

Group Project

Name: Predicting Deficits in Action Prediction from Tumor Location_Course_STAT 627-
Statistical Machine Learning

PUBLISHED

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#Start of EDA

```
#install needed libraries and read in data to a data frame; then view data
library(dplyr)
```

Attaching package: 'dplyr'

The following objects are masked from 'package:stats':

filter, lag

The following objects are masked from 'package:base':

intersect, setdiff, setequal, union

```
library(readr)
library(car)
```

Loading required package: carData

Attaching package: 'car'

The following object is masked from 'package:dplyr':

recode

```
data <- read_csv("D:\\MS Data Science_online\\STAT_627_FALL2025\\BAROUTI_FALL2025\\Group Project\\")
```

Rows: 69 Columns: 24

— Column specification —————

Delimiter: ","

dbl (24): Id, Sex, Age, AgeMonths, Location, Age at diagnosis (months), Time...

i Use `spec()` to retrieve the full column specification for this data.

i Specify the column types or set `show_col_types = FALSE` to quiet this message.

```
glimpse(data)
```

Rows: 69
Columns: 24

\$ Id	<dbl>	110, 120, 122, 123, 124, 125, 126, 128...
\$ Sex	<dbl>	0, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, ...
\$ Age	<dbl>	14.58, 12.29, 17.40, 8.42, 17.57, 18.1...
\$ AgeMonths	<dbl>	174.93, 147.47, 208.77, 101.07, 210.83...
\$ Location	<dbl>	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, ...
\$ `Age at diagnosis (months)`	<dbl>	96, 103, 70, 54, 160, 72, 23, 131, 32, ...
\$ `Time since diagnosis (months)`	<dbl>	79, 44, 139, 47, 51, 146, 130, 33, 169...
\$ `Tumor type`	<dbl>	1, 4, 4, 4, 1, 2, 2, 3, 3, 4, 3, 4, 4, ...
\$ Radiotherapy	<dbl>	1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, ...
\$ Chemotherapy	<dbl>	1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, ...
\$ Neurosurgery	<dbl>	1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, ...
\$ FSIQ	<dbl>	87, 116, 111, 132, 60, 100, 66, 91, 10...
\$ `TomA Raw scores`	<dbl>	17, 16, 15, 16, 14, 17, 16, 14, 16, 14...
\$ `TomA-Tscores`	<dbl>	13.00, 11.81, 7.11, 14.65, 4.18, 12.98...
\$ `TomB Raw scores`	<dbl>	8, 8, 6, 6, 5, 7, 5, 7, 8, 5, 8, 6, 8, ...
\$ `TomB-Tscores`	<dbl>	13.15, 13.91, 6.25, 10.29, 3.00, 9.50, ...
\$ `Affect Rec. Raw scores`	<dbl>	31, 29, 27, 25, 25, 31, 21, 25, 30, 23...
\$ `Affect Rec.-Tscores`	<dbl>	11.02, 10.12, 6.46, 6.77, 4.19, 11.00, ...
\$ `Accuracy Familiarization`	<dbl>	1.00, 0.99, 0.96, 1.00, 0.98, 0.99, 0...
\$ `ATP 10%`	<dbl>	0.85, 0.85, 0.95, 0.80, 0.79, 0.45, 0...
\$ `ATP 40%`	<dbl>	0.90, 0.63, 0.74, 0.74, 0.80, 0.95, 0...
\$ `ATP 60%`	<dbl>	0.89, 0.80, 0.90, 0.40, 0.74, 0.80, 0...
\$ `ATP 90%`	<dbl>	0.84, 0.84, 0.70, 0.95, 0.75, 0.85, 0...
\$ `BETA index`	<dbl>	0.504, 0.126, -0.686, 0.111, -0.740, 0...

#Data Cleaning

```
# data cleaning

# change data types to factor; majority boolean; tumor type range from 1 to 4
data$Sex<- as.factor(data$Sex)
data$Location <- as.factor(data$Location)
data$`Tumor type` <- as.factor(data$`Tumor type`)
data$Radiotherapy <- as.factor(data$Radiotherapy)
data$Chemotherapy <- as.factor(data$Chemotherapy)
data$Neurosurgery <- as.factor(data$Neurosurgery)

head(data)
```

```
# A tibble: 6 × 24
  Id Sex     Age AgeMonths Location `Age at diagnosis (months)`
  <dbl> <fct> <dbl>    <dbl> <fct>                  <dbl>
1 110 0      14.6     175. 1                         96
2 120 0      12.3     147. 1                         103
3 122 0      17.4     209. 1                        70
4 123 0      8.42     101. 1                        54
```

```

5   124 1      17.6       211. 1           160
6   125 1      18.2       218. 1           72
# i 18 more variables: `Time since diagnosis (months)` <dbl>,
# `Tumor type` <fct>, Radiotherapy <fct>, Chemotherapy <fct>,
# Neurosurgery <fct>, FSIQ <dbl>, `TomA Raw scores` <dbl>,
# `TomA-Tscores` <dbl>, `TomB Raw scores` <dbl>, `TomB-Tscores` <dbl>,
# `Affect Rec. Raw scores` <dbl>, `Affect Rec.-Tscores` <dbl>,
# `Accuracy Familiarization` <dbl>, `ATP 10%` <dbl>, `ATP 40%` <dbl>,
# `ATP 60%` <dbl>, `ATP 90%` <dbl>, `BETA index` <dbl>

```

```

#data cleaning
#checking duplicate entries

sum(duplicated(data))

```

[1] 5

```
data[duplicated(data),]
```

```

# A tibble: 5 × 24
  Id Sex     Age AgeMonths Location `Age at diagnosis (months)`
  <dbl> <fct> <dbl> <dbl> <fct> <dbl>
1 NA <NA>    NA    NA <NA>          NA
2 NA <NA>    NA    NA <NA>          NA
3 NA <NA>    NA    NA <NA>          NA
4 NA <NA>    NA    NA <NA>          NA
5 NA <NA>    NA    NA <NA>          NA
# i 18 more variables: `Time since diagnosis (months)` <dbl>,
# `Tumor type` <fct>, Radiotherapy <fct>, Chemotherapy <fct>,
# Neurosurgery <fct>, FSIQ <dbl>, `TomA Raw scores` <dbl>,
# `TomA-Tscores` <dbl>, `TomB Raw scores` <dbl>, `TomB-Tscores` <dbl>,
# `Affect Rec. Raw scores` <dbl>, `Affect Rec.-Tscores` <dbl>,
# `Accuracy Familiarization` <dbl>, `ATP 10%` <dbl>, `ATP 40%` <dbl>,
# `ATP 60%` <dbl>, `ATP 90%` <dbl>, `BETA index` <dbl>

```

**Found 5 dupes

```

# data cleaning
# remove dupes

data<-data%>%
  distinct()

```

```

#data cleaning
#test to make sure dupes are removed
sum(duplicated(data))

```

[1] 0

```
data[duplicated(data),]
```

```
# A tibble: 0 × 24
# i 24 variables: Id <dbl>, Sex <fct>, Age <dbl>, AgeMonths <dbl>,
#   Location <fct>, Age at diagnosis (months) <dbl>,
#   Time since diagnosis (months) <dbl>, Tumor type <fct>, Radiotherapy <fct>,
#   Chemotherapy <fct>, Neurosurgery <fct>, FSIQ <dbl>, TomA Raw scores <dbl>,
#   TomA-Tscores <dbl>, TomB Raw scores <dbl>, TomB-Tscores <dbl>,
#   Affect Rec. Raw scores <dbl>, Affect Rec.-Tscores <dbl>,
#   Accuracy Familiarization <dbl>, ATP 10% <dbl>, ATP 40% <dbl>, ...
```

```
# data cleaning
# check NAs
colSums(is.na(data))
```

	Id	Sex
	1	1
	Age	AgeMonths
	1	1
	Location	Age at diagnosis (months)
	1	22
Time since diagnosis (months)		Tumor type
	22	22
	Radiotherapy	Chemotherapy
	22	22
	Neurosurgery	FSIQ
	22	22
	TomA Raw scores	TomA-Tscores
	22	22
	TomB Raw scores	TomB-Tscores
	22	22
	Affect Rec. Raw scores	Affect Rec.-Tscores
	22	22
Accuracy Familiarization		ATP 10%
	1	1
	ATP 40%	ATP 60%
	1	1
	ATP 90%	BETA index
	1	1

```
# remove NAs
data <- data %>%
  filter(complete.cases(.))

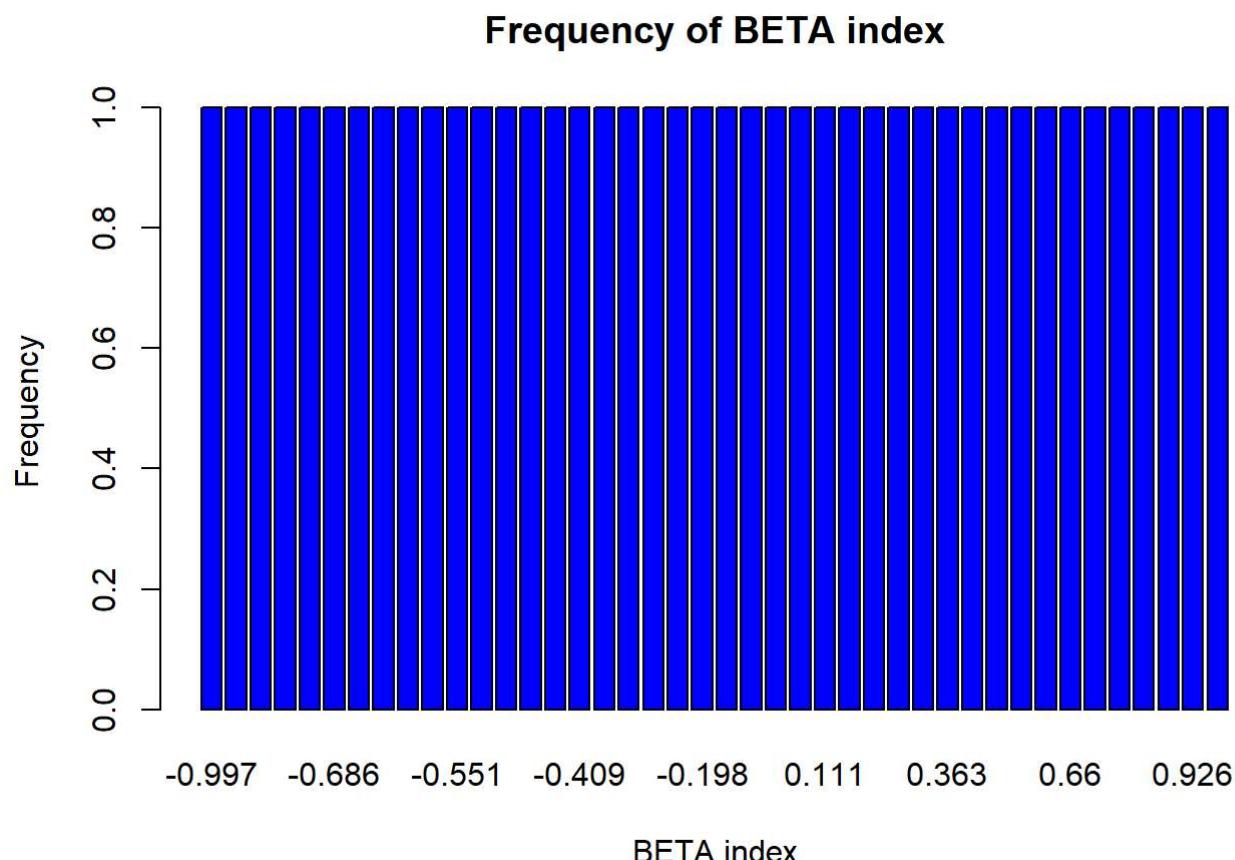
# checking rows and columns
nrow(data)
```

```
ncol(data)
```

