.65	12.06	41.46	62.66	31.06	68.94	37.5
## Clarity.LACE..Score	73.000	39.00	12.00	5.00	48.00	71.00	40.00	73.00	18.0
## CV residual	0.361	-9.42	-2.65	-7.06	6.54	8.34	8.94	4.06	-19.5
##	2389	2396	2397	2412	2452	2456	2457	2491	2504
## Predicted	78.58	54.106	38.05	38.7	68.04	45.14	46.3	67.29	80.1
## cvpred	78.13	54.275	38.22	38.8	68.02	45.43	46.5	68.28	79.8
## Clarity.LACE..Score	76.00	55.000	45.00	22.0	78.00	49.00	56.0	61.00	76.0
## CV residual	-2.13	0.725	6.78	-16.8	9.98	3.57	9.5	-7.28	-3.8
##	2522	2527	2531	2532	2540	2571	2581	2582	2599
## Predicted	28.13	42.8	78.29	13.17	51.4	62.60	25.3	65.3	52.0
## cvpred	28.51	42.7	78.05	13.44	51.7	62.53	25.6	65.4	52.2
## Clarity.LACE..Score	30.00	31.0	75.00	11.00	36.0	69.00	43.0	79.0	40.0
## CV residual	1.49	-11.7	-3.05	-2.44	-15.7	6.47	17.4	13.6	-12.2
##	2622	2626	2633	2647	2664	2674	2689	2697	2708
## Predicted	66.44	10.26	18.12	69.75	68.825	73.33	11.63	36	80.0
## cvpred	66.86	10.34	18.11	69.62	68.943	73.12	11.72	36	80.4
## Clarity.LACE..Score	76.00	3.00	11.00	72.00	68.000	71.00	5.00	47	72.0
## CV residual	9.14	-7.34	-7.11	2.38	-0.943	-2.12	-6.72	11	-8.4
##	2709	2760	2806	2814	2815	2828	2838	2845	2856
## Predicted	10.26	65.38	43.38	40.74	45.41	64.55	80.36	31.773	44.40
## cvpred	10.34	64.58	43.22	41.04	45.21	64.45	80.17	31.962	44.86
## Clarity.LACE..Score	3.00	73.00	53.00	43.00	50.00	71.00	74.00	31.000	48.00
## CV residual	-7.34	8.42	9.78	1.96	4.79	6.55	-6.17	-0.962	3.14
##	2877	2893	2902	2904	2919	2957	2968	2972	2987
## Predicted	61.6	20.37	66.8	70.86	78.533	46.77	28.07	62.6	55.674
## cvpred	61.6	20.54	67.6	71.33	79.262	47.33	28.44	62.5	55.888
## Clarity.LACE..Score	57.0	15.00	58.0	66.00	79.000	50.00	27.00	39.0	56.000
## CV residual	-4.6	-5.54	-9.6	-5.33	-0.262	2.67	-1.44	-23.5	0.112
##	2994	3003	3010	3023	3031	3032	3077	3108	3128
## Predicted	65.82	44.59	40.03	44.58	15.41	75.5	35.57	27.467	41.9
## cvpred	65.48	44.78	40.44	44.73	15.28	75.4	35.98	27.755	42.1

```

## Clarity.LACE..Score 70.00 49.00 45.00 54.00 6.00 61.0 43.00 28.000 23.0
## CV residual 4.52 4.22 4.56 9.27 -9.28 -14.4 7.02 0.245 -19.1
## 3134 3152 3164 3195 3214 3216 3220 3227 3236
## Predicted 43.98 69.52 69.5 51.79 63.17 63.4 72.05 12.55 48.50
## cvpred 43.86 69.39 69.0 51.73 64.08 63.1 72.18 12.75 48.41
## Clarity.LACE..Score 49.00 68.00 53.0 53.00 74.00 81.0 66.00 8.00 57.00
## CV residual 5.14 -1.39 -16.0 1.27 9.92 17.9 -6.18 -4.75 8.59
## 3267 3298 3318 3343 3344 3352 3368 3382 3408
## Predicted 57.83 68.000 67.23 86.00 80.25 56.75 42.17 71.61 75.82
## cvpred 57.44 68.052 67.23 85.51 79.99 57.01 42.26 71.41 75.43
## Clarity.LACE..Score 48.00 69.000 63.00 81.00 82.00 59.00 51.00 74.00 72.00
## CV residual -9.44 0.948 -4.23 -4.51 2.01 1.99 8.74 2.59 -3.43
## 3418 3431 3481 3489 3495 3497 3498 3529 3533
## Predicted 40.3 12.610 79.18 46.2 10.1 58.57 52.91 41.5 68.45
## cvpred 40.2 12.821 78.79 46.3 10.2 58.46 52.65 41.6 68.42
## Clarity.LACE..Score 18.0 13.000 72.00 60.0 3.0 66.00 60.00 66.0 72.00
## CV residual -22.2 0.179 -6.79 13.7 -7.2 7.54 7.35 24.4 3.58
## 3546 3557 3571 3582 3589 3599 3610 3653 3666
## Predicted 13 76.5 79.55 70.91 9.94 69.95 33.09 42.69 59.9
## cvpred 13 76.2 80.46 70.26 10.00 72.17 32.86 42.65 59.5
## Clarity.LACE..Score 6 60.0 75.00 74.00 3.00 65.00 42.00 38.00 70.0
## CV residual -7 -16.2 -5.46 3.74 -7.00 -7.17 9.14 -4.65 10.5
## 3673 3677 3711 3717 3726 3733 3741 3753 3774
## Predicted 49.47 42.55 39.97 59.17 73.612 41.64 39.52 44.88 47.2
## cvpred 49.85 42.44 40.37 59.11 73.271 41.43 39.77 45.43 47.5
## Clarity.LACE..Score 52.00 50.00 45.00 57.00 74.000 51.00 49.00 48.00 30.0
## CV residual 2.15 7.56 4.63 -2.11 0.729 9.57 9.23 2.57 -17.5
## 3800 3809 3821 3827 3838 3841 3934 3976
## Predicted 28.26 66.80 63 53.289 54.063 39.97 78.82 76.0
## cvpred 28.65 66.95 63 54.005 54.217 40.37 79.12 77.1
## Clarity.LACE..Score 30.00 68.00 51 55.000 54.000 45.00 75.00 73.0
## CV residual 1.35 1.05 -12 0.995 -0.217 4.63 -4.12 -4.1
##
## Sum of squares = 18401 Mean square = 76.3 n = 241
##
## fold 2
## Observations in test set: 241
## 2 4 60 72 107 152 182 196 203
## Predicted 30.5 38.7 42.4 42.5 61.08 81.13 53.4 51.24 39.41
## cvpred 31.2 38.0 42.8 42.9 61.09 80.56 53.4 51.48 39.92
## Clarity.LACE..Score 15.0 57.0 27.0 27.0 68.00 71.00 74.0 56.00 46.00
## CV residual -16.2 19.0 -15.8 -15.9 6.91 -9.56 20.6 4.52 6.08
## 217 223 250 296 305 317 378 383 387
## Predicted 50.45 43.8 68.69 47.9 34.4 11.75 36.0 69.3 42.8
## cvpred 50.77 43.0 68.47 47.1 33.6 11.73 36.7 69.5 41.9
## Clarity.LACE..Score 55.00 61.0 71.00 60.0 39.0 5.00 17.0 53.0 60.0
## CV residual 4.23 18.0 2.53 12.9 5.4 -6.73 -19.7 -16.5 18.1
## 432 444 457 475 486 521 532 547 571
## Predicted 37.82 58.67 11.63 64.64 16.1 65.8 15.64 31.24 28.698
## cvpred 38.23 58.74 11.61 64.63 16.0 65.8 15.65 30.77 28.173

```

```