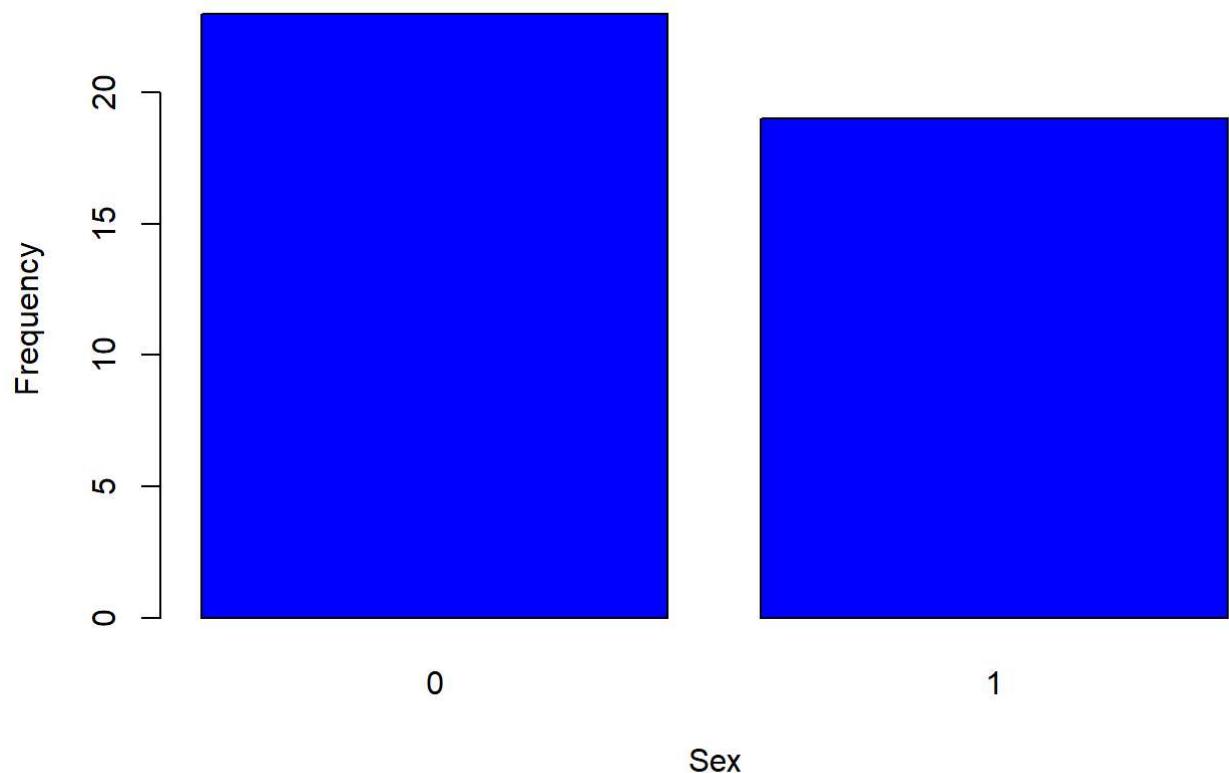
```
[1] 24
```

```
#start of analysis; Recall: high bias => underfitting & high variance =>overfitting
```

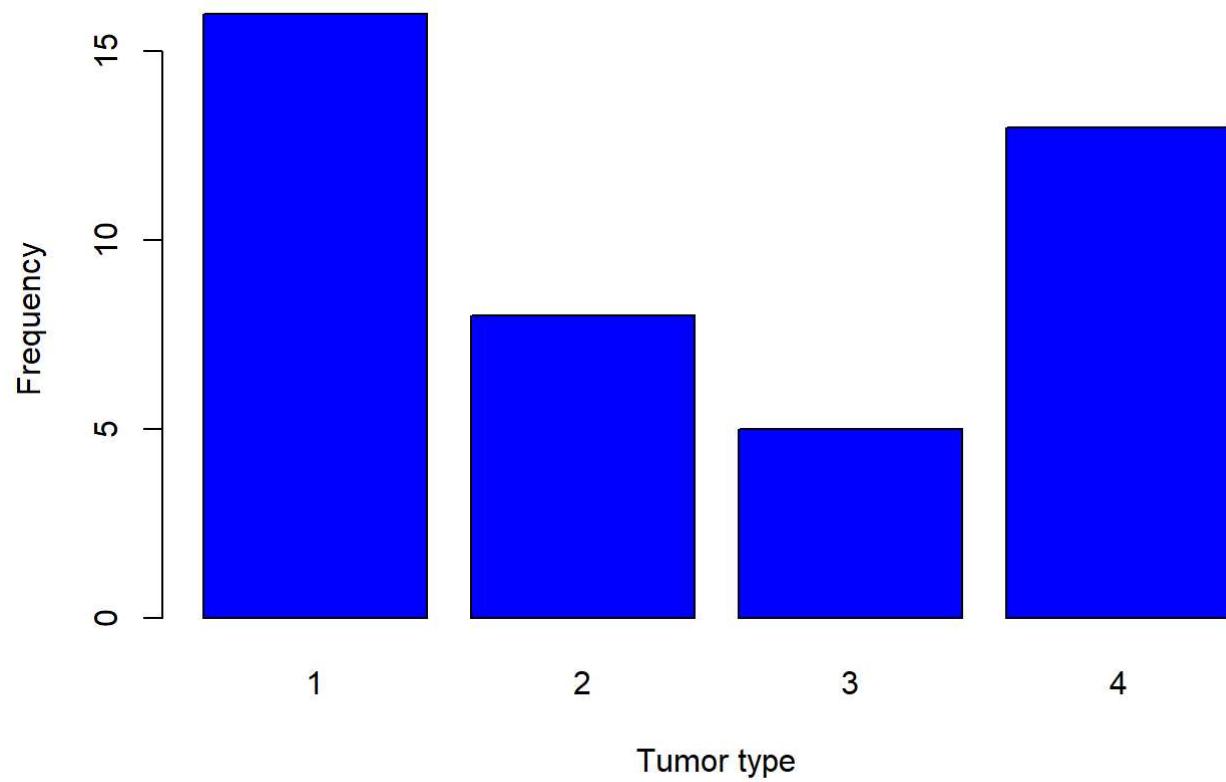
```
#visual 1  
# checking bias and variance in the data using bar plot  
variables <- c("BETA index", "Sex", "Tumor type", "Radiotherapy", "Chemotherapy")  
  
for (var_name in variables) {  
  freq_table <- table(data[[var_name]])  
  
  barplot(freq_table, main = paste("Frequency of", var_name), xlab = var_name, ylab = "Frequency",c
```



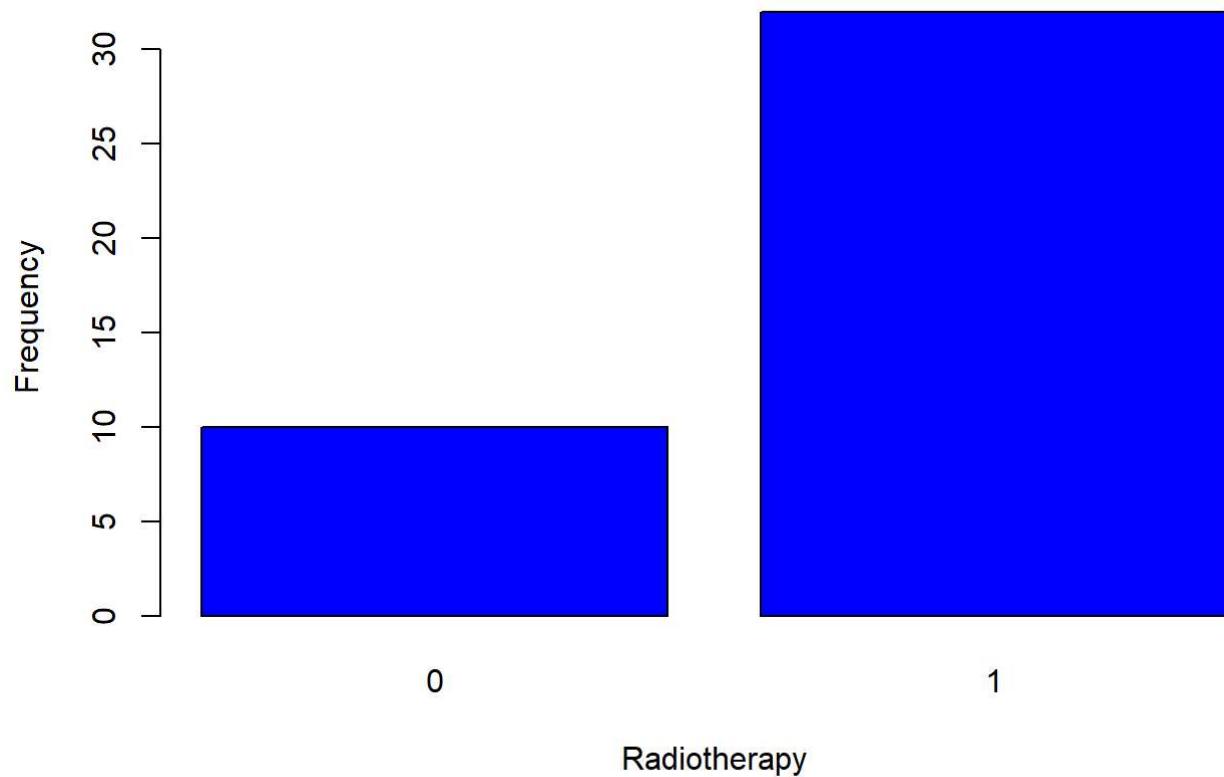
Frequency of Sex



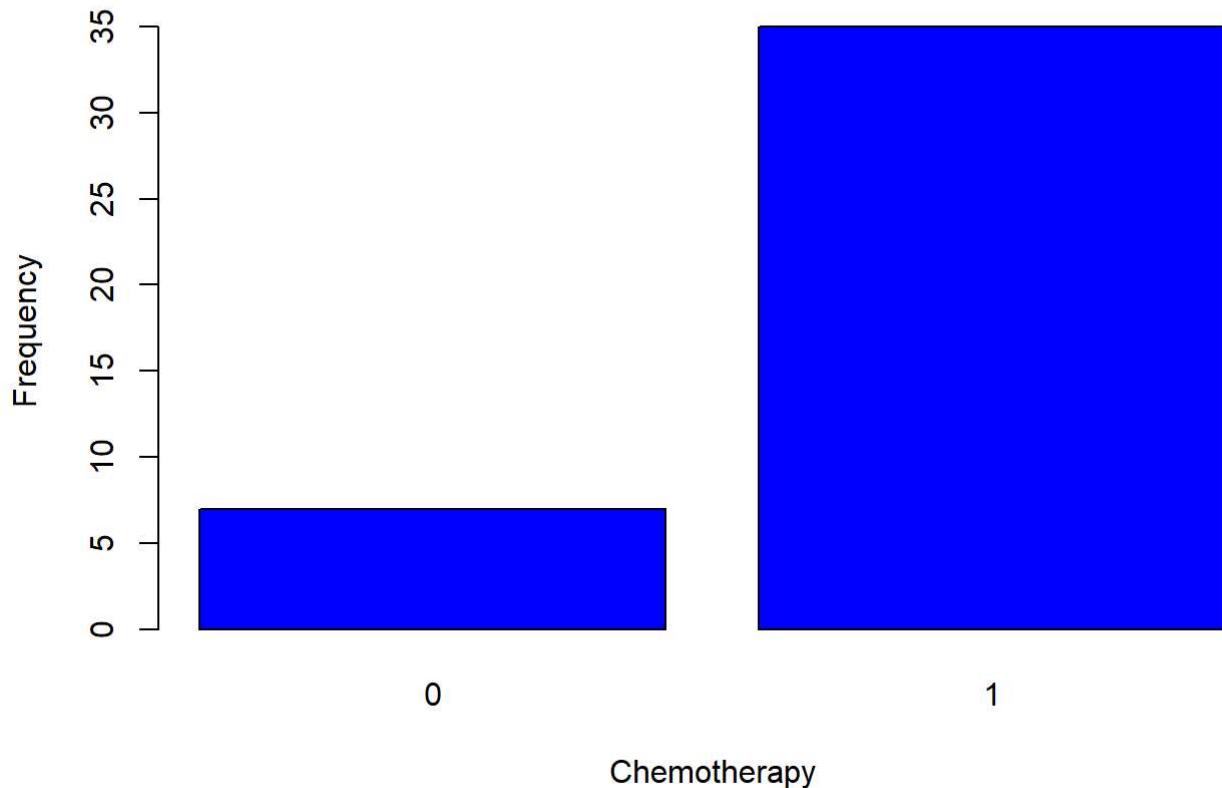
Frequency of Tumor type



Frequency of Radiotherapy



Frequency of Chemotherapy



**bar plots may not be very useful; will look at scatter plots

```
# visual 2
# plot a scatter plot for beta index vs atp 10 and atp 90 and toma-tscoes (sex,age_months)

library(plotly)
```

Warning: package 'plotly' was built under R version 4.5.2

Loading required package: ggplot2

Attaching package: 'plotly'

The following object is masked from 'package:ggplot2':

last_plot

The following object is masked from 'package:stats':