## Clarity.LACE..Score 44.00 60.00 5.00 70.00 13.0 54.0 8.00 24.00 29.000
## CV residual 5.77 1.26 -6.61 5.37 -3.0 -11.8 -7.65 -6.77 0.827
## 577 583 590 615 619 635 639 648 702
## Predicted 44.69 63.04 74.4 61.08 49.6 12.610 66.2 42.4 56.89
## cvpred 44.84 62.87 74.1 61.09 48.8 12.502 66.1 42.8 56.96
## Clarity.LACE..Score 48.00 71.00 55.0 58.00 62.0 13.000 50.0 27.0 64.00
## CV residual 3.16 8.13 -19.1 -3.09 13.2 0.498 -16.1 -15.8 7.04
## 705 728 733 739 742 759 775 807
## Predicted 14.0324 73.22 46.43 64.72 57.1 60.87 55.05 63.45
## cvpred 13.9235 72.42 46.68 64.86 57.1 60.96 55.37 63.23
## Clarity.LACE..Score 14.0000 70.00 50.00 73.00 33.0 55.00 58.00 72.00
## CV residual 0.0765 -2.42 3.32 8.14 -24.1 -5.96 2.63 8.77
## 815 825 831 833 848 874 883 896
## Predicted 52.64 61.08 12.99 44.801 61.38 54.12 15.454 51.2
## cvpred 52.73 60.18 12.98 45.203 61.38 54.33 15.345 51.5
## Clarity.LACE..Score 56.00 69.00 15.00 45.000 62.00 61.00 15.000 38.0
## CV residual 3.27 8.82 2.02 -0.203 0.62 6.67 -0.345 -13.5
## 897 901 910 917 936 939 940 957
## Predicted 14.53 50.958 40.71 62.0 71.21 24.65 64.09 78.514
## cvpred 14.41 49.844 41.19 62.1 71.02 24.25 64.16 78.289
## Clarity.LACE..Score 12.00 50.000 50.00 47.0 79.00 28.00 55.00 79.000
## CV residual -2.41 0.156 8.81 -15.1 7.98 3.75 -9.16 0.711
## 970 978 997 1026 1052 1067 1073 1074 1106
## Predicted 46.745 30.6 55.12 10.27 49.11 68.49 36.7 38.9 47.93
## cvpred 46.126 30.3 55.36 10.25 49.12 67.33 36.2 38.3 47.07
## Clarity.LACE..Score 46.000 57.0 57.00 4.00 51.00 70.00 65.0 49.0 56.00
## CV residual -0.126 26.7 1.64 -6.25 1.88 2.67 28.8 10.7 8.93
## 1109 1110 1136 1152 1217 1230 1239 1251 1278
## Predicted 72.2 59.11 73.9 32.67 12.86 60.87 36.1 66.91 71.34
## cvpred 72.1 59.23 73.7 33.26 12.86 61.06 36.7 66.83 70.27
## Clarity.LACE..Score 83.0 53.00 54.0 41.00 6.00 54.00 49.0 74.00 73.00
## CV residual 10.9 -6.23 -19.7 7.74 -6.86 -7.06 12.3 7.17 2.73
## 1283 1314 1326 1359 1377 1384 1386 1412 1417
## Predicted 20.974 30.54 49.3 38.6 13.24 63.53 56.97 71.40 50.43
## cvpred 20.793 31.25 49.5 39.3 13.21 63.33 56.98 71.19 50.59
## Clarity.LACE..Score 21.000 40.00 37.0 52.0 6.00 67.00 64.00 73.00 47.00
## CV residual 0.207 8.75 -12.5 12.7 -7.21 3.67 7.02 1.81 -3.59
## 1446 1447 1453 1479 1485 1503 1532 1534 1543
## Predicted 79.48 59.50 69.37 69.44 47.50 10.19 42.73 53.6 69.92
## cvpred 79.12 58.69 68.67 69.38 46.67 10.23 42.93 53.8 69.72
## Clarity.LACE..Score 76.00 50.00 70.00 73.00 42.00 3.00 47.00 43.0 72.00
## CV residual -3.12 -8.69 1.33 3.62 -4.67 -7.23 4.07 -10.8 2.28
## 1561 1574 1606 1608 1613 1615 1631 1649 1690
## Predicted 55.37 62.37 30.54 58 57.8 33.8 14.172 14.19 42.0
## cvpred 55.68 62.23 31.25 58 58.0 33.3 14.004 14.26 41.4
## Clarity.LACE..Score 53.00 67.00 40.00 45 45.0 44.0 15.000 6.00 60.0
## CV residual -2.68 4.77 8.75 -13 -13.0 10.7 0.996 -8.26 18.6
## 1696 1710 1748 1750 1761 1770 1788 1795 1830
## Predicted 60.45 72.7 20.705 71 55.1 74.34 43.75 54.74 64.0
## cvpred 60.52 72.0 20.257 71 55.4 74.33 44.21 55.11 64.2

```

## Clarity.LACE..Score	53.00	61.0	20.000	82	48.0	78.00	52.00	65.00	54.0
## CV residual	-7.52	-11.0	-0.257	11	-7.4	3.67	7.79	9.89	-10.2
##	1831	1840	1909	1939	1941	1982	2022	2056	2077
## Predicted	71.77	72.77	58.11	46.1	19.92	47.7	71.39	15.45	65.45
## cvpred	71.69	72.76	58.21	45.7	19.64	48.1	71.35	15.48	65.31
## Clarity.LACE..Score	81.00	81.00	61.00	49.0	18.00	51.0	67.00	8.00	70.00
## CV residual	9.31	8.24	2.79	3.3	-1.64	2.9	-4.35	-7.48	4.69
##	2084	2089	2097	2118	2121	2131	2151	2159	2176
## Predicted	70.83	34.14	7.86	10.3	48.82	63.77	12.99	13.30	69.21
## cvpred	70.68	33.33	7.80	10.3	49.15	63.79	12.98	13.16	68.82
## Clarity.LACE..Score	73.00	39.00	2.00	28.0	51.00	69.00	6.00	11.00	69.00
## CV residual	2.32	5.67	-5.80	17.7	1.85	5.21	-6.98	-2.16	0.18
##	2202	2224	2226	2247	2249	2299	2310	2339	2345
## Predicted	60.4	13.11	17.45	77.58	42.7	15.199	12.79	33.3	51.723
## cvpred	60.2	13.09	17.14	77.13	41.8	15.117	12.81	34.0	50.812
## Clarity.LACE..Score	72.0	5.00	14.00	75.00	27.0	15.000	6.00	45.0	51.000
## CV residual	11.8	-8.09	-3.14	-2.13	-14.8	-0.117	-6.81	11.0	0.188
##	2365	2423	2429	2484	2492	2496	2542	2556	2588
## Predicted	34.18	65.49	63.60	46.4	46.8	24.77	42.60	11.69	13.18
## cvpred	34.94	64.49	62.77	45.3	44.9	24.37	42.81	11.67	13.15
## Clarity.LACE..Score	43.00	71.00	69.00	58.0	60.0	28.00	47.00	5.00	4.00
## CV residual	8.06	6.51	6.23	12.7	15.1	3.63	4.19	-6.67	-9.15
##	2612	2621	2652	2684	2707	2727	2728	2739	2768
## Predicted	42.3	64	52.75	44.88	79.94	75.2	48.13	34.1	18.71
## cvpred	41.5	64	52.81	45.14	79.75	74.8	47.28	33.5	18.81
## Clarity.LACE..Score	62.0	68	53.00	47.00	76.00	76.0	57.00	55.0	9.00
## CV residual	20.5	4	0.19	1.86	-3.75	1.2	9.72	21.5	-9.81
##	2788	2791	2809	2819	2821	2825	2841	2852	2859
## Predicted	11.75	39.97	25.80	35.15	34.5	42.1	71.53	49.60	61.445
## cvpred	11.73	40.31	25.46	35.96	35.2	42.4	71.38	49.79	61.437
## Clarity.LACE..Score	5.00	45.00	23.00	44.00	15.0	47.0	70.00	53.00	62.000
## CV residual	-6.73	4.69	-2.46	8.04	-20.2	4.6	-1.38	3.21	0.563
##	2862	2867	2876	2888	2929	2936	2943	2954	2978
## Predicted	64.2	73.26	73.88	69.86	14.172	24.41	35.93	8.77	47.20
## cvpred	64.1	72.98	73.83	69.98	14.004	24.13	36.61	8.80	46.41
## Clarity.LACE..Score	69.0	70.00	80.00	79.00	15.000	27.00	46.00	2.00	55.00
## CV residual	4.9	-2.98	6.17	9.02	0.996	2.87	9.39	-6.80	8.59
##	2982	2996	3029	3036	3057	3061	3067	3072	
## Predicted	34.4	65.812	68.45	56.29	75.767	15.594	69.132	16.41	
## cvpred	34.1	65.707	68.33	56.74	75.639	15.425	69.189	16.19	
## Clarity.LACE..Score	50.0	66.000	71.00	48.00	76.000	16.000	70.000	7.00	
## CV residual	15.9	0.293	2.67	-8.74	0.361	0.575	0.811	-9.19	
##	3088	3092	3103	3117	3149	3183	3197	3218	3248
## Predicted	69.4	11.49	19.75	75.49	53.122	53.3	69.5	80.09	62.50
## cvpred	69.3	11.53	19.69	75.19	53.469	53.7	69.6	79.93	62.72
## Clarity.LACE..Score	66.0	4.00	16.00	70.00	53.000	75.0	46.0	78.00	56.00
## CV residual	-3.3	-7.53	-3.69	-5.19	-0.469	21.3	-23.6	-1.93	-6.72
##	3256	3306	3313	3315	3322	3360	3379	3416	3438
## Predicted	15.56	48.82	11.5	29.46	75.03	36.30	43.8	71.80	47.44
## cvpred	15.59	48.05	11.5	29.04	74.89	35.68	44.4	71.73	47.82

```

## Clarity.LACE..Score  8.00 51.00  5.0 34.00 73.00 40.00 55.0 77.00 51.00
## CV residual          -7.59  2.95 -6.5  4.96 -1.89  4.32 10.6  5.27  3.18
##                      3462  3468  3474  3504  3511  3543  3549 3567  3575
## Predicted            69.42 76.91 50.50 46.97 80.08 49.75 73.238 84.0 12.34
## cvpred               69.23 76.74 50.79 47.17 79.93 49.95 73.114 83.6 12.44
## Clarity.LACE..Score  76.00 75.00 52.00 55.00 81.00 52.00 74.000 78.0  4.00
## CV residual           6.77 -1.74  1.21  7.83  1.07  2.05  0.886 -5.6 -8.44
##                      3576  3586 3645 3656  3657 3676  3679  3690  3705
## Predicted            12.92 52.98   60 33.4 19.49 32.6 73.47 44.72 63.89
## cvpred               12.92 53.44   60 31.5 19.11 33.4 73.05 44.04 63.85
## Clarity.LACE..Score  6.00 50.00   48 50.0 21.00 48.0 69.00 51.00 67.00
## CV residual          -6.92 -3.44  -12 18.5  1.89 14.6 -4.05  6.96  3.15
##                      3708  3723 3743  3748  3755  3764 3768  3791  3823
## Predicted            52.92 70.513 48.3 16.92 41.17  66.4 78.9  9.56 49.20
## cvpred               53.38 69.766 47.7 16.85 41.42  65.9 78.7  9.66 49.48
## Clarity.LACE..Score  46.00 70.000 45.0  8.00 46.00  55.0 77.0  3.00 52.00
## CV residual          -7.38  0.234 -2.7 -8.85  4.58 -10.9 -1.7 -6.66  2.52
##                      3848  3865  3874  3877  3882  3886  3887  3912
## Predicted            37.2 20.183 66.57 73.187 46.31 71.821 53.47  40.2
## cvpred               37.8 19.835 66.54 73.197 46.82 71.743 53.71  40.6
## Clarity.LACE..Score  20.0 19.000 74.00 74.000 51.00 71.000 51.00  24.0
## CV residual          -17.8 -0.835  7.46  0.803  4.18 -0.743 -2.71 -16.6
##                      3933  3935  3981
## Predicted            78.2 12.86 52.39
## cvpred               77.4 12.86 52.63
## Clarity.LACE..Score  75.0  6.00 54.00
## CV residual          -2.4 -6.86  1.37
##
## Sum of squares = 19705      Mean square = 81.8      n = 241
##
## fold 3
## Observations in test set: 241
##                      8    16    74    115    116    119    146    168    194
## Predicted            30.47  60.1 60.65 64.10  57.9 10.26  61.8 72.24  70.1
## cvpred               30.13  60.8 61.25 64.83  59.2 10.19  62.6 73.01  71.4
## Clarity.LACE..Score  40.00  47.0 65.00 68.00  43.0  6.00  52.0 76.00  51.0
## CV residual           9.87 -13.8  3.75  3.17 -16.2 -4.19 -10.6  2.99 -20.4
##                      276  357  361  364  401  426  431  446  483
## Predicted            31.7 54.0 43.29 49.0  68.3 54.55 70.733 73.80 58.11
## cvpred               32.8 55.2 43.48 50.3  69.0 54.52 71.504 74.66 58.42
## Clarity.LACE..Score  6.0 66.0 51.00 61.0  50.0 59.00 71.000 72.00 54.00
## CV residual          -26.8 10.8  7.52 10.7 -19.0  4.48 -0.504 -2.66 -4.42
##                      492  495  501  528  535  563  564  573
## Predicted            55.216 72.1  64.1  62.6 74.27  6.17 35.24 56.039
## cvpred               55.395 72.9  64.8  62.8 75.18  5.84 36.39 56.031
## Clarity.LACE..Score  55.000 42.0  53.0  42.0 73.00  0.00 45.00 57.000
## CV residual          -0.395 -30.9 -11.8 -20.8 -2.18 -5.84  8.61  0.969
##                      576  582  586  624  638  656  662  663  683
## Predicted            37.01 67.62 60.46 79.73 44.30  74.6  66.1 55.25 47.93
## cvpred               36.67 68.21 61.33 80.53 45.07  75.7  66.5 55.02 47.83

```