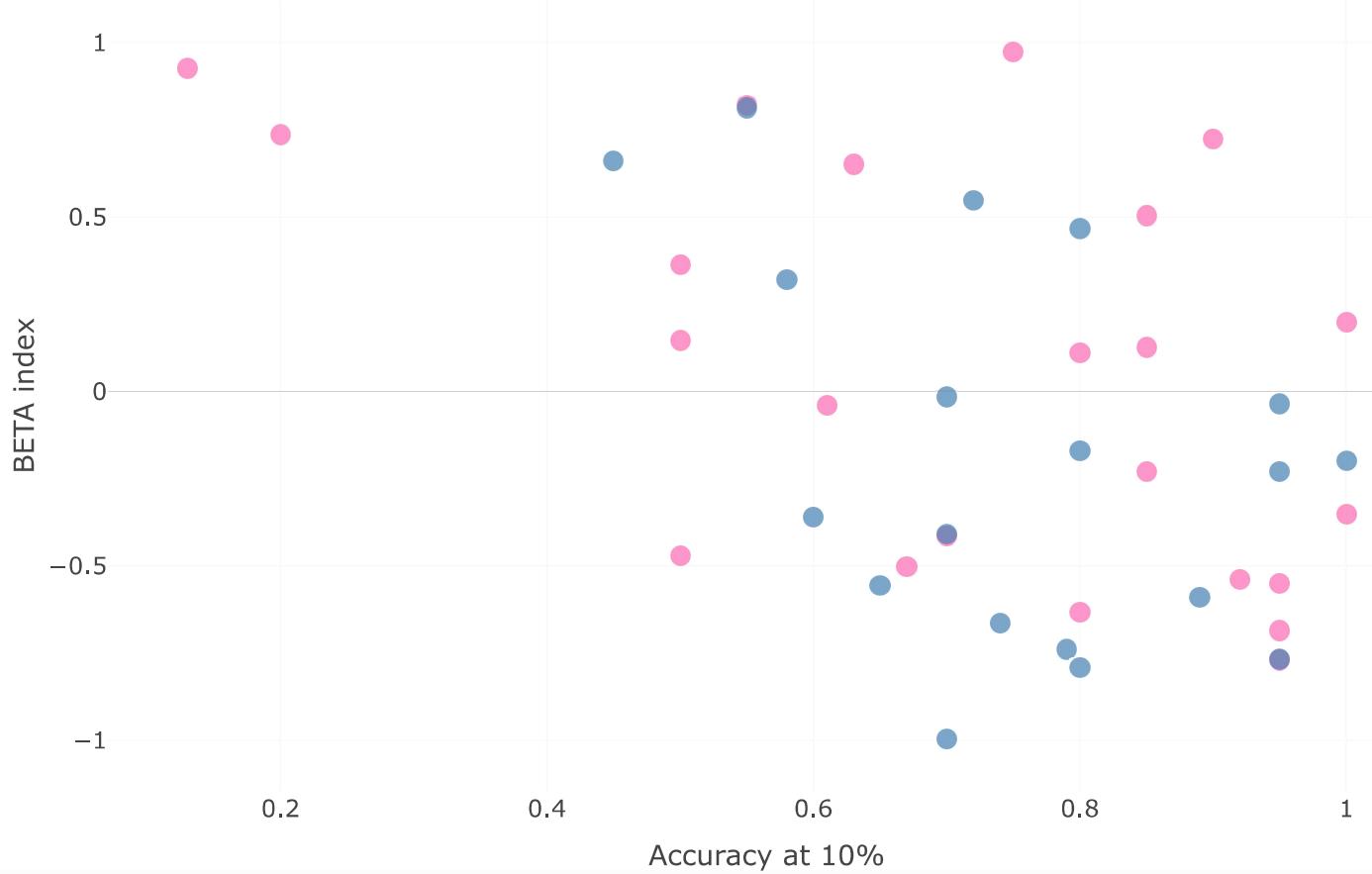
filter

The following object is masked from 'package:graphics':

```
layout
```

```
plot_ly(  
  data = data,  
  x = `ATP 10%`,  
  y = `BETA index`,  
  type = "scatter",  
  mode = "markers",  
  color = ~Sex,  
  colors = c("hotpink", "steelblue"),  
  marker = list(size = 10, opacity = 0.7),  
  hoverinfo = "text",  
  text = ~paste(  
    "ID:", Id,  
    "<br>Sex:", ifelse(Sex == 0, "Female", "Male"),  
    "<br>Accuracy 10%:", round(`ATP 10%`, 3),  
    "<br>Beta Index:", round(`BETA index`, 3)  
  )  
) %>%  
  layout(  
    title = "Interactive Beta Index vs Accuracy (10%) by Sex",  
    xaxis = list(title = "Accuracy at 10%"),  
    yaxis = list(title = "BETA index"),  
    legend = list(title = list(text = "Sex"))  
)
```

Interactive Beta Index vs Accuracy (10%) by Sex



```
# visual 3
# plot a scatter plot for beta index vs atp 10 and atp 90 and toma-tscoes (sex,age_months)

library(plotly)

plot_ly(
  data,
  x = ~ data$`TomA Raw scores`,
  y = ~ data$`BETA index`,
  z = `ATP 90%`,
  color = ~Sex,
  colors = c("hotpink", "steelblue"),
  type = "scatter3d",
  mode = "markers",
  marker = list(size = 5, opacity = 0.8)
) %>%
  layout(
    title = "3D Interactive Plot: TomA vs Beta Index vs Accuracy 90%",
    scene = list(
      xaxis = list(title = "TomA T-scores"),
      yaxis = list(title = "Beta Index"),
      zaxis = list(title = "Accuracy 90%")
    )
  )
}
```

```
)  
)
```

3D Interactive Plot: TomA vs Beta Index vs Accuracy 90%

```
# shows all data cleaning done  
glimpse(data)
```

Rows: 42

Columns: 24

```
$ Id <dbl> 110, 120, 122, 123, 124, 125, 126, 128...  
$ Sex <fct> 0, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1,...  
$ Age <dbl> 14.58, 12.29, 17.40, 8.42, 17.57, 18.1...  
$ AgeMonths <dbl> 174.93, 147.47, 208.77, 101.07, 210.83...  
$ Location <fct> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,...  
$ `Age at diagnosis (months)` <dbl> 96, 103, 70, 54, 160, 72, 23, 131, 32,...  
$ `Time since diagnosis (months)` <dbl> 79, 44, 139, 47, 51, 146, 130, 33, 169...  
$ `Tumor type` <fct> 1, 4, 4, 4, 1, 2, 2, 3, 3, 4, 3, 4, 4,...  
$ Radiotherapy <fct> 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1,...  
$ Chemotherapy <fct> 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1,...  
$ Neurosurgery <fct> 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,...  
$ FSIQ <dbl> 87, 116, 111, 132, 60, 100, 66, 91, 10...  
$ `TomA Raw scores` <dbl> 17, 16, 15, 16, 14, 17, 16, 14, 16, 14...  
$ `TomA-Tscores` <dbl> 13.00, 11.81, 7.11, 14.65, 4.18, 12.98...  
$ `TomB Raw scores` <dbl> 8, 8, 6, 6, 5, 7, 5, 7, 8, 5, 8, 6, 8,...  
$ `TomB-Tscores` <dbl> 13.15, 13.91, 6.25, 10.29, 3.00, 9.50,...
```

```

$ `Affect Rec. Raw scores`      <dbl> 31, 29, 27, 25, 25, 31, 21, 25, 30, 23...
$ `Affect Rec.-Tscores`        <dbl> 11.02, 10.12, 6.46, 6.77, 4.19, 11.00, ...
$ `Accuracy Familiarization`   <dbl> 1.00, 0.99, 0.96, 1.00, 0.98, 0.99, 0...
$ `ATP 10%`                     <dbl> 0.85, 0.85, 0.95, 0.80, 0.79, 0.45, 0...
$ `ATP 40%`                     <dbl> 0.90, 0.63, 0.74, 0.74, 0.80, 0.95, 0...
$ `ATP 60%`                     <dbl> 0.89, 0.80, 0.90, 0.40, 0.74, 0.80, 0...
$ `ATP 90%`                     <dbl> 0.84, 0.84, 0.70, 0.95, 0.75, 0.85, 0...
$ `BETA index`                  <dbl> 0.504, 0.126, -0.686, 0.111, -0.740, 0...

```

Hypothesis beta = 0 || Null hypothesis there is no difference between groups. beta != 0 || Alternated there a difference between groups.

```

# creating model
# Multi colinearity

full_model <- lm(`BETA index` ~ . , data = data)
summary(full_model)

```

Call:

```
lm(formula = `BETA index` ~ ., data = data)
```

Residuals:

Min	1Q	Median	3Q	Max
-0.33734	-0.10728	0.03889	0.13285	0.35914

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	0.922183	2.225715	0.414	0.684133
Id	0.002098	0.005269	0.398	0.695710
Sex1	-0.048050	0.121655	-0.395	0.698081
Age	28.125962	29.698687	0.947	0.357701
AgeMonths	-2.210036	2.490031	-0.888	0.387928
Location2	0.109639	0.170241	0.644	0.528685
`Age at diagnosis (months)`	-0.128912	0.074615	-1.728	0.103290
`Time since diagnosis (months)`	-0.129267	0.074881	-1.726	0.103547
`Tumor type`^2	-0.020744	0.196610	-0.106	0.917284
`Tumor type`^3	0.022106	0.236925	0.093	0.926820
`Tumor type`^4	-0.165108	0.188444	-0.876	0.393907
Radiotherapy1	0.256472	0.252843	1.014	0.325509
Chemotherapy1	0.154897	0.270730	0.572	0.575176
Neurosurgery1	0.227632	0.193193	1.178	0.255921
FSIQ	-0.002388	0.004742	-0.504	0.621327
`TomA Raw scores`	-0.035241	0.121518	-0.290	0.775538
`TomA-Tscores`	0.012720	0.059663	0.213	0.833867
`TomB Raw scores`	-0.020541	0.212301	-0.097	0.924123
`TomB-Tscores`	0.035828	0.066759	0.537	0.598879
`Affect Rec. Raw scores`	-0.125251	0.143171	-0.875	0.394610
`Affect Rec.-Tscores`	0.097368	0.135861	0.717	0.483906
`Accuracy Familiarization`	0.245103	1.064687	0.230	0.820845
`ATP 10%`	-2.517672	0.370224	-6.800	4.26e-06 ***

```

`ATP 40%`          0.313751  0.645860  0.486 0.633703
`ATP 60%`          0.346269  0.524379  0.660 0.518430
`ATP 90%`          2.279053  0.529067  4.308 0.000542 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

```

Residual standard error: 0.2927 on 16 degrees of freedom
 Multiple R-squared: 0.8958, Adjusted R-squared: 0.7331
 F-statistic: 5.504 on 25 and 16 DF, p-value: 0.0004478

Residual standard error: 0.2927 Multiple R-squared: 0.8958 Adjusted R-squared: 0.7331 F-statistic:

5.504 on 25 and 16 D

p-value: 0.0004478 = 4.478 x 10-4

##Observations model P value is significant; R squared about 90 of model variance can be explained;
 Adjusted R squared decreased to 73% because of number of variables, suspect overfitting P value for Predictor: ATP 10% = 4.26e-06 is significant P value for Predictor: ATP 90% = 0.000542 = 5.42e-4 is significant

```

# checking multicollinearity within the variables and that GVIF is between or including 0-10 but no more than 10
vif(full_model)

```

	GVIF	Df	GVIF^(1/(2*Df))
Id	2.865309e+00	1	1.692722
Sex	1.797292e+00	1	1.340631
Age	6.075089e+06	1	2464.769582
AgeMonths	6.150624e+06	1	2480.045194
Location	3.551805e+00	1	1.884623
`Age at diagnosis (months)`	6.050161e+03	1	77.782778
`Time since diagnosis (months)`	4.770319e+03	1	69.067496
`Tumor type`	1.189579e+01	3	1.510888
Radiotherapy	5.685009e+00	1	2.384326
Chemotherapy	4.990221e+00	1	2.233880
Neurosurgery	2.541156e+00	1	1.594101
FSIQ	3.647441e+00	1	1.909827
`TomA Raw scores`	2.544638e+01	1	5.044441
`TomA-Tscores`	2.556421e+01	1	5.056107
`TomB Raw scores`	3.887842e+01	1	6.235256
`TomB-Tscores`	3.848875e+01	1	6.203930
`Affect Rec. Raw scores`	1.177769e+02	1	10.852508
`Affect Rec.-Tscores`	9.874312e+01	1	9.936957
`Accuracy Familiarization`	6.979900e+00	1	2.641950
`ATP 10%`	2.704654e+00	1	1.644583
`ATP 40%`	7.448511e+00	1	2.729196
`ATP 60%`	6.712183e+00	1	2.590788
`ATP 90%`	3.880530e+00	1	1.969906

Based on GVIF we removed the following predictors to reduce the model: is Age, AgeMonths, Age at diagnosis, Time since diagnosis, Tumor type, Affect Rec. Raw scores and ... above 10. removed id, not usefull**

```
# used the variables in reduced model which were GVIF 0-10
#reduced_model_1 <- lm(`BETA index` ~ Id +Sex +Location + Radiotherapy +Chemotherapy + Neurosurgery +
reduced_model_1 <- lm(`BETA index` ~ Sex +Location + Radiotherapy +Chemotherapy + Neurosurgery +
summary(reduced_model_1)
```

Call:

```
lm(formula = `BETA index` ~ Sex + Location + Radiotherapy + Chemotherapy +
  Neurosurgery + FSIQ + `Accuracy Familiarization` + `ATP 10%` +
  `ATP 40%` + `ATP 60%` + `ATP 90%`, data = data)
```

Residuals:

Min	1Q	Median	3Q	Max
-0.54111	-0.18944	0.01978	0.18165	0.45238

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-0.889638	0.535347	-1.662	0.1070
Sex1	-0.002910	0.100813	-0.029	0.9772
Location2	0.109064	0.108108	1.009	0.3211
Radiotherapy1	0.145770	0.192209	0.758	0.4541
Chemotherapy1	0.232067	0.205350	1.130	0.2674
Neurosurgery1	0.207478	0.146075	1.420	0.1658
FSIQ	-0.002074	0.003294	-0.630	0.5336
`Accuracy Familiarization`	-0.245255	0.794815	-0.309	0.7598
`ATP 10%`	-2.502258	0.293231	-8.533	1.60e-09 ***
`ATP 40%`	-0.008976	0.437442	-0.021	0.9838
`ATP 60%`	0.699049	0.364595	1.917	0.0648 .
`ATP 90%`	2.731569	0.349848	7.808	1.03e-08 ***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2848 on 30 degrees of freedom