## Clarity.LACE..Score	44.00	74.00	67.00	75.00	53.00	60.0	50.0	62.00	51.00
## CV residual	7.33	5.79	5.67	-5.53	7.93	-15.7	-16.5	6.98	3.17
##	684	686	720	727	773	781	783	810	853
## Predicted	41.80	59.6	45.86	38.3	67.9	52.39	51.00	57.1	70.062
## cvpred	41.97	60.2	45.44	38.2	68.8	52.45	51.89	57.5	70.756
## Clarity.LACE..Score	48.00	45.0	50.00	42.0	77.0	57.00	56.00	54.0	70.000
## CV residual	6.03	-15.2	4.56	3.8	8.2	4.55	4.11	-3.5	-0.756
##	855	861	880	922	931	934	984	987	
## Predicted	14.1600	52.62	12.86	48.1	81.1	74.14	53.802	55.6	
## cvpred	14.0501	52.68	12.91	48.0	82.0	74.93	54.225	56.5	
## Clarity.LACE..Score	14.0000	55.00	6.00	35.0	67.0	73.00	55.000	50.0	
## CV residual	-0.0501	2.32	-6.91	-13.0	-15.0	-1.93	0.775	-6.5	
##	1006	1050	1053	1054	1061	1092	1096	1133	1154
## Predicted	13.84	8.39	34.94	49.11	40.8	69.65	39.5	75.8	44.31
## cvpred	13.81	8.39	34.74	48.74	41.8	69.86	39.4	77.1	44.01
## Clarity.LACE..Score	8.00	2.00	43.00	51.00	64.0	68.00	23.0	57.0	49.00
## CV residual	-5.81	-6.39	8.26	2.26	22.2	-1.86	-16.4	-20.1	4.99
##	1171	1175	1185	1219	1225	1226	1271	1285	1305
## Predicted	52.87	45.6	34.9	10.52	46.7	42.18	14.34	38.51	37.92
## cvpred	54.02	46.7	34.7	10.37	46.6	41.71	14.42	38.63	37.87
## Clarity.LACE..Score	62.00	23.0	17.0	4.00	36.0	47.00	7.00	46.00	45.00
## CV residual	7.98	-23.7	-17.7	-6.37	-10.6	5.29	-7.42	7.37	7.13
##	1318	1339	1364	1379	1392	1413	1420	1425	1454
## Predicted	64.9984	37.54	32.95	82.3	11.56	53.99	53.4	67.90	59.206
## cvpred	65.9489	37.58	32.88	82.7	11.54	54.08	53.3	68.74	59.278
## Clarity.LACE..Score	66.0000	45.00	42.00	78.0	5.00	51.00	61.0	71.00	59.000
## CV residual	0.0511	7.42	9.12	-4.7	-6.54	-3.08	7.7	2.26	-0.278
##	1460	1463	1472	1480	1481	1482	1497	1513	1540
## Predicted	62.37	67.41	14.34	74.8	75.4	50.19	15.57	36.4	76.38
## cvpred	62.89	68.47	14.42	76.1	76.7	50.34	15.74	37.2	77.01
## Clarity.LACE..Score	67.00	71.00	7.00	51.0	51.0	53.00	11.00	48.0	70.00
## CV residual	4.11	2.53	-7.42	-25.1	-25.7	2.66	-4.74	10.8	-7.01
##	1586	1592	1600	1625	1627	1637	1648	1659	1662
## Predicted	31.5	70.88	38.7	70.33	45.71	69.180	50.4	42.54	40.97
## cvpred	32.4	71.97	38.5	71.23	46.43	69.635	50.4	42.12	40.58
## Clarity.LACE..Score	13.0	74.00	22.0	73.00	53.00	69.000	32.0	47.00	46.00
## CV residual	-19.4	2.03	-16.5	1.77	6.57	-0.635	-18.4	4.88	5.42
##	1705	1706	1735	1739	1743	1753	1827	1832	1858
## Predicted	64.9	75.94	67.99	72.140	73.84	68.46	76.409	41.09	67.5
## cvpred	65.2	76.66	67.68	73.108	74.38	69.23	77.421	41.02	68.6
## Clarity.LACE..Score	67.0	72.00	72.00	74.000	71.00	78.00	78.000	46.00	50.0
## CV residual	1.8	-4.66	4.32	0.892	-3.38	8.77	0.579	4.98	-18.6
##	1865	1877	1899	1905	1950	1953	1980	1994	2040
## Predicted	54.86	11.10	39.60	30.3	12.86	11.50	68.6	72.8	45.2
## cvpred	55.28	11.22	39.17	30.0	12.91	11.49	69.5	73.7	45.0
## Clarity.LACE..Score	63.00	4.00	45.00	40.0	6.00	5.00	59.0	39.0	27.0
## CV residual	7.72	-7.22	5.83	10.0	-6.91	-6.49	-10.5	-34.7	-18.0
##	2054	2059	2071	2080	2110	2112	2140	2165	
## Predicted	57.691	55.57	41.99	47.9	57.720	72.19	44.47	46.57	
## cvpred	58.177	55.85	41.57	47.9	57.768	72.83	44.32	46.51	

## Clarity.LACE..Score	59.000	60.00	49.00	33.0	58.000	74.00	49.00	51.00	
## CV residual	0.823	4.15	7.43	-14.9	0.232	1.17	4.68	4.49	
##	2170	2191	2195	2196	2209	2232	2246	2263	2277
## Predicted	40.4	48.65	11.82	72.48	36.1	12.78	34.50	71.342	49.63
## cvpred	40.1	48.55	11.73	72.94	37.0	12.87	34.43	72.168	50.81
## Clarity.LACE..Score	24.0	51.00	5.00	69.00	59.0	5.00	43.00	73.000	46.00
## CV residual	-16.1	2.45	-6.73	-3.94	22.0	-7.87	8.57	0.832	-4.81
##	2306	2317	2335	2341	2353	2363	2370	2381	2402
## Predicted	74.51	78.70	44.14	25.87	68.592	43.2	16.60	17.282	47.03
## cvpred	75.11	79.49	45.11	25.93	69.503	43.9	16.58	17.139	46.95
## Clarity.LACE..Score	72.00	76.00	51.00	24.00	70.000	53.0	14.00	18.000	38.00
## CV residual	-3.11	-3.49	5.89	-1.93	0.497	9.1	-2.58	0.861	-8.95
##	2432	2441	2447	2455	2509	2524	2536	2539	2547
## Predicted	23.61	48.5	66.9	48.454	81.39	26.109	10.72	20.3	81.69
## cvpred	23.56	48.5	68.5	48.409	81.93	26.147	10.94	20.3	81.67
## Clarity.LACE..Score	27.00	33.0	47.0	48.000	80.00	27.000	4.00	13.0	75.00
## CV residual	3.44	-15.5	-21.5	-0.409	-1.93	0.853	-6.94	-7.3	-6.67
##	2589	2597	2638	2643	2646	2679	2685	2717	2726
## Predicted	16.33	41.05	72.1	43.34	40.14	44.7	43.1	51.70	72.57
## cvpred	16.41	41.08	73.7	43.42	39.84	44.6	44.0	52.19	73.33
## Clarity.LACE..Score	13.00	47.00	69.0	49.00	47.00	60.0	33.0	58.00	72.00
## CV residual	-3.41	5.92	-4.7	5.58	7.16	15.4	-11.0	5.81	-1.33
##	2733	2734	2736	2741	2770	2786	2790	2796	2816
## Predicted	82.04	78.88	66.96	73.8	46.3	25.81	20.23	50.50	79.53
## cvpred	82.71	79.92	67.64	74.7	47.5	25.89	20.49	51.17	79.97
## Clarity.LACE..Score	79.00	78.00	73.00	76.0	30.0	24.00	17.00	61.00	77.00
## CV residual	-3.71	-1.92	5.36	1.3	-17.5	-1.89	-3.49	9.83	-2.97
##	2848	2869	2908	2911	2916	2928	2959	3018	3026
## Predicted	48.3	56.75	12.01	12.92	59.86	47.598	35.57	14.22	27.8
## cvpred	49.5	57.55	11.88	12.96	60.58	47.602	35.22	14.32	28.6
## Clarity.LACE..Score	31.0	66.00	5.00	6.00	51.00	47.000	43.00	7.00	16.0
## CV residual	-18.5	8.45	-6.88	-6.96	-9.58	-0.602	7.78	-7.32	-12.6
##	3060	3073	3082	3110	