Multiple R-squared: 0.8152, Adjusted R-squared: 0.7474

F-statistic: 12.03 on 11 and 30 DF, p-value: 3.371e-08

```
# compared values like p-values and standard error to determine better model. We know the VIF shou
reduced_model_2 <- lm(`BETA index` ~ `ATP 10%` + `ATP 90%`, data = data )
summary(reduced_model_2)
```

Call:

```
lm(formula = `BETA index` ~ `ATP 10%` + `ATP 90%`, data = data)
```

```

Residuals:
    Min      1Q Median      3Q     Max
-0.70985 -0.17586 -0.04343  0.17692  0.60831

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) -0.4728     0.2503  -1.889   0.0664 .
`ATP 10%`   -1.9292     0.2508  -7.693 2.44e-09 ***
`ATP 90%`    2.4258     0.2992   8.108 6.79e-10 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3116 on 39 degrees of freedom
Multiple R-squared:  0.7123,    Adjusted R-squared:  0.6975
F-statistic: 48.28 on 2 and 39 DF,  p-value: 2.815e-11
**Above suggests underfitting because Adj R Squared in model 2 is lower than model 1 Adjusted R-squared: 0.6975 (model 2) Adjusted R-squared: 0.7474 (model 1)

```

OBSERVATION:

```
#full_model : # Adjusted R-squared: 0.7331 # Residual standard error: 0.2927 on 16 degrees of freedom #
p-value: 0.0004478
```

1 red_model_1 : (based on vif model we chose the variables with less than 10 vif, because it is such a small dataset)

2 Highest adjusted r squared and lowest standard error so we chose this model.

3 Adjusted R-squared: 0.7388

```
#Residual standard error: 0.2896 on 29 degrees of freedom # p-value: 1.213e-07
```

4 red_model_2

5 Adjusted R-squared: 0.6975

6 Residual standard error: 0.3116 on 39 degrees of freedom

7 p-value: 2.815e-11

```
# linear regression base model without splitting data set.  
full_model <- lm(`BETA index` ~ . , data = data)  
summary(full_model)
```

Call:

```
lm(formula = `BETA index` ~ ., data = data)
```

Residuals:

Min	1Q	Median	3Q	Max
-0.33734	-0.10728	0.03889	0.13285	0.35914

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)		
(Intercept)	0.922183	2.225715	0.414	0.684133		
Id	0.002098	0.005269	0.398	0.695710		
Sex1	-0.048050	0.121655	-0.395	0.698081		
Age	28.125962	29.698687	0.947	0.357701		
AgeMonths	-2.210036	2.490031	-0.888	0.387928		
Location2	0.109639	0.170241	0.644	0.528685		
`Age at diagnosis (months)`	-0.128912	0.074615	-1.728	0.103290		
`Time since diagnosis (months)`	-0.129267	0.074881	-1.726	0.103547		
`Tumor type` ²	-0.020744	0.196610	-0.106	0.917284		
`Tumor type` ³	0.022106	0.236925	0.093	0.926820		
`Tumor type` ⁴	-0.165108	0.188444	-0.876	0.393907		
Radiotherapy1	0.256472	0.252843	1.014	0.325509		
Chemotherapy1	0.154897	0.270730	0.572	0.575176		
Neurosurgery1	0.227632	0.193193	1.178	0.255921		
FSIQ	-0.002388	0.004742	-0.504	0.621327		
`TomA Raw scores`	-0.035241	0.121518	-0.290	0.775538		
`TomA-Tscores`	0.012720	0.059663	0.213	0.833867		
`TomB Raw scores`	-0.020541	0.212301	-0.097	0.924123		
`TomB-Tscores`	0.035828	0.066759	0.537	0.598879		
`Affect Rec. Raw scores`	-0.125251	0.143171	-0.875	0.394610		
`Affect Rec.-Tscores`	0.097368	0.135861	0.717	0.483906		
`Accuracy Familiarization`	0.245103	1.064687	0.230	0.820845		
`ATP 10%`	-2.517672	0.370224	-6.800	4.26e-06 ***		
`ATP 40%`	0.313751	0.645860	0.486	0.633703		
`ATP 60%`	0.346269	0.524379	0.660	0.518430		
`ATP 90%`	2.279053	0.529067	4.308	0.000542 ***		

Signif. codes:	0 `***`	0.001 `**`	0.01 `*`	0.05 `.`	0.1 ' '	1

Residual standard error: 0.2927 on 16 degrees of freedom

Multiple R-squared: 0.8958, Adjusted R-squared: 0.7331

F-statistic: 5.504 on 25 and 16 DF, p-value: 0.0004478

overall p-value is less than 0.05 meaning there is a difference between the groups so we reject the null hypothesis. Hypothesis beta = 0 || Null hypothesis there is no difference between groups. beta != 0 || Alternated there a difference between groups.

```
# linear regression base model without splitting data set.  
full_model_2 <- lm(`BETA index` ~ . , data = data)  
summary(full_model_2)
```

Call:

```
lm(formula = `BETA index` ~ . , data = data)
```

Residuals:

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-0.33734	-0.10728	0.03889	0.13285	0.35914

Coefficients:

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AgeMonths	-2.210036	2.490031	-0.888	0.387928
Location2	0.109639	0.170241	0.644	0.528685
`Age at diagnosis (months)`	-0.128912	0.074615	-1.728	0.103290
`Time since diagnosis (months)`	-0.129267	0.074881	-1.726	0.103547
`Tumor type` 2	-0.020744	0.196610	-0.106	0.917284
`Tumor type` 3	0.022106	0.236925	0.093	0.926820
`Tumor type` 4	-0.165108	0.188444	-0.876	0.393907
Radiotherapy1	0.256472	0.252843	1.014	0.325509
Chemotherapy1	0.154897	0.270730	0.572	0.575176
Neurosurgery1	0.227632	0.193193	1.178	0.255921
FSIQ	-0.002388	0.004742	-0.504	0.621327
`TomA Raw scores`	-0.035241	0.121518	-0.290	0.775538
`TomA-Tscores`	0.012720	0.059663	0.213	0.833867
`TomB Raw scores`	-0.020541	0.212301	-0.097	0.924123
`TomB-Tscores`	0.035828	0.066759	0.537	0.598879
`Affect Rec. Raw scores`	-0.125251	0.143171	-0.875	0.394610
`Affect Rec.-Tscores`	0.097368	0.135861	0.717	0.483906
`Accuracy Familiarization`	0.245103	1.064687	0.230	0.820845
`ATP 10%`	-2.517672	0.370224	-6.800	4.26e-06 ***
`ATP 40%`	0.313751	0.645860	0.486	0.633703
`ATP 60%`	0.346269	0.524379	0.660	0.518430
`ATP 90%`	2.279053	0.529067	4.308	0.000542 ***

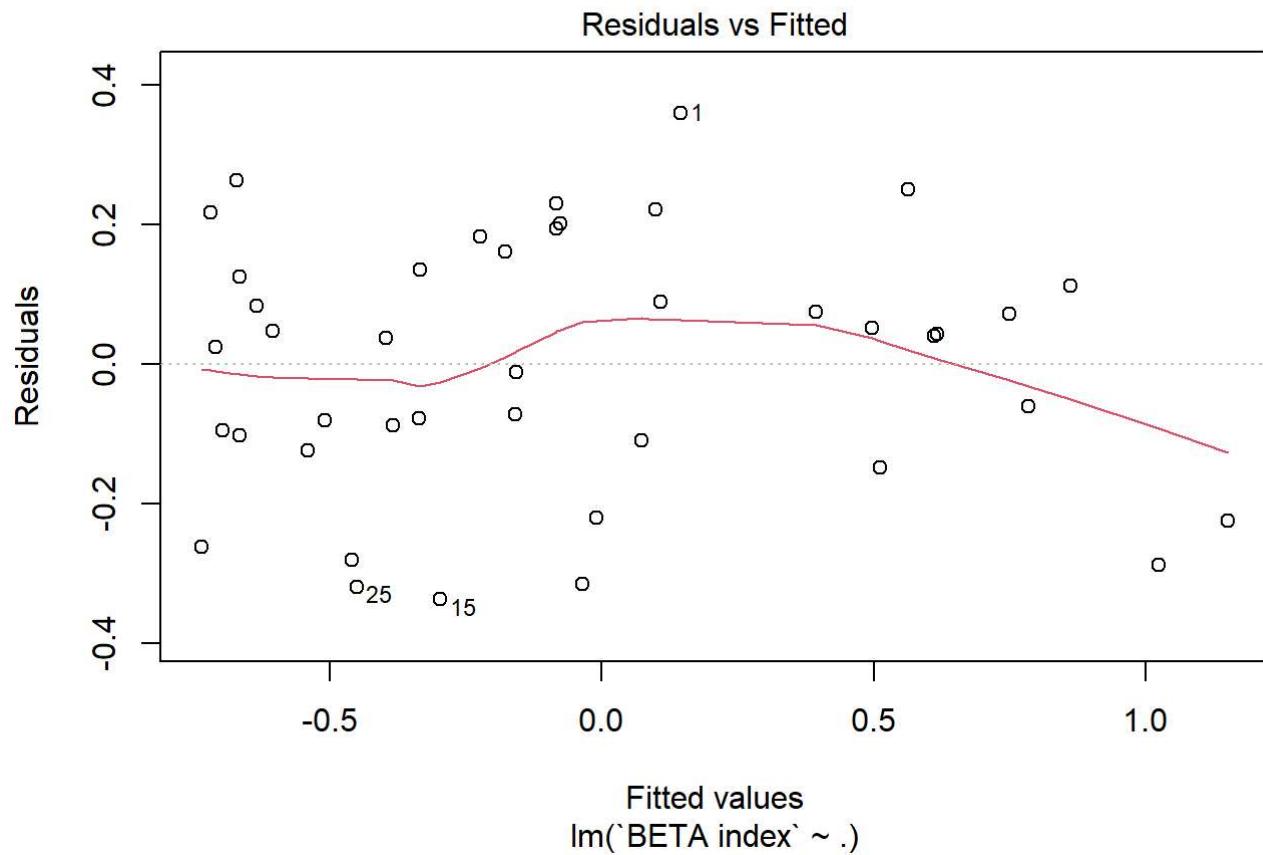
Signif. codes:	0 ****	0.001 **	0.01 *	0.05 .

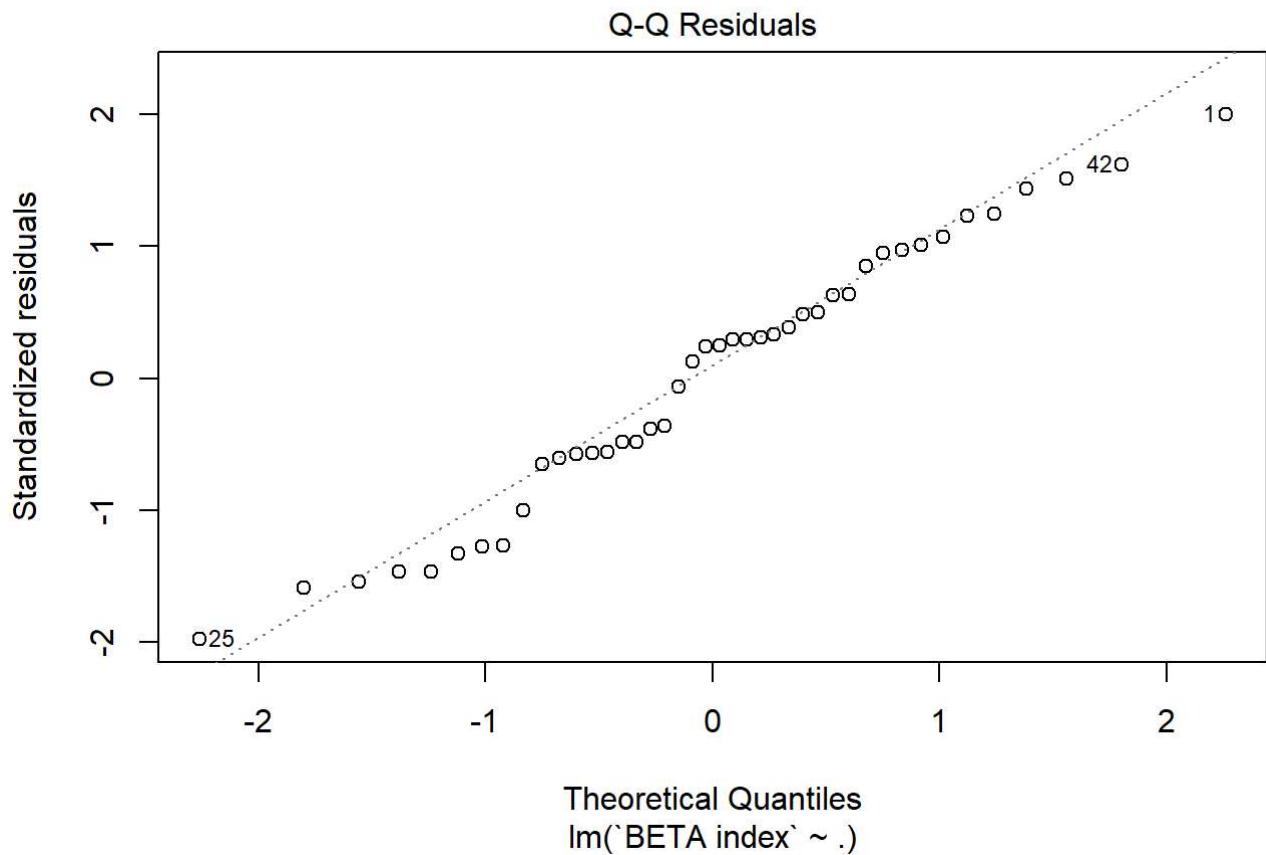
Residual standard error: 0.2927 on 16 degrees of freedom