3119	3124	3181	3191	3200
## Predicted	35.5	59.01	80.19	74.72	49.42	28.09	15.80	20.18	37.20
## cvpred	35.6	59.61	81.01	75.67	49.64	28.16	15.63	20.21	36.81
## Clarity.LACE..Score	50.0	65.00	79.00	72.00	44.00	33.00	17.00	19.00	44.00
## CV residual	14.4	5.39	-2.01	-3.67	-5.64	4.84	1.37	-1.21	7.19
##	3224	3244	3245	3246	3260	3288	3290	3308	3334
## Predicted	74.19	14.22	45.0	75.694	65.9	75.95	11.23	50.12	40.03
## cvpred	75.03	14.32	46.1	76.452	66.7	76.98	11.32	50.29	39.54
## Clarity.LACE..Score	72.00	13.00	64.0	77.000	53.0	75.00	10.00	53.00	45.00
## CV residual	-3.03	-1.32	17.9	0.548	-13.7	-1.98	-1.32	2.71	5.46
##	3340	3349	3377	3388	3397	3420	3424	3439	3443
## Predicted	75.81	48.426	78.5	17.8	60.4	11.56	58.4	44.84	66.771
## cvpred	76.71	48.609	79.5	17.7	61.4	11.54	59.1	44.92	67.498
## Clarity.LACE..Score	76.00	48.000	61.0	28.0	45.0	5.00	48.0	50.00	68.000
## CV residual	-0.71	-0.609	-18.5	10.3	-16.4	-6.54	-11.1	5.08	0.502
##	3491	3512	3520	3530	3551	3552	3554	3572	3585
## Predicted	73.89	68.00	71.03	41.2	11.88	81.8	64.79	57.69	50.55
## cvpred	74.66	68.37	71.33	41.1	11.78	82.0	65.45	58.86	50.19

```

## Clarity.LACE..Score 73.00 72.00 73.00 22.0 5.00 83.0 56.00 55.00 53.00
## CV residual -1.66 3.63 1.67 -19.1 -6.78 1.0 -9.45 -3.86 2.81
## 3608 3622 3664 3672 3707 3715 3739 3745 3761
## Predicted 66.630 39.67 64.87 49.60 88.6 65.51 15.80 73.27 79.16
## cvpred 67.248 39.22 64.91 50.51 88.9 66.36 15.63 73.71 80.09
## Clarity.LACE..Score 68.000 45.00 66.00 58.00 78.0 70.00 17.00 77.00 76.00
## CV residual 0.752 5.78 1.09 7.49 -10.9 3.64 1.37 3.29 -4.09
## 3770 3775 3796 3798 3801 3803 3814 3845 3852 3866
## Predicted 28.1 52.2 74.5 73 39.96 18.78 78.3 43.2 32.4 55.7
## cvpred 28.2 52.3 75.5 74 39.84 18.94 78.8 43.1 32.7 56.6
## Clarity.LACE..Score 27.0 62.0 60.0 62 46.00 9.00 75.0 23.0 50.0 66.0
## CV residual -1.2 9.7 -15.5 -12 6.16 -9.94 -3.8 -20.1 17.3 9.4
## 3870 3871 3872 3883 3942 3949 3950 3974 3996
## Predicted 36.2 52.2 23.75 45.2 59.08 44.5 73.60 51.87 44.81
## cvpred 37.1 49.0 23.65 45.2 59.18 44.3 75.11 52.15 44.39
## Clarity.LACE..Score 48.0 75.0 28.00 50.0 62.00 55.0 70.00 50.00 48.00
## CV residual 10.9 26.0 4.35 4.8 2.82 10.7 -5.11 -2.15 3.61
##
## Sum of squares = 23288 Mean square = 96.6 n = 241
##
## fold 4
## Observations in test set: 241
## 11 20 21 38 59 68 70 98 112
## Predicted 60.70 63.69 47.0 54.04 66.13 43.0 69.6 69.98 43.86
## cvpred 60.42 63.19 46.7 53.51 65.54 42.7 69.1 69.42 43.53
## Clarity.LACE..Score 67.00 56.00 50.0 45.00 68.00 53.0 55.0 75.00 51.00
## CV residual 6.58 -7.19 3.3 -8.51 2.46 10.3 -14.1 5.58 7.47
## 127 135 139 140 174 191 224 241 247
## Predicted 37.82 39.01 46.5 69.263 63.8 44.30 43.7 68.10 14.08
## cvpred 37.58 38.85 46.1 69.221 63.3 43.99 43.6 67.71 14.03
## Clarity.LACE..Score 44.00 41.00 58.0 69.000 74.0 49.00 51.0 63.00 6.00
## CV residual 6.42 2.15 11.9 -0.221 10.7 5.01 7.4 -4.71 -8.03
## 262 278 298 301 318 335 377 395 402
## Predicted 76.56 68.34 41.46 14.41 10.332 52.6 66.93 34.78 68.9
## cvpred 76.51 67.73 41.18 14.34 10.301 52.1 66.49 34.59 69.0
## Clarity.LACE..Score 72.00 71.00 48.00 10.00 10.000 55.0 71.00 44.00 50.0
## CV residual -4.51 3.27 6.82 -4.34 -0.301 2.9 4.51 9.41 -19.0
## 404 459 462 471 537 542 544 546 569
## Predicted 67.68 49.8 41.1 54.13 11.75 75.51 67.6 53.99 57.5
## cvpred 67.07 49.2 40.9 53.84 11.71 75.01 67.8 53.62 57.1
## Clarity.LACE..Score 69.00 27.0 52.0 57.00 5.00 73.00 78.0 55.00 68.0
## CV residual 1.93 -22.2 11.1 3.16 -6.71 -2.01 10.2 1.38 10.9
## 584 594 600 609 620 623 665 723 730
## Predicted 56.86 65.10 72.59 69.66 18.07 66.77 12.40 50.77 46.6
## cvpred 56.35 64.81 72.13 69.32 17.89 66.78 12.37 50.19 46.2
## Clarity.LACE..Score 59.00 72.00 78.00 62.00 20.00 67.00 5.00 53.00 33.0
## CV residual 2.65 7.19 5.87 -7.32 2.11 0.22 -7.37 2.81 -13.2
## 772 786 826 835 843 887 908 909 925
## Predicted 45.1 19.81 62.89 34.40 73.61 46.42 53.0 40.10 35.57
## cvpred 44.8 19.85 62.45 34.11 73.14 45.79 52.6 39.83 35.53

```

## Clarity.LACE..Score	64.0	10.00	70.00	44.00	75.00	52.00	63.0	44.00	43.00
## CV residual	19.2	-9.85	7.55	9.89	1.86	6.21	10.4	4.17	7.47
##	942	1000	1017	1023	1097	1105	1113	1128	1145
## Predicted	58.2	79.21	20.3	55.59	50.8	65.78	70.04	30.3	23.98
## cvpred	57.6	78.83	20.2	55.66	51.2	65.36	69.82	30.2	23.73
## Clarity.LACE..Score	42.0	81.00	9.0	64.00	35.0	69.00	72.00	18.0	26.00
## CV residual	-15.6	2.17	-11.2	8.34	-16.2	3.64	2.18	-12.2	2.27
##	1186	1195	1202	1205	1207	1260	1266	1269	1276
## Predicted	38.40	63.05	68.07	21.21	37.3	25.444	43.6	11.69	66.2
## cvpred	38.18	63.15	67.55	21.16	36.9	25.293	43.3	11.65	65.8
## Clarity.LACE..Score	48.00	71.00	62.00	19.00	59.0	25.000	27.0	5.00	78.0
## CV residual	9.82	7.85	-5.55	-2.16	22.1	-0.293	-16.3	-6.65	12.2
##	1288	1292	1299	1322	1389	1409	1411	1429	1432
## Predicted	46.4	53.6	60.3	65.8	39.15	42.41	44.40	67.25	67.3
## cvpred	46.1	53.3	