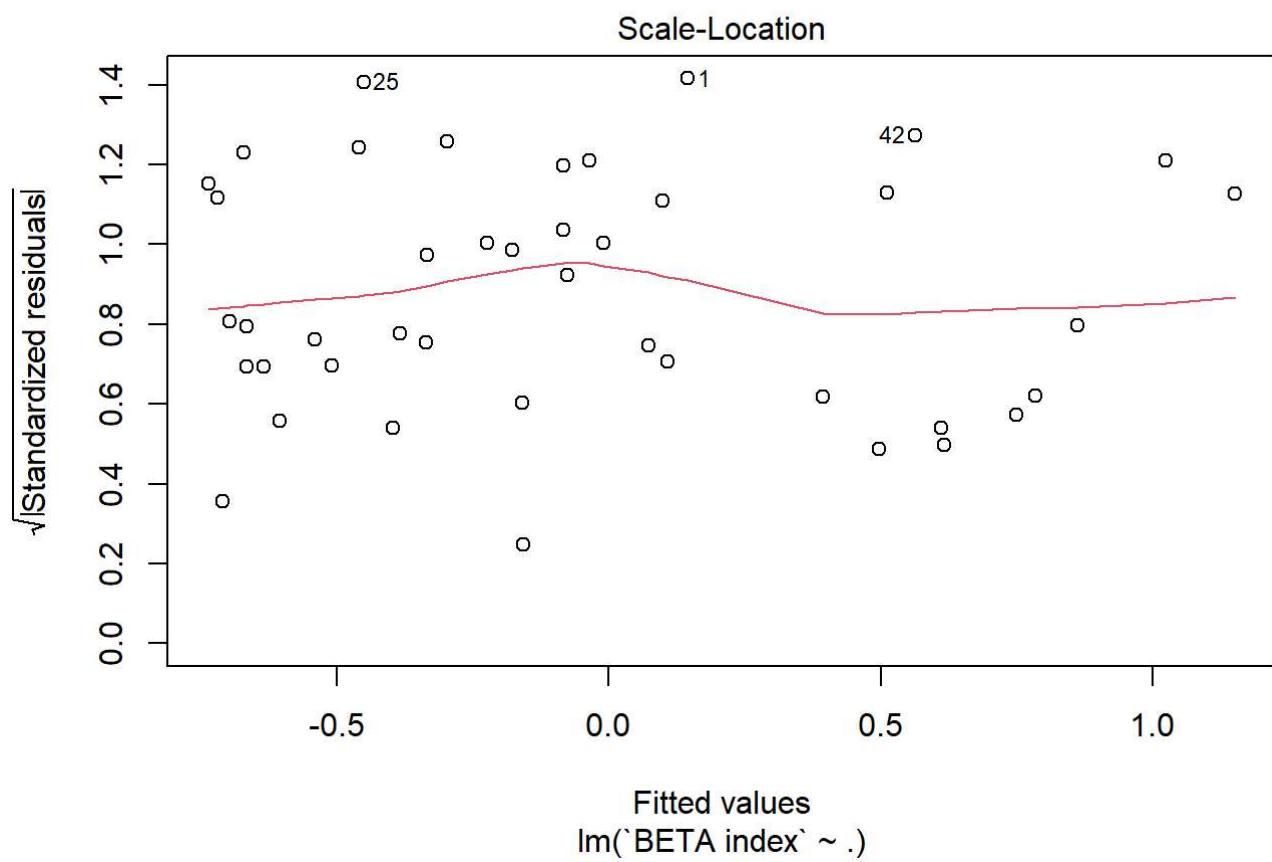
Multiple R-squared: 0.8958, Adjusted R-squared: 0.7331

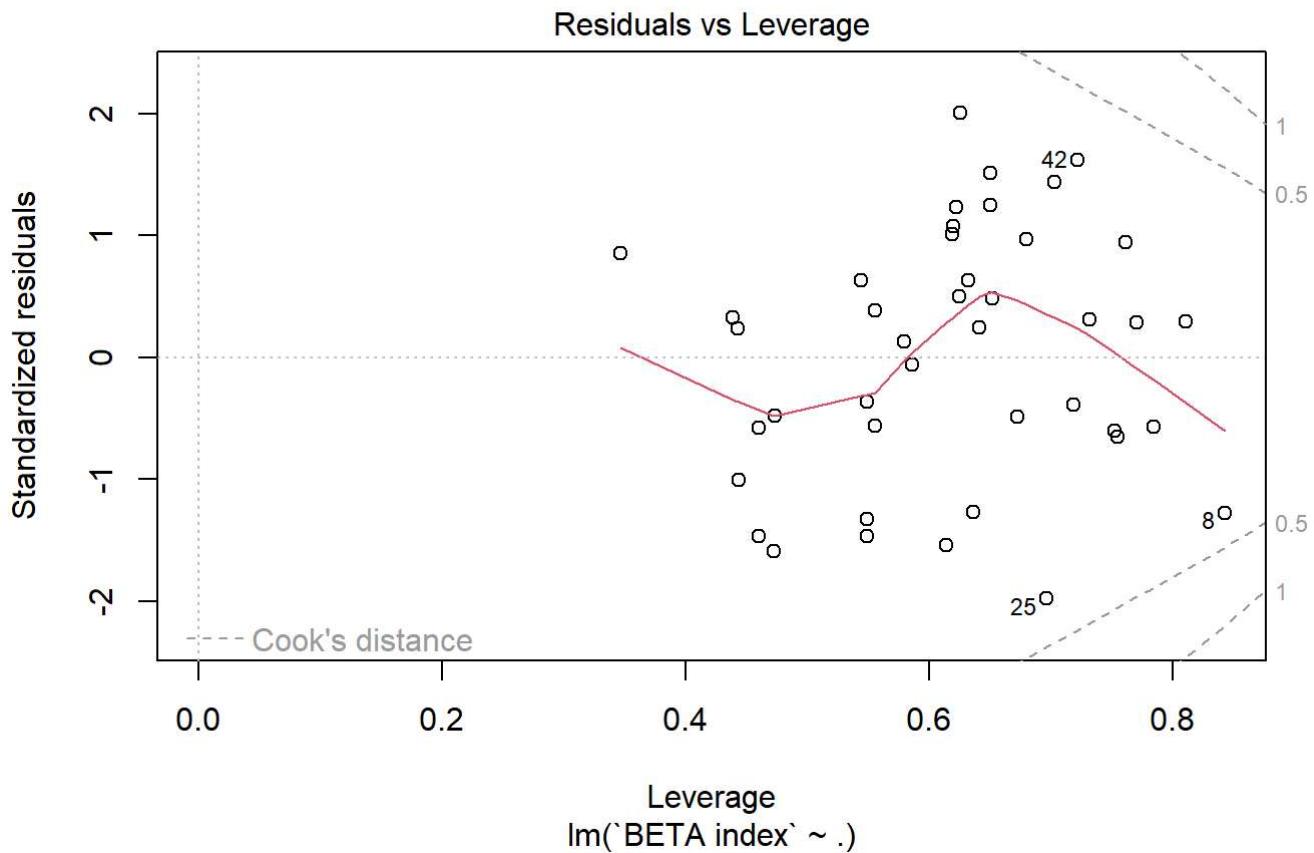
F-statistic: 5.504 on 25 and 16 DF, p-value: 0.0004478

```
# overall p-value is less than 0.05 meaning there is a difference between the groups so we reject  
plot(full_model_2)
```









```
# residuals vs fitted plot no definite pattern. So it is not a bad plot.
# Q-Q plot we outliers. Not a good straight line.
```

Checking for model assumptions

```
# split the data.
# dataset is so small we use a 95% to training and 5% for validation.
set.seed(123)
Z <- sample(nrow(data), .95* nrow(data))
data_train <- data[Z,]
data_test <- data[-Z,]

x_train <- model.matrix(`BETA index` ~ . , data = data_train)[,-1]
y_train <- data_train$`BETA index`

x_test <- model.matrix(`BETA index` ~ . , data = data_test)[,-1]
y_test <- data_test$`BETA index`
```

for test set performance

```
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
# model 1 LR with split dataset
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
set.seed(123)
full_model <- lm(`BETA index` ~ . , data = data_train)
pred_full <- predict(full_model, newdata = data_test)
mse_lm <- mean((y_test - pred_full)^2)
mse_lm
```

```
[1] 0.4216649
```

for variable selection

```
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
# model 2 Lasso #####3 ps l complet the inter
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
library(glmnet)
```

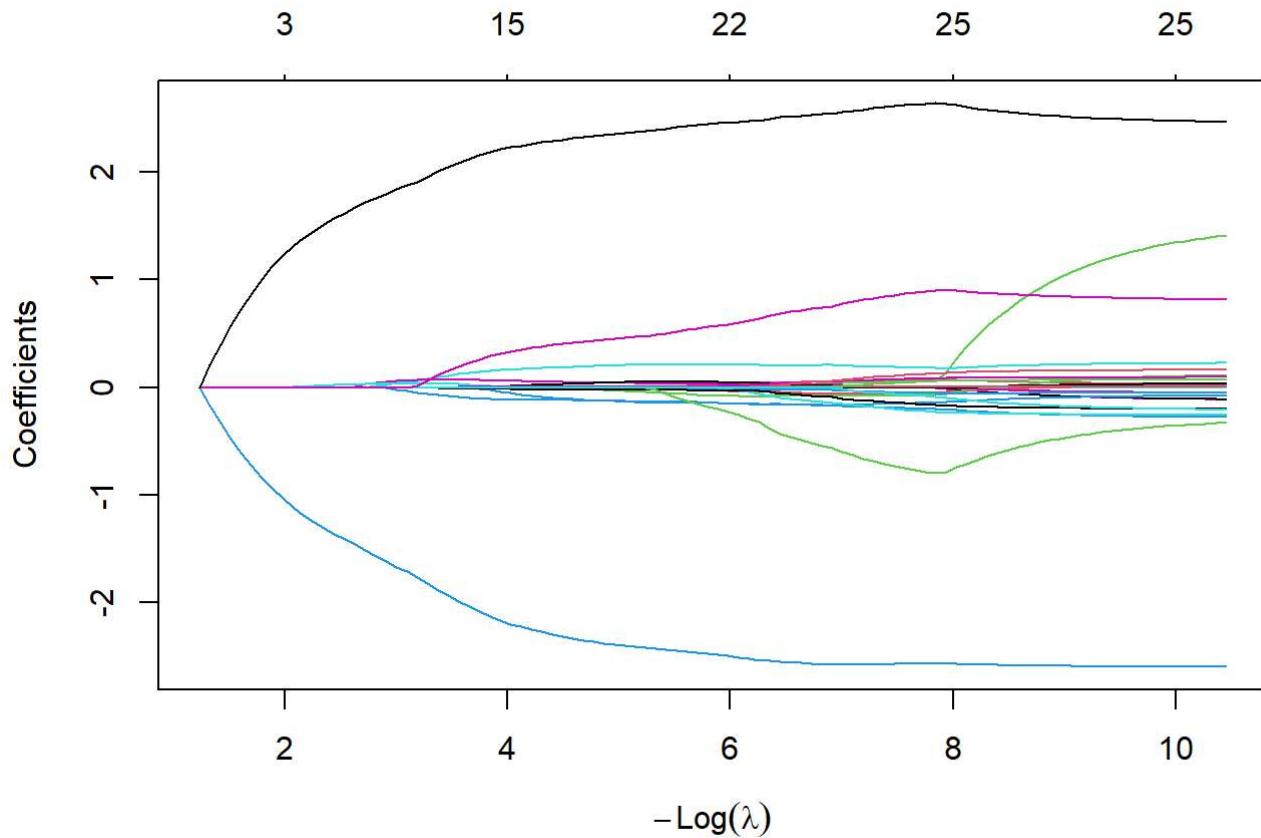
```
Loading required package: Matrix
```

```
Loaded glmnet 4.1-10
```

```
set.seed(123)
lasso_model <- glmnet(x_train, y_train,alpha=1)
best_lambda_lasso <- lasso_model$lambda.min
pred_lasso <- predict(lasso_model,s= best_lambda_lasso, newx = x_test )
mse_lasso <- mean((y_test - pred_lasso)^2)
mse_lasso
```

```
[1] 0.2995838
```

```
plot(lasso_model)
```



```
coef(lasso_model)
```

```
27 x 100 sparse Matrix of class "dgCMatrix"
[[ suppressing 100 column names 's0', 's1', 's2' ... ]]
```

(Intercept)	-0.09769231	-0.1244460	-0.1504370	-0.1741190
Id
Sex1
Age
AgeMonths
Location1
Location2
`Age at diagnosis (months)`
`Time since diagnosis (months)`
`Tumor type`2
`Tumor type`3
`Tumor type`4
Radiotherapy1
Chemotherapy1
Neurosurgery1
FSIQ

`TomA Raw scores`
`TomA-Tscores`
`TomB Raw scores`
`TomB-Tscores`
`Affect Rec. Raw scores`
`Affect Rec.-Tscores`
`Accuracy Familiarization`
`ATP 10%`	.	-0.1738325	-0.3328985	-0.4778336
`ATP 40%`
`ATP 60%`
`ATP 90%`	.	0.2055823	0.3957219	0.5689700
(Intercept)	-0.1956972	-0.2153584	-0.2332730	-0.2495961
Id
Sex1
Age
AgeMonths
Location1
Location2
`Age at diagnosis (months)`
`Time since diagnosis (months)`
`Tumor type`2
`Tumor type`3
`Tumor type`4
Radiotherapy1
Chemotherapy1
Neurosurgery1
FSIQ
`TomA Raw scores`
`TomA-Tscores`
`TomB Raw scores`
`TomB-Tscores`
`Affect Rec. Raw scores`
`Affect Rec.-Tscores`
`Accuracy Familiarization`
`ATP 10%`	-0.6098930	-0.7302207	-0.8398587	-0.9397569
`ATP 40%`
`ATP 60%`
`ATP 90%`	0.7268273	0.8706609	1.0017168	1.1211300
(Intercept)	-2.647661e-01	-0.296509403	-0.325404671	
Id
Sex1
Age
AgeMonths
Location1
Location2
`Age at diagnosis (months)`
`Time since diagnosis (months)`
`Tumor type`2
`Tumor type`3

`Tumor type`4	.	.	.
Radiotherapy1	.	.	.
Chemotherapy1	.	.	.
Neurosurgery1	.	.	.
FSIQ	.	.	.
`TomA Raw scores`	.	.	.
`TomA-Tscores`	.	.	.
`TomB Raw scores`	8.775755e-05	0.004840866	0.009165768
`TomB-Tscores`	.	.	.
`Affect Rec. Raw scores`	.	.	.
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-1.030805e+00	-1.110624769	-1.183368827
`ATP 40%`	.	.	.
`ATP 60%`	.	.	.
`ATP 90%`	1.229621e+00	1.310263431	1.383768411
(Intercept)	-0.35173276	-0.3757219	-0.39757998
Id	.	.	.
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	.	.	.
Location2	.	.	.
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	.	.	.
`Tumor type`2	.	.	.
`Tumor type`3	.	.	.
`Tumor type`4	.	.	.
Radiotherapy1	.	.	.
Chemotherapy1	.	.	.
Neurosurgery1	.	.	.
FSIQ	.	.	.
`TomA Raw scores`	.	.	.
`TomA-Tscores`	.	.	.
`TomB Raw scores`	0.01310642	0.0166970	0.01996859
`TomB-Tscores`	.	.	.
`Affect Rec. Raw scores`	.	.	.
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-1.24965065	-1.3100442	-1.36507250
`ATP 40%`	.	.	.
`ATP 60%`	.	.	.
`ATP 90%`	1.45074360	1.5117689	1.56737288
(Intercept)	-4.174056e-01	-0.437473075	-0.464927281
Id	.	.	.
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	.	.	.

Location2	.	.	.
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	.	.	.
`Tumor type`2	.	.	.
`Tumor type`3	.	.	.
`Tumor type`4	.	.	.
Radiotherapy1	.	.	.
Chemotherapy1	.	0.008959898	0.032050509
Neurosurgery1	.	.	.
FSIQ	.	.	.
`TomA Raw scores`	.	.	.
`TomA-Tscores`	.	.	.
`TomB Raw scores`	2.294955e-02	0.026844564	0.030157446
`TomB-Tscores`	.	.	.
`Affect Rec. Raw scores`	.	.	.
`Affect Rec.-Tscores`	-2.974201e-05	-0.002127080	-0.003270602
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-1.415133e+00	-1.461845484	-1.515902294
`ATP 40%`	.	.	.
`ATP 60%`	.	.	.
`ATP 90%`	1.618119e+00	1.667913721	1.715134303
(Intercept)	-0.486157113	-0.499906427	-0.508342797
Id	.	.	.
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	.	.	.
Location2	.	.	.
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	.	.	.
`Tumor type`2	.	.	.
`Tumor type`3	.	.	.
`Tumor type`4	.	-0.008143232	-0.021639472
Radiotherapy1	0.010632256	0.024083324	0.038816884
Chemotherapy1	0.044231381	0.052146463	0.057478030
Neurosurgery1	.	.	.
FSIQ	.	.	.
`TomA Raw scores`	.	.	.
`TomA-Tscores`	.	.	.
`TomB Raw scores`	0.032983925	0.034977303	0.036323012
`TomB-Tscores`	.	.	.
`Affect Rec. Raw scores`	.	.	.
`Affect Rec.-Tscores`	-0.004287601	-0.005196739	-0.005996912
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-1.568630809	-1.619331224	-1.667682523
`ATP 40%`	.	.	.
`ATP 60%`	.	.	.
`ATP 90%`	1.757006705	1.797799041	1.837163972
(Intercept)	-0.516037809	-0.526110665	-0.4997599297

Id	.	.	.
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	.	.	.
Location2	.	.	.
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	.	.	.
`Tumor type`2	.	.	.
`Tumor type`3	.	.	.
`Tumor type`4	-0.033925567	-0.046187133	-0.0590666960
Radiotherapy1	0.052226762	0.065356721	0.0803271918
Chemotherapy1	0.062293552	0.065976324	0.0670639003
Neurosurgery1	.	.	.
FSIQ	.	.	.
`TomA Raw scores`	.	.	.
`TomA-Tscores`	.	.	-0.0003475609
`TomB Raw scores`	0.037558514	0.038144140	0.0375768275
`TomB-Tscores`	.	.	.
`Affect Rec. Raw scores`	.	.	-0.0020531650
`Affect Rec.-Tscores`	-0.006730082	-0.007689382	-0.0070128253
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-1.711669363	-1.761063082	-1.8228552103
`ATP 40%`	.	.	.
`ATP 60%`	.	0.017793522	0.0645798895
`ATP 90%`	1.872992553	1.909883767	1.9551696689
(Intercept)	-0.400791387	-0.327985605	-3.089776e-01
Id	.	.	5.663863e-05
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	.	.	.
Location2	.	.	.
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	.	.	.
`Tumor type`2	.	.	.
`Tumor type`3	.	.	.
`Tumor type`4	-0.070649326	-0.081197665	-9.176527e-02
Radiotherapy1	0.096930909	0.111114596	1.238189e-01
Chemotherapy1	0.066759362	0.067030449	6.763255e-02
Neurosurgery1	.	.	.
FSIQ	.	.	.
`TomA Raw scores`	.	.	-1.276414e-04
`TomA-Tscores`	-0.001815475	-0.003058837	-3.927961e-03
`TomB Raw scores`	0.036115939	0.034853081	3.223039e-02
`TomB-Tscores`	.	.	4.915741e-04
`Affect Rec. Raw scores`	-0.007472070	-0.011481101	-1.254062e-02
`Affect Rec.-Tscores`	-0.002801905	.	.
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-1.883092568	-1.936886981	-1.985848e+00

`ATP 40%`	.	.	.
`ATP 60%`	0.112535993	0.155817693	1.941665e-01
`ATP 90%`	2.005475230	2.049526107	2.083115e+00
(Intercept)	-2.814119e-01	-2.611227e-01	-2.436361e-01
Id	2.098308e-04	3.720174e-04	4.988322e-04
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	-7.254442e-03	-1.696990e-02	-2.703453e-02
Location2	3.294213e-16	1.317685e-15	2.494190e-15
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	.	.	1.522863e-05
`Tumor type`2	.	.	.
`Tumor type`3	.	.	.
`Tumor type`4	-9.952517e-02	-1.048970e-01	-1.092173e-01
Radiotherapy1	1.356476e-01	1.471899e-01	1.564090e-01
Chemotherapy1	6.830008e-02	6.604150e-02	6.563234e-02
Neurosurgery1	.	.	4.315888e-03
FSIQ	.	.	.
`TomA Raw scores`	.	.	.
`TomA-Tscores`	-5.117960e-03	-5.990687e-03	-6.924823e-03
`TomB Raw scores`	2.280103e-02	1.700554e-02	1.044261e-02
`TomB-Tscores`	3.060583e-03	4.722465e-03	6.558918e-03
`Affect Rec. Raw scores`	-1.331073e-02	-1.425492e-02	-1.500985e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-2.038971e+00	-2.085111e+00	-2.128150e+00
`ATP 40%`	.	.	.
`ATP 60%`	2.300746e-01	2.604299e-01	2.901157e-01
`ATP 90%`	2.121111e+00	2.154777e+00	2.188133e+00
(Intercept)	-2.216407e-01	-2.107098e-01	-2.045277e-01
Id	6.175306e-04	7.071574e-04	7.685266e-04
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	-4.156774e-02	-5.468808e-02	-6.704665e-02
Location2	3.615791e-15	4.086393e-15	4.545230e-15
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	1.451638e-04	2.462449e-04	3.277299e-04
`Tumor type`2	.	.	.
`Tumor type`3	.	.	.
`Tumor type`4	-1.118002e-01	-1.133392e-01	-1.138103e-01
Radiotherapy1	1.622501e-01	1.669445e-01	1.706156e-01
Chemotherapy1	6.348829e-02	6.111263e-02	5.818277e-02
Neurosurgery1	7.881968e-03	1.221009e-02	1.708241e-02
FSIQ	2.455597e-04	4.532160e-04	6.328600e-04
`TomA Raw scores`	.	.	.
`TomA-Tscores`	-8.191652e-03	-9.138664e-03	-9.867814e-03
`TomB Raw scores`	2.877319e-03	.	.

`TomB-Tscores`	8.585638e-03	9.390929e-03	9.453720e-03
`Affect Rec. Raw scores`	-1.613157e-02	-1.734700e-02	-1.864440e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-2.166473e+00	-2.197849e+00	-2.223957e+00
`ATP 40%`	.	.	.
`ATP 60%`	3.133571e-01	3.333177e-01	3.508044e-01
`ATP 90%`	2.209647e+00	2.228113e+00	2.245070e+00
(Intercept)	-1.958101e-01	-1.831756e-01	-1.712767e-01
Id	8.272059e-04	8.793003e-04	9.282665e-04
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	-7.813556e-02	-8.800533e-02	-9.694618e-02
Location2	5.035440e-15	5.564868e-15	6.039391e-15
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	4.058074e-04	4.814658e-04	5.506088e-04
`Tumor type` 2	.	.	.
`Tumor type` 3	.	.	.
`Tumor type` 4	-1.145210e-01	-1.155015e-01	-1.164836e-01
Radiotherapy1	1.744624e-01	1.785596e-01	1.825150e-01
Chemotherapy1	5.540842e-02	5.289019e-02	5.054215e-02
Neurosurgery1	2.111703e-02	2.435986e-02	2.725606e-02
FSIQ	8.026666e-04	9.625468e-04	1.106933e-03
`TomA Raw scores`	-4.380017e-04	-1.418057e-03	-2.391945e-03
`TomA-Tscores`	-1.038117e-02	-1.065099e-02	-1.086465e-02
`TomB Raw scores`	.	.	.
`TomB-Tscores`	9.454417e-03	9.375929e-03	9.293381e-03
`Affect Rec. Raw scores`	-1.975472e-02	-2.067505e-02	-2.149280e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-2.248394e+00	-2.271770e+00	-2.293280e+00
`ATP 40%`	.	.	.
`ATP 60%`	3.667021e-01	3.813539e-01	3.947405e-01
`ATP 90%`	2.260375e+00	2.274613e+00	2.287600e+00
(Intercept)	-1.598681e-01	-1.504883e-01	-1.413022e-01
Id	9.713977e-04	9.835848e-04	9.990537e-04
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	-1.049051e-01	-1.105184e-01	-1.159630e-01
Location2	6.651174e-15	7.066872e-15	7.459040e-15
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	6.161750e-04	6.789932e-04	7.369454e-04
`Tumor type` 2	.	.	.
`Tumor type` 3	-1.477885e-03	-8.758055e-03	-1.504890e-02
`Tumor type` 4	-1.177529e-01	-1.203712e-01	-1.226251e-01
Radiotherapy1	1.864971e-01	1.906790e-01	1.946632e-01
Chemotherapy1	4.810495e-02	4.675771e-02	4.505758e-02