60.1	65.4	39.06	42.01	44.03	66.93	66.8
## Clarity.LACE..Score	30.0	43.0	47.0	51.0	43.00	48.00	48.00	72.00	70.0
## CV residual	-16.1	-10.3	-13.1	-14.4	3.94	5.99	3.97	5.07	3.2
##	1457	1462	1464	1468	1474	1484	1488	1524	
## Predicted	24.26	62.12	67.15	67.5	22.664	68.01	65.70	76.545	
## cvpred	24.16	61.77	66.64	67.0	22.537	67.83	65.78	76.059	
## Clarity.LACE..Score	22.00	68.00	62.00	55.0	23.000	70.00	71.00	77.000	
## CV residual	-2.16	6.23	-4.64	-12.0	0.463	2.17	5.22	0.941	
##	1551	1562	1564	1577	1593	1616	1643	1645	1653
## Predicted	25.58	52.25	77.6	64.7	69.90	40.99	49.73	46.77	39.21
## cvpred	25.35	51.98	77.2	64.4	70.26	40.74	49.47	46.51	39.12
## Clarity.LACE..Score	31.00	56.00	65.0	68.0	67.00	47.00	59.00	50.00	46.00
## CV residual	5.65	4.02	-12.2	3.6	-3.26	6.26	9.53	3.49	6.88
##	1666	1675	1702	1717	1722	1732	1740	1754	1758
## Predicted	64.8	11.88	67.701	71.8	29.44	11.69	73.98	71.73	54.49
## cvpred	64.4	11.84	67.341	71.3	29.28	11.65	73.42	71.18	54.05
## Clarity.LACE..Score	71.0	5.00	68.000	56.0	28.00	5.00	78.00	70.00	58.00
## CV residual	6.6	-6.84	0.659	-15.3	-1.28	-6.65	4.58	-1.18	3.95
##	1771	1791	1810	1814	1834	1845	1869	1873	1882
## Predicted	17.39	55.23	52.16	29.02	64.48	30.92	68.46	37.6	60.70
## cvpred	17.37	54.93	51.84	28.62	64.04	30.82	68.05	37.3	60.31
## Clarity.LACE..Score	16.00	58.00	60.00	38.00	67.00	40.00	73.00	60.0	56.00
## CV residual	-1.37	3.07	8.16	9.38	2.96	9.18	4.95	22.7	-4.31
##	1895	1896	1920	1922	1931	1959	1997	1999	2012
## Predicted	57.7	43.30	62.4	49.77	85.9	41.0	65.94	55.80	70.43
## cvpred	57.5	43.16	61.9	49.37	86.2	40.9	65.47	55.52	70.46
## Clarity.LACE..Score	44.0	49.00	71.0	52.00	76.0	47.0	58.00	58.00	71.00
## CV residual	-13.5	5.84	9.1	2.63	-10.2	6.1	-7.47	2.48	0.54
##	2048	2060	2107	2111	2142	2153	2169	2179	2182
## Predicted	13.05	65.99	56.3	28.53	49.00	62.87	15.76	54.5	23.62
## cvpred	12.99	65.78	55.9	28.28	48.78	62.67	15.79	54.2	23.32
## Clarity.LACE..Score	6.00	73.00	71.0	31.00	52.00	72.00	7.00	36.0	28.00
## CV residual	-6.99	7.22	15.1	2.72	3.22	9.33	-8.79	-18.2	4.68
##	2188	2197	2204	2238	2255	2261	2269	2276	
## Predicted	71.37	12.74	74.506	68.26	70.134	53.47	17.155	65.3	
## cvpred	71.11	12.66	74.692	67.74	69.682	53.59	17.006	64.7	

## Clarity.LACE..Score	68.00	13.00	75.000	69.00	70.000	46.00	18.000	62.0	
## CV residual	-3.11	0.34	0.308	1.26	0.318	-7.59	0.994	-2.7	
##	2336	2340	2344	2352	2355	2378	2401	2410	2431
## Predicted	24.77	55.10	61.73	11.75	12.65	11.50	82.17	34.1	44.7
## cvpred	24.49	54.81	61.36	11.71	12.62	11.46	82.02	33.9	44.3
## Clarity.LACE..Score	28.00	58.00	67.00	5.00	5.00	14.00	76.00	44.0	49.0
## CV residual	3.51	3.19	5.64	-6.71	-7.62	2.54	-6.02	10.1	4.7
##	2435	2495	2497	2498	2510	2541	2544	2545	2563
## Predicted	39.89	69.42	41.1	64.6	54.6	56.56	57.25	44.61	74.28
## cvpred	39.65	69.41	40.8	64.1	54.4	56.25	56.92	44.42	73.98
## Clarity.LACE..Score	46.00	69.00	51.0	70.0	72.0	66.00	60.00	49.00	82.00
## CV residual	6.35	-0.41	10.2	5.9	17.6	9.75	3.08	4.58	8.02
##	2567	2593	2605	2648	2653	2654	2699	2701	2746
## Predicted	59.8	41.91	37.4	46.90	52.81	41.0	46.04	48.98	55.674
## cvpred	59.2	42.21	37.2	46.63	52.29	40.9	45.82	49.08	55.272
## Clarity.LACE..Score	73.0	40.00	46.0	50.00	55.00	47.0	49.00	55.00	56.000
## CV residual	13.8	-2.21	8.8	3.37	2.71	6.1	3.18	5.92	0.728
##	2747	2752	2759	2777	2783	2785	2801	2811	2840
## Predicted	67.09	55.31	17.97	75.09	76.423	45.87	88.0	75.6	46.37
## cvpred	66.58	54.88	17.87	74.72	75.916	45.61	88.3	75.2	46.05
## Clarity.LACE..Score	68.00	56.00	11.00	73.00	75.000	55.00	78.0	89.0	55.00
## CV residual	1.42	1.12	-6.87	-1.72	-0.916	9.39	-10.3	13.8	8.95
##	2881	2891	2906	2918	2921	2962	2964	2980	2988
## Predicted	23.82	42.6	14.28	14.427	74.5	53.7	61.2	71.743	60.65
## cvpred	23.71	42.3	14.22	14.317	74.0	53.3	60.6	71.289	60.21
## Clarity.LACE..Score	20.00	53.0	7.00	15.000	86.0	35.0	63.0	71.000	69.00
## CV residual	-3.71	10.7	-7.22	0.683	12.0	-18.3	2.4	-0.289	8.79
##	3020	3028	3041	3051	3054	3062	3080	3105	3125
## Predicted	71.6	68.75	66.7	24.1	67.22	72.42	28.58	44.7	11.88
## cvpred	71.0	68.87	66.3	23.9	66.61	72.17	28.47	44.3	11.84
## Clarity.LACE..Score	72.0	75.00	77.0	27.0	70.00	75.00	30.00	49.0	2.00
## CV residual	1.0	6.13	10.7	3.1	3.39	2.83	1.53	4.7	-9.84
##	3131	3153	3180	3238	3247	3251	3259	3301	3326
## Predicted	16.28	32.78	75.40	75.01	38.46	53.41	25.35	64.63	51.78
## cvpred	16.29	33.11	75.48	74.83	38.24	53.23	25.28	64.43	51.54
## Clarity.LACE..Score	14.00	38.00	79.00	78.00	45.00	55.00	27.00	69.00	56.00
## CV residual	-2.29	4.89	3.52	3.17	6.76	1.77	1.72	4.57	4.46
##	3329	3364	3372	3375	3415	3428	3467	3475	3488
## Predicted	30.67	42.25	59.21	66.8	11.56	66.96	29.3	74.91	57.87
## cvpred	30.57	41.94	58.68	66.7	11.52	66.85	29.1	74.52	57.57
## Clarity.LACE..Score	40.00	50.00	53.00	70.0	5.00	73.00	9.0	73.00	54.00
## CV residual	9.43	8.06	-5.68	3.3	-6.52	6.15	-20.1	-1.52	-3.57
##	3490	3531	3538	3555	3628	3637	3648	3691	3766
## Predicted	50.72	36.27	53.8	65.39	45.10	54.6	73.86	64.58	69.45
## cvpred	50.23	36.06	53.5	64.84	44.76	54.2	73.66	64.19	68.95
## Clarity.LACE..Score	53.00	39.00	74.0	57.00	49.00	44.0	77.00	72.00	72.00
## CV residual	2.77	2.94	20.5	-7.84	4.24	-10.2	3.34	7.81	3.05
##	3773	3782	3785	3787	3824	3853	3867	3893	3910
## Predicted	47.75	80.61	83.04	68.42	66.36	35.9	68.9	65.89	76.90
## cvpred	47.59	80.65	82.93	68.13	66.33	35.7	68.7	65.62	76.95

```