Neurosurgery1	3.000245e-02	3.385525e-02	3.719179e-02
FSIQ	1.234373e-03	1.307833e-03	1.380269e-03
`TomA Raw scores`	-3.323379e-03	-4.037733e-03	-4.724117e-03
`TomA-Tscores`	-1.105745e-02	-1.132548e-02	-1.155560e-02
`TomB Raw scores`	.	.	.
`TomB-Tscores`	9.229332e-03	9.260327e-03	9.279839e-03
`Affect Rec. Raw scores`	-2.222842e-02	-2.280693e-02	-2.335645e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-2.312918e+00	-2.331209e+00	-2.347875e+00
`ATP 40%`	.	.	.
`ATP 60%`	4.067550e-01	4.179250e-01	4.279756e-01
`ATP 90%`	2.299837e+00	2.313571e+00	2.325939e+00
 (Intercept)	-1.329040e-01	-1.252443e-01	-1.186783e-01
Id	1.013658e-03	1.027038e-03	1.037958e-03
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	-1.209267e-01	-1.254491e-01	-1.294510e-01
Location2	7.841404e-15	8.278672e-15	8.602211e-15
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	7.899035e-04	8.381777e-04	8.816766e-04
`Tumor type`2	.	.	.
`Tumor type`3	-2.077090e-02	-2.598386e-02	-3.079674e-02
`Tumor type`4	-1.246876e-01	-1.265689e-01	-1.283034e-01
Radiotherapy1	1.983241e-01	2.016662e-01	2.045110e-01
Chemotherapy1	4.346819e-02	4.201414e-02	4.093709e-02
Neurosurgery1	4.020598e-02	4.294878e-02	4.550891e-02
FSIQ	1.446927e-03	1.507727e-03	1.561956e-03
`TomA Raw scores`	-5.354839e-03	-5.930915e-03	-6.428562e-03
`TomA-Tscores`	-1.176353e-02	-1.195250e-02	-1.213484e-02
`TomB Raw scores`	.	.	.
`TomB-Tscores`	9.296572e-03	9.311590e-03	9.329539e-03
`Affect Rec. Raw scores`	-2.385744e-02	-2.431377e-02	-2.472443e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	.	.	.
`ATP 10%`	-2.363055e+00	-2.376888e+00	-2.389381e+00
`ATP 40%`	.	.	.
`ATP 60%`	4.371137e-01	4.454381e-01	4.530417e-01
`ATP 90%`	2.337156e+00	2.347371e+00	2.356671e+00
 (Intercept)	-1.123123e-01	-1.064879e-01	-1.009614e-01
Id	1.048779e-03	1.058966e-03	1.068318e-03
Sex1	.	.	.
Age	.	.	.
AgeMonths	.	.	.
Location1	-1.332126e-01	-1.366436e-01	-1.397697e-01
Location2	9.015948e-15	9.390469e-15	9.723812e-15
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	9.217013e-04	9.582484e-04	9.915663e-04

`Tumor type`2	.	.	.
`Tumor type`3	-3.512408e-02	-3.906252e-02	-4.265054e-02
`Tumor type`4	-1.298557e-01	-1.312760e-01	-1.325720e-01
Radiotherapy1	2.072679e-01	2.098088e-01	2.121303e-01
Chemotherapy1	3.974547e-02	3.862840e-02	3.760466e-02
Neurosurgery1	4.779782e-02	4.986949e-02	5.175399e-02
FSIQ	1.612213e-03	1.658273e-03	1.700293e-03
`TomA Raw scores`	-6.904255e-03	-7.341540e-03	-7.741088e-03
`TomA-Tscores`	-1.229268e-02	-1.243506e-02	-1.256438e-02
`TomB Raw scores`	.	.	.
`TomB-Tscores`	9.342480e-03	9.353609e-03	9.363566e-03
`Affect Rec. Raw scores`	-2.510386e-02	-2.544958e-02	-2.576447e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	.	.	-4.109476e-04
`ATP 10%`	-2.400869e+00	-2.411342e+00	-2.420800e+00
`ATP 40%`	.	.	.
`ATP 60%`	4.599615e-01	4.662580e-01	4.721104e-01
`ATP 90%`	2.365182e+00	2.372913e+00	2.379981e+00
(Intercept)	-8.050802e-02	-5.680083e-02	-2.398339e-02
Id	1.071997e-03	1.050734e-03	1.038727e-03
Sex1	2.107544e-03	5.724267e-03	9.144378e-03
Age	.	.	.
AgeMonths	.	.	.
Location1	-1.433548e-01	-1.462784e-01	-1.480875e-01
Location2	1.020226e-14	1.071208e-14	1.156994e-14
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	1.021825e-03	1.045790e-03	1.071480e-03
`Tumor type`2	.	.	-4.432409e-03
`Tumor type`3	-4.637364e-02	-4.998556e-02	-5.549752e-02
`Tumor type`4	-1.321204e-01	-1.312346e-01	-1.321637e-01
Radiotherapy1	2.124970e-01	2.111676e-01	2.093987e-01
Chemotherapy1	3.604618e-02	3.615803e-02	3.634400e-02
Neurosurgery1	5.291488e-02	5.425033e-02	5.407269e-02
FSIQ	1.777868e-03	1.855964e-03	1.951049e-03
`TomA Raw scores`	-8.061397e-03	-8.377011e-03	-8.971031e-03
`TomA-Tscores`	-1.280977e-02	-1.308002e-02	-1.325307e-02
`TomB Raw scores`	.	.	.
`TomB-Tscores`	9.387371e-03	9.422658e-03	9.507930e-03
`Affect Rec. Raw scores`	-2.613395e-02	-2.649339e-02	-2.693730e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	-2.644300e-02	-5.670849e-02	-9.341856e-02
`ATP 10%`	-2.428915e+00	-2.437315e+00	-2.445715e+00
`ATP 40%`	.	.	.
`ATP 60%`	4.856564e-01	5.010606e-01	5.184691e-01
`ATP 90%`	2.390539e+00	2.403148e+00	2.416282e+00
(Intercept)	8.189135e-03	4.481306e-02	7.682569e-02
Id	1.044772e-03	1.053248e-03	1.073505e-03
Sex1	1.198426e-02	1.472300e-02	1.683002e-02
Age	.	2.426396e-04	7.795340e-04

AgeMonths	.	.	.
Location1	-1.481839e-01	-1.480042e-01	-1.479872e-01
Location2	1.200035e-14	1.260331e-14	1.329450e-14
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	1.098448e-03	1.120936e-03	1.134993e-03
`Tumor type`2	-1.085743e-02	-1.768451e-02	-2.382201e-02
`Tumor type`3	-6.226436e-02	-6.881971e-02	-7.445162e-02
`Tumor type`4	-1.353454e-01	-1.389303e-01	-1.424395e-01
Radiotherapy1	2.097704e-01	2.104500e-01	2.112231e-01
Chemotherapy1	3.596602e-02	3.549906e-02	3.532811e-02
Neurosurgery1	5.286701e-02	5.130954e-02	5.029355e-02
FSIQ	2.034805e-03	2.122904e-03	2.193812e-03
`TomA Raw scores`	-1.001107e-02	-1.173875e-02	-1.395684e-02
`TomA-Tscores`	-1.320549e-02	-1.284034e-02	-1.215925e-02
`TomB Raw scores`	.	.	.
`TomB-Tscores`	9.577348e-03	9.641109e-03	9.751025e-03
`Affect Rec. Raw scores`	-2.727276e-02	-2.759686e-02	-2.786898e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	-1.248792e-01	-1.561996e-01	-1.805698e-01
`ATP 10%`	-2.454474e+00	-2.464031e+00	-2.472501e+00
`ATP 40%`	.	.	.
`ATP 60%`	5.338605e-01	5.491954e-01	5.615527e-01
`ATP 90%`	2.427118e+00	2.437531e+00	2.445548e+00
(Intercept)	1.051094e-01	1.450360e-01	1.817340e-01
Id	1.091146e-03	1.211117e-03	1.347134e-03
Sex1	1.868798e-02	2.171813e-02	2.573555e-02
Age	1.253860e-03	2.818813e-03	4.236701e-03
AgeMonths	.	.	.
Location1	-1.480434e-01	-1.485556e-01	-1.506066e-01
Location2	1.415433e-14	1.701814e-14	1.920546e-14
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	1.147365e-03	1.163696e-03	1.189975e-03
`Tumor type`2	-2.923807e-02	-3.453817e-02	-3.747190e-02
`Tumor type`3	-7.947331e-02	-8.235445e-02	-8.314988e-02
`Tumor type`4	-1.455863e-01	-1.506927e-01	-1.537809e-01
Radiotherapy1	2.121180e-01	2.127082e-01	2.102772e-01
Chemotherapy1	3.509460e-02	3.705456e-02	4.020182e-02
Neurosurgery1	4.948257e-02	4.692644e-02	4.415390e-02
FSIQ	2.254198e-03	2.363874e-03	2.510177e-03
`TomA Raw scores`	-1.594474e-02	-1.773107e-02	-1.695504e-02
`TomA-Tscores`	-1.154704e-02	-1.126460e-02	-1.226227e-02
`TomB Raw scores`	.	-1.154034e-02	-2.860616e-02
`TomB-Tscores`	9.845757e-03	1.335671e-02	1.849972e-02
`Affect Rec. Raw scores`	-2.810745e-02	-2.810347e-02	-2.815220e-02
`Affect Rec.-Tscores`	.	.	.
`Accuracy Familiarization`	-2.016277e-01	-2.261119e-01	-2.582441e-01
`ATP 10%`	-2.480249e+00	-2.495115e+00	-2.509854e+00
`ATP 40%`	.	.	.
`ATP 60%`	5.724571e-01	5.870709e-01	6.046686e-01
`ATP 90%`	2.452866e+00	2.458396e+00	2.464597e+00

(Intercept)	2.146802e-01	2.653658e-01	4.855091e-01
Id	1.468975e-03	1.595312e-03	1.842540e-03
Sex1	2.945528e-02	3.296250e-02	3.865894e-02
Age	5.468411e-03	6.824985e-03	9.886242e-03
AgeMonths	.	.	.
Location1	-1.525529e-01	-1.544448e-01	-1.589984e-01
Location2	2.173102e-14	2.455463e-14	3.220682e-14
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	1.214968e-03	1.236145e-03	1.253640e-03
`Tumor type`2	-4.000635e-02	-4.230395e-02	-4.314624e-02
`Tumor type`3	-8.383471e-02	-8.423736e-02	-8.161766e-02
`Tumor type`4	-1.563955e-01	-1.585994e-01	-1.571463e-01
Radiotherapy1	2.078476e-01	2.057459e-01	2.018543e-01
Chemotherapy1	4.307579e-02	4.506599e-02	4.151839e-02
Neurosurgery1	4.163456e-02	3.903596e-02	3.362709e-02
FSIQ	2.645536e-03	2.777189e-03	3.021322e-03
`TomA Raw scores`	-1.603686e-02	-1.456590e-02	-5.922302e-03
`TomA-Tscores`	-1.327207e-02	-1.450972e-02	-1.938486e-02
`TomB Raw scores`	-4.420823e-02	-5.880347e-02	-8.063314e-02
`TomB-Tscores`	2.319874e-02	2.764296e-02	3.463181e-02
`Affect Rec. Raw scores`	-2.820864e-02	-2.982294e-02	-4.396317e-02
`Affect Rec.-Tscores`	.	1.528222e-03	1.486511e-02
`Accuracy Familiarization`	-2.883095e-01	-3.181647e-01	-3.821148e-01
`ATP 10%`	-2.523075e+00	-2.534314e+00	-2.539400e+00
`ATP 40%`	.	.	.
`ATP 60%`	6.209306e-01	6.364542e-01	6.643376e-01
`ATP 90%`	2.470414e+00	2.476500e+00	2.492505e+00
(Intercept)	6.905965e-01	8.354092e-01	9.673909e-01
Id	2.049346e-03	2.208980e-03	2.355380e-03
Sex1	4.316185e-02	4.588712e-02	4.838832e-02
Age	1.276238e-02	1.550867e-02	1.802339e-02
AgeMonths	.	.	.
Location1	-1.621164e-01	-1.628674e-01	-1.635670e-01
Location2	3.963694e-14	4.367284e-14	4.781364e-14
`Age at diagnosis (months)`	.	.	.
`Time since diagnosis (months)`	1.263834e-03	1.264234e-03	1.264673e-03
`Tumor type`2	-4.546795e-02	-5.028342e-02	-5.466484e-02
`Tumor type`3	-8.045480e-02	-8.121147e-02	-8.187127e-02
`Tumor type`4	-1.569956e-01	-1.605123e-01	-1.637305e-01
Radiotherapy1	2.002290e-01	2.019389e-01	2.034720e-01
Chemotherapy1	3.739752e-02	3.517250e-02	3.318534e-02
Neurosurgery1	2.870676e-02	2.468671e-02	2.100824e-02
FSIQ	3.225179e-03	3.361550e-03	3.486547e-03
`TomA Raw scores`	.	.	.
`TomA-Tscores`	-2.288027e-02	-2.347458e-02	-2.401925e-02
`TomB Raw scores`	-9.641048e-02	-1.064068e-01	-1.156533e-01
`TomB-Tscores`	3.975654e-02	4.298796e-02	4.597328e-02
`Affect Rec. Raw scores`	-5.682240e-02	-6.450331e-02	-7.148999e-02
`Affect Rec.-Tscores`	2.700395e-02	3.439045e-02	4.111117e-02