## Clarity.LACE..Score 47.00 77.00 76.00 70.00 75.00 44.0 46.0 68.00 81.00
## CV residual -0.59 -3.65 -6.93 1.87 8.67 8.3 -22.7 2.38 4.05
## 3911 3938 3943 3953 3954 3965 3971 3985 3988
## Predicted 63.5 67.97 11.4 59.58 76.3 41.2 43.33 16.54 37.75
## cvpred 62.8 67.94 11.4 59.26 75.8 40.9 43.62 16.54 37.52
## Clarity.LACE..Score 75.0 77.00 4.0 66.00 57.0 51.0 47.00 8.00 44.00
## CV residual 12.2 9.06 -7.4 6.74 -18.8 10.1 3.38 -8.54 6.48
##
## Sum of squares = 16103 Mean square = 66.8 n = 241
##
## fold 5
## Observations in test set: 241
## 24 26 66 105 138 151 180 190 207
## Predicted 69.6 39.74 47.03 65.06 57.6 51.104 35.93 42.2 11.5
## cvpred 70.6 39.37 47.17 64.64 57.8 50.589 35.48 42.4 11.4
## Clarity.LACE..Score 74.0 46.00 50.00 72.00 30.0 51.000 44.00 47.0 4.0
## CV residual 3.4 6.63 2.83 7.36 -27.8 0.411 8.52 4.6 -7.4
## 220 221 251 257 261 265 277 282 297
## Predicted 69.2 34.25 76.9 66.5 65.91 8.452 65.39 36.93 62.18
## cvpred 68.8 33.71 77.3 66.1 65.57 8.209 65.29 36.98 61.75
## Clarity.LACE..Score 76.0 42.00 66.0 71.0 75.00 8.000 71.00 38.00 66.00
## CV residual 7.2 8.29 -11.3 4.9 9.43 -0.209 5.71 1.02 4.25
## 304 321 322 331 334 353 392 408 413
## Predicted 36.31 64.6 58.4 72.57 46.9 67.7 62.6 37.5 46.6
## cvpred 35.98 64.4 58.0 72.72 47.0 67.7 62.2 36.9 46.6
## Clarity.LACE..Score 44.00 48.0 45.0 78.00 50.0 75.0 77.0 48.0 33.0
## CV residual 8.02 -16.4 -13.0 5.28 3.0 7.3 14.8 11.1 -13.6
## 418 435 447 448 458 491 497 510 514
## Predicted 68.03 60.6 18.92 59.7 34.37 38.8 37.2 73.07 60.44
## cvpred 67.49 59.9 18.86 59.0 33.83 38.5 36.9 72.87 59.76
## Clarity.LACE..Score 66.00 54.0 15.00 66.0 42.00 49.0 47.0 74.00 69.00
## CV residual -1.49 -5.9 -3.86 7.0 8.17 10.5 10.1 1.13 9.24
## 516 519 530 550 607 617 618 629 640 643
## Predicted 63.13 55.25 64.79 37.2 56.89 13.3 57.9 38.9 69.9 11.5
## cvpred 62.95 55.56 64.62 36.8 56.97 13.0 58.0 39.1 69.8 11.4
## Clarity.LACE..Score 58.00 56.00 71.00 51.0 63.00 43.0 45.0 50.0 83.0 4.0
## CV residual -4.95 0.44 6.38 14.2 6.03 30.0 -13.0 10.9 13.2 -7.4
## 652 658 668 678 682 685 738 748
## Predicted 72.1427 35.60 9.94 32.5 77.49 54.19 58.008 13.05
## cvpred 72.0517 35.05 9.76 32.3 77.53 54.35 58.169 13.05
## Clarity.LACE..Score 72.0000 44.00 3.00 43.0 76.00 56.00 59.000 6.00
## CV residual -0.0517 8.95 -6.76 10.7 -1.53 1.65 0.831 -7.05
## 791 796 842 854 886 914 932 954 974
## Predicted 42.12 67.17 65.81 69.25 47.01 44.81 78.873 75.63 44.66
## cvpred 42.23 67.02 65.64 69.22 47.13 44.86 78.887 75.62 44.73
## Clarity.LACE..Score 47.00 72.00 70.00 78.00 52.00 48.00 79.000 71.00 52.00
## CV residual 4.77 4.98 4.36 8.78 4.87 3.14 0.113 -4.62 7.27
## 983 1043 1062 1070 1086 1090 1098 1102 1103
## Predicted 53.21 63.05 39.8 78.46 39.77 14.160 49.60 8.64 40.18
## cvpred 53.25 62.87 39.8 78.55 39.76 14.308 49.83 8.46 40.74

```

## Clarity.LACE..Score	55.00	68.00	15.0	75.00	47.00	14.000	53.00	2.00	46.00
## CV residual	1.75	5.13	-24.8	-3.55	7.24	-0.308	3.17	-6.46	5.26
##	1119	1124	1142	1159	1178	1189	1198	1200	1210
## Predicted	14.2	48.78	51.5	67.47	41.03	70.315	37.614	75.44	11.63
## cvpred	14.1	48.65	51.7	67.77	40.67	69.749	38.283	75.35	11.58
## Clarity.LACE..Score	7.0	47.00	62.0	61.00	50.00	69.000	39.000	74.00	5.00
## CV residual	-7.1	-1.65	10.3	-6.77	9.33	-0.749	0.717	-1.35	-6.58
##	1221	1246	1252	1257	1295	1298	1300	1306	1324
## Predicted	15.4	61.56	33.03	12.9	59.96	69.22	53.26	37.5	77.36
## cvpred	15.5	61.23	32.61	12.8	60.26	69.12	53.33	36.8	77.36
## Clarity.LACE..Score	32.0	67.00	42.00	6.0	65.00	72.00	55.00	18.0	72.00
## CV residual	16.5	5.77	9.39	-6.8	4.74	2.88	1.67	-18.8	-5.36
##	1439	1477	1486	1495	1502	1552	1569	1605	1644
## Predicted	69.75	56.0	56.21	13.05	81.55	71.91	13.05	58.632	70.95
## cvpred	69.56	55.9	56.18	13.05	81.02	71.82	13.05	58.781	70.21
## Clarity.LACE..Score	72.00	57.0	47.00	6.00	79.00	76.00	6.00	59.000	76.00
## CV residual	2.44	1.1	-9.18	-7.05	-2.02	4.18	-7.05	0.219	5.79
##	1647	1661	1668	1697	1698	1727	1736	1741	
## Predicted	39.67	55.119	77.417	63.3	57.25	72.231	22.75	63.88	
## cvpred	39.51	55.392	77.494	63.0	57.14	72.499	23.19	63.59	
## Clarity.LACE..Score	45.00	56.000	77.000	75.0	60.00	72.000	25.00	57.00	
## CV residual	5.49	0.608	-0.494	12.0	2.86	-0.499	1.81	-6.59	
##	1752	1756	1767	1768	1803	1825	1841	1853	1861
## Predicted	70.159	37.7	35.35	33.2	73.92	32.75	73.6	11.75	69.0
## cvpred	69.703	37.1	34.95	33.7	73.89	33.27	73.5	11.75	69.1
## Clarity.LACE..Score	70.000	51.0	43.00	49.0	72.00	35.00	54.0	5.00	56.0
## CV residual	0.297	13.9	8.05	15.3	-1.89	1.73	-19.5	-6.75	-13.1
##	1880	1893	1970	2016	2018	2024	2031	2039	2046
## Predicted	15.51	41.23	58.0	69.02	35.5	60.77	52.16	18.8	60.7
## cvpred	15.48	41.16	57.5	69.51	35.8	60.04	52.77	18.7	60.5
## Clarity.LACE..Score	8.00	46.00	77.0	73.00	27.0	70.00	47.00	40.0	45.0
## CV residual	-7.48	4.84	19.5	3.49	-8.8	9.96	-5.77	21.3	-15.5
##	2047	2065	2070	2073	2098	2120	2122	2162	2203
## Predicted	76.190	68.3	53.1	39.35	42.54	11.69	69.1	48.54	76.46
## cvpred	75.555	68.2	53.3	39.09	42.47	11.66	68.7	48.64	76.98
## Clarity.LACE..Score	75.000	36.0	55.0	45.00	47.00	5.00	73.0	51.00	75.00
## CV residual	-0.555	-32.2	1.7	5.91	4.53	-6.66	4.3	2.36	-1.98
##	2230	2233	2241	2253	2296	2303	2384	2386	2391
## Predicted	16.60	77.89	11.5	13.55	65.84	72.77	22.75	69.19	44.87
## cvpred	16.61	78.73	11.4	13.41	65.65	72.81	22.91	68.78	44.72
## Clarity.LACE..Score	14.00	75.00	4.0	5.00	72.00	74.00	20.00	73.00	49.00
## CV residual	-2.61	-3.73	-7.4	-8.41	6.35	1.19	-2.91	4.22	4.28
##	2405	2406	2416	2464	2478	2480	2486	2502	2516
## Predicted	67.2	74.517	37.27	46	12.8018	75.84	60.84	37.56	61.6
## cvpred	67.0	74.476	37.71	46	12.9224	76.09	60.31	37.46	61.0
## Clarity.LACE..Score	54.0	75.000	41.00	33	13.0000	72.00	68.00	46.00	77.0
## CV residual	-13.0	0.524	3.29	-13	0.0776	-4.09	7.69	8.54	16.0
##	2549	2584	2600	2617	2659	2687	2691	2703	2710
## Predicted	78.46	71.36	54.274	45.9	42.12	52.70	11.5	63.6	11.30
## cvpred	78.55	72.37	53.556	46.4	42.23	52.57	11.4	63.0	11.15

## Clarity.LACE..Score	76.00	73.00	53.000	36.0	47.00	56.00	4.0	75.0	4.00
## CV residual	-2.55	0.63	-0.556	-10.4	4.77	3.43	-7.4	12.0	-7.15
##	2712	2722	2725	2778	2812	2824	2835	2844	2847
## Predicted	30.8	49.11	79.079	11.9	30.78	65.71	60.217	76.5	47.7
## cvpred	30.4	49.31	79.219	12.0	31.32	64.62	60.828	76.4	47.9
## Clarity.LACE..Score	46.0	51.00	80.000	5.0	37.00	66.00	60.000	68.0	31.0
## CV residual	15.6	1.69	0.781	-7.0	5.68	1.38	-0.828	-8.4	-16.9
##	2861	2884	2887	2898	2914	2924	2947	2998	3008
## Predicted	74.87	20.40	7.86	69.6	71.15	30.056	44.72	49.3	50.81
## cvpred	74.97	20.17	7.86	69.5	71.16	30.482	44.33	49.6	50.48
## Clarity.LACE..Score	71.00	13.00	2.00	57.0	70.00	30.000	50.00	64.0	55.00
## CV residual	-3.97	-7.17	-5.86	-12.5	-1.16	-0.482	5.67	14.4	4.52
##	3011	3012	3027	3047	3059	3069	3093	3096	3120
## Predicted	47.16	65.0	13.82	14.09	10.26	34.24	24.91	49.12	22.06
## cvpred	47.12	64.9	13.67	14.02	10.18	33.66	25.42	48.87	22.47
## Clarity.LACE..Score	50.00	53.0	6.00	10.00	3.00	43.00	29.00	50.00	26.00
## CV residual	2.88	-11.9	-7.67	-4.02	-7.18	9.34	3.58	1.13	3.53
##	3127	3142	3167	3175	3178	3196	3204	3222	3268
## Predicted	70.08	61.9	53.15	34.989	13.30	48.3	72.39	64.391	47.20
## cvpred	70.05	61.2	53.09	35.354	13.39	48.3	72.16	64.088	46.84
## Clarity.LACE..Score	74.00	49.0	51.00	36.000	6.00	51.0	74.00	65.000	54.00
## CV residual	3.95	-12.2	-2.09	0.646	-7.39	2.7	1.84	0.912	7.16
##	3274	3276	3277	3286	3336	3347	3350	3354	3365
## Predicted	62.9	70.35	68.4	65.9	41.76	45.82	11.50	69.6	39.3
## cvpred	63.4	70.08	67.6	65.6	42.08	45.87	11.41	69.6	39.7
## Clarity.LACE..Score	74.0	79.00	81.0	76.0	35.00	50.00	5.00	52.0	50.0
## CV residual	10.6	8.92	13.4	10.4	-7.08	4.13	-6.41	-17.6	10.3
##	3410	3536	3547	3569	3577	3597	3607	3652	
## Predicted	18.02	66.9	67.04	48.2	54.125	73.543	16.8881	52.16	
## cvpred	18.08	66.7	66.94	48.4	54.266	73.404	17.0911	52.15	
## Clarity.LACE..Score	15.00	71.0	68.00	35.0	55.000	73.000	17.0000	62.00	
## CV residual	-3.08	4.3	1.06	-13.4	0.734	-0.404	-0.0911	9.85	
##	3661	3684	3686	3689	3700	3720	3738	3751	
## Predicted	62.37	45.47	10.33	43.4	76.9	39.52	12.8018	68.85	
## cvpred	62.78	45.41	10.28	43.2	77.0	39.43	12.9224	68.83	
## Clarity.LACE..Score	58.00	50.00	5.00	25.0	64.0	49.00	13.0000	70.00	
## CV residual	-4.78	4.59	-5.28	-18.2	-13.0	9.57	0.0776	1.17	
##	3767	3778	3779	3808	3828	3833	3859	3862	
## Predicted	61.16	65.56	50.7	20.8469	66.4	32.8	56.141	17.95	
## cvpred	60.91	67.41	50.7	21.0917	66.9	32.7	56.375	18.28	
## Clarity.LACE..Score	58.00	62.00	35.0	21.0000	54.0	59.0	57.000	20.00	
## CV residual	-2.91	-5.41	-15.7	-0.0917	-12.9	26.3	0.625	1.72	
##	3880	3901	3921	3922	3925	3929	3932	3961	3977
## Predicted	48.1	63.2	70.1	62.72	66.4	64.54	71.399	52.03	30.6
## cvpred	48.2	62.9	69.9	63.06	66.4	64.42	71.103	51.99	32.7
## Clarity.LACE..Score	28.0	74.0	71.0	57.00	45.0	73.00	71.000	50.00	21.0
## CV residual	-20.2	11.1	1.1	-6.06	-21.4	8.58	-0.103	-1.99	-11.7
##	3980	3999							
## Predicted	63.89	58.63							
## cvpred	64.19	58.78							



```
## Clarity.LACE..Score 67.00 65.00
## CV residual          2.81  6.22
##
## Sum of squares = 19085      Mean square = 79.2      n = 241
##
## Overall (Sum over all 241 folds)
##      ms
## 80.2
```

```
attr(cvmodel5,'ms')
```

```
## [1] 80.2
```

```
par(mfrow=c(2,2))
plot(model5)
```