`Accuracy Familiarization`	-4.352933e-01	-4.648943e-01	-4.919253e-01
`ATP 10%`	-2.543964e+00	-2.552598e+00	-2.560554e+00
`ATP 40%`	.	.	.
`ATP 60%`	6.876590e-01	7.025163e-01	7.161054e-01
`ATP 90%`	2.506783e+00	2.515247e+00	2.522946e+00
 (Intercept)	 1.088642e+00	 1.244610e+00	 1.318743e+00
Id	2.489400e-03	2.641100e-03	2.750473e-03
Sex1	5.067466e-02	5.263890e-02	5.476874e-02
Age	2.032748e-02	3.827133e-02	3.961162e-02
AgeMonths	.	.	.
Location1	-1.642078e-01	-1.658014e-01	-1.677993e-01
Location2	5.224809e-14	8.358895e-14	8.855453e-14
`Age at diagnosis (months)`	-2.437804e-06	-1.260906e-03	-1.283594e-03
`Time since diagnosis (months)`	1.263747e-03	.	.
`Tumor type` 2	-5.873855e-02	-6.237196e-02	-6.309623e-02
`Tumor type` 3	-8.249376e-02	-8.081642e-02	-8.082259e-02
`Tumor type` 4	-1.666889e-01	-1.685675e-01	-1.685994e-01
Radiotherapy1	2.048972e-01	2.074206e-01	2.060608e-01
Chemotherapy1	3.134107e-02	2.758442e-02	2.628466e-02
Neurosurgery1	1.756076e-02	1.425241e-02	1.184753e-02
FSIQ	3.600962e-03	3.708657e-03	3.815792e-03
`TomA Raw scores`	.	2.165981e-04	3.505581e-03
`TomA-Tscores`	-2.452433e-02	-2.510351e-02	-2.698488e-02
`TomB Raw scores`	-1.241169e-01	-1.322026e-01	-1.411126e-01
`TomB-Tscores`	4.869959e-02	5.139101e-02	5.423100e-02
`Affect Rec. Raw scores`	-7.788685e-02	-8.669672e-02	-9.147256e-02
`Affect Rec.-Tscores`	4.726602e-02	5.563670e-02	6.017638e-02
`Accuracy Familiarization`	-5.166731e-01	-5.407220e-01	-5.647950e-01
`ATP 10%`	-2.567841e+00	-2.574756e+00	-2.577302e+00
`ATP 40%`	.	.	-2.531018e-03
`ATP 60%`	7.285552e-01	7.410887e-01	7.525641e-01
`ATP 90%`	2.530057e+00	2.537026e+00	2.541698e+00
 (Intercept)	 1.473136e+00	 1.608441e+00	 1.731615e+00
Id	2.905379e-03	3.039237e-03	3.161101e-03
Sex1	5.766746e-02	6.033483e-02	6.276320e-02
Age	4.158056e-02	4.325795e-02	4.478498e-02
AgeMonths	.	.	.
Location1	-1.727885e-01	-1.768232e-01	-1.804960e-01
Location2	9.652413e-14	1.043516e-13	1.123435e-13
`Age at diagnosis (months)`	-1.312412e-03	-1.335056e-03	-1.355675e-03
`Time since diagnosis (months)`	.	.	.
`Tumor type` 2	-6.131270e-02	-6.010039e-02	-5.899803e-02
`Tumor type` 3	-7.957327e-02	-7.855114e-02	-7.762221e-02
`Tumor type` 4	-1.651668e-01	-1.623309e-01	-1.597502e-01
Radiotherapy1	2.020478e-01	1.987824e-01	1.958106e-01
Chemotherapy1	2.163705e-02	1.761930e-02	1.396166e-02
Neurosurgery1	8.328112e-03	5.223484e-03	2.397130e-03
FSIQ	3.961850e-03	4.091900e-03	4.210293e-03
`TomA Raw scores`	1.193502e-02	1.906089e-02	2.554746e-02

`TomA-Tscores`	-3.141189e-02	-3.516715e-02	-3.858557e-02
`TomB Raw scores`	-1.546419e-01	-1.659374e-01	-1.762196e-01
`TomB-Tscores`	5.857941e-02	6.222987e-02	6.555288e-02
`Affect Rec. Raw scores`	-1.026814e-01	-1.124128e-01	-1.212715e-01
`Affect Rec.-Tscores`	7.068226e-02	7.980405e-02	8.810787e-02
`Accuracy Familiarization`	-5.995878e-01	-6.320259e-01	-6.615579e-01
`ATP 10%`	-2.575721e+00	-2.574442e+00	-2.573279e+00
`ATP 40%`	-1.698953e-02	-2.779754e-02	-3.763706e-02
`ATP 60%`	7.751605e-01	7.945435e-01	8.121900e-01
`ATP 90%`	2.556280e+00	2.568662e+00	2.579934e+00
(Intercept)	1.843266e+00	1.937022e+00	2.021976e+00
Id	3.270951e-03	3.352287e-03	3.425890e-03
Sex1	6.496458e-02	6.688027e-02	6.862000e-02
Age	4.617522e-02	4.736736e-02	4.844473e-02
AgeMonths	.	.	.
Location1	-1.838696e-01	-1.873938e-01	-1.905935e-01
Location2	1.220173e-13	1.300891e-13	1.384631e-13
`Age at diagnosis (months)`	-1.374136e-03	-1.386931e-03	-1.398631e-03
`Time since diagnosis (months)`	.	.	.
`Tumor type`2	-5.795399e-02	-5.633289e-02	-5.485706e-02
`Tumor type`3	-7.678070e-02	-7.598102e-02	-7.526148e-02
`Tumor type`4	-1.573653e-01	-1.544930e-01	-1.518791e-01
Radiotherapy1	1.930848e-01	1.900723e-01	1.873288e-01
Chemotherapy1	1.068223e-02	8.472971e-03	6.470252e-03
Neurosurgery1	.	.	.
FSIQ	4.315771e-03	4.381214e-03	4.440637e-03
`TomA Raw scores`	3.144161e-02	3.673071e-02	4.153922e-02
`TomA-Tscores`	-4.168946e-02	-4.443405e-02	-4.692869e-02
`TomB Raw scores`	-1.855576e-01	-1.935693e-01	-2.008307e-01
`TomB-Tscores`	6.857438e-02	7.121029e-02	7.359924e-02
`Affect Rec. Raw scores`	-1.293191e-01	-1.363180e-01	-1.426637e-01
`Affect Rec.-Tscores`	9.565362e-02	1.022378e-01	1.082071e-01
`Accuracy Familiarization`	-6.882512e-01	-7.103943e-01	-7.305089e-01
`ATP 10%`	-2.572198e+00	-2.570773e+00	-2.569469e+00
`ATP 40%`	-4.654817e-02	-5.419517e-02	-6.114826e-02
`ATP 60%`	8.282176e-01	8.423940e-01	8.552681e-01
`ATP 90%`	2.590258e+00	2.600674e+00	2.610135e+00
(Intercept)	2.099661e+00	2.179910e+00	2.249154e+00
Id	3.493257e-03	3.574875e-03	3.645529e-03
Sex1	7.021019e-02	7.177488e-02	7.314808e-02
Age	4.942783e-02	5.040744e-02	5.199985e-02
AgeMonths	.	.	.
Location1	-1.935103e-01	-1.957324e-01	-1.976781e-01
Location2	1.443978e-13	1.513200e-13	1.568237e-13
`Age at diagnosis (months)`	-1.409343e-03	-1.423480e-03	-1.499148e-03
`Time since diagnosis (months)`	.	.	-6.557379e-05
`Tumor type`2	-5.351523e-02	-5.296481e-02	-5.240183e-02
`Tumor type`3	-7.460022e-02	-7.400931e-02	-7.332586e-02
`Tumor type`4	-1.494950e-01	-1.480011e-01	-1.465981e-01

Radiotherapy1	1.848257e-01	1.830476e-01	1.814749e-01
Chemotherapy1	4.631613e-03	2.102566e-03	.
Neurosurgery1	-3.741231e-05	-2.399786e-03	-4.402274e-03
FSIQ	4.495292e-03	4.578321e-03	4.647467e-03
`TomA Raw scores`	4.593180e-02	5.009278e-02	5.379061e-02
`TomA-Tscores`	-4.920779e-02	-5.140877e-02	-5.335270e-02
`TomB Raw scores`	-2.074605e-01	-2.140791e-01	-2.198243e-01
`TomB-Tscores`	7.577976e-02	7.790790e-02	7.975579e-02
`Affect Rec. Raw scores`	-1.484625e-01	-1.541804e-01	-1.591544e-01
`Affect Rec.-Tscores`	1.136613e-01	1.190138e-01	1.236716e-01
`Accuracy Familiarization`	-7.489135e-01	-7.682629e-01	-7.849914e-01
`ATP 10%`	-2.568280e+00	-2.567598e+00	-2.567064e+00
`ATP 40%`	-6.750613e-02	-7.389866e-02	-7.941523e-02
`ATP 60%`	8.670283e-01	8.783487e-01	8.882098e-01
`ATP 90%`	2.618765e+00	2.625690e+00	2.631845e+00
(Intercept)	2.302587e+00	2.410913e+00	2.426012e+00
Id	3.695364e-03	3.839277e-03	3.969523e-03
Sex1	7.445404e-02	7.359316e-02	6.923407e-02
Age	5.445554e-02	1.467261e-01	2.689687e-01
AgeMonths	.	.	.
Location1	-1.990879e-01	-2.063125e-01	-2.132001e-01
Location2	1.620562e-13	3.887979e-13	7.180031e-13
`Age at diagnosis (months)`	-1.658882e-03	-9.163618e-03	-1.920872e-02
`Time since diagnosis (months)`	-2.200843e-04	-7.744660e-03	-1.781881e-02
`Tumor type` 2	-5.178845e-02	-4.488122e-02	-3.818283e-02
`Tumor type` 3	-7.253129e-02	-5.841766e-02	-4.190019e-02
`Tumor type` 4	-1.452568e-01	-1.372210e-01	-1.312155e-01
Radiotherapy1	1.791699e-01	1.761827e-01	1.808512e-01
Chemotherapy1	.	-7.521867e-04	-5.659530e-03
Neurosurgery1	-5.680904e-03	-3.853669e-03	-1.945560e-04
FSIQ	4.695785e-03	4.641959e-03	4.486466e-03
`TomA Raw scores`	5.681682e-02	6.259234e-02	6.316220e-02
`TomA-Tscores`	-5.494242e-02	-5.744489e-02	-5.707719e-02
`TomB Raw scores`	-2.246543e-01	-2.335212e-01	-2.359606e-01
`TomB-Tscores`	8.131162e-02	8.435551e-02	8.530430e-02
`Affect Rec. Raw scores`	-1.630255e-01	-1.723392e-01	-1.751689e-01
`Affect Rec.-Tscores`	1.273364e-01	1.360420e-01	1.385225e-01
`Accuracy Familiarization`	-7.985172e-01	-7.883831e-01	-7.439818e-01
`ATP 10%`	-2.567071e+00	-2.567298e+00	-2.569984e+00
`ATP 40%`	-8.362845e-02	-9.760626e-02	-1.082184e-01
`ATP 60%`	8.963914e-01	9.034146e-01	8.948492e-01
`ATP 90%`	2.637274e+00	2.635974e+00	2.619338e+00
(Intercept)	2.452434e+00	2.466463e+00	2.476628e+00
Id	4.111310e-03	4.224042e-03	4.320108e-03
Sex1	6.555775e-02	6.194099e-02	5.861703e-02
Age	3.766470e-01	4.786229e-01	5.713809e-01
AgeMonths	.	.	.
Location1	-2.187220e-01	-2.243608e-01	-2.296451e-01
Location2	1.112765e-12	1.523037e-12	1.963767e-12

`Age at diagnosis (months)`	-2.805208e-02	-3.643169e-02	-4.405440e-02
`Time since diagnosis (months)`	-2.668213e-02	-3.508505e-02	-4.273038e-02
`Tumor type`2	-3.317475e-02	-2.773409e-02	-2.255898e-02
`Tumor type`3	-2.738558e-02	-1.361546e-02	-1.078043e-03
`Tumor type`4	-1.268245e-01	-1.219695e-01	-1.173188e-01
Radiotherapy1	1.856406e-01	1.896402e-01	1.931131e-01
Chemotherapy1	-1.111586e-02	-1.536513e-02	-1.897432e-02
Neurosurgery1	.	2.592371e-03	5.678846e-03
FSIQ	4.392929e-03	4.269835e-03	4.147400e-03
`TomA Raw scores`	6.386783e-02	6.436077e-02	6.477353e-02
`TomA-Tscores`	-5.691658e-02	-5.662753e-02	-5.633245e-02
`TomB Raw scores`	-2.389251e-01	-2.410647e-01	-2.428339e-01
`TomB-Tscores`	8.634565e-02	8.716104e-02	8.786060e-02
`Affect Rec. Raw scores`	-1.782693e-01	-1.806858e-01	-1.827740e-01
`Affect Rec.-Tscores`	1.412469e-01	1.433647e-01	1.451947e-01
`Accuracy Familiarization`	-7.083485e-01	-6.717697e-01	-6.377279e-01
`ATP 10%`	-2.572927e+00	-2.575252e+00	-2.577230e+00
`ATP 40%`	-1.183564e-01	-1.273001e-01	-1.352744e-01
`ATP 60%`	8.881766e-01	8.811094e-01	8.745255e-01
`ATP 90%`	2.603557e+00	2.589430e+00	2.576929e+00
(Intercept)	2.488143e+00	2.496376e+00	2.503881e+00
Id	4.394076e-03	4.475044e-03	4.548812e-03
Sex1	5.577869e-02	5.300154e-02	5.047159e-02
Age	6.486988e-01	7.263619e-01	7.971145e-01
AgeMonths	.	.	.
Location1	-2.331894e-01	-2.376899e-01	-2.417902e-01
Location2	2.424353e-12	2.928140e-12	3.427380e-12
`Age at diagnosis (months)`	-5.041253e-02	-5.679438e-02	-6.260837e-02
`Time since diagnosis (months)`	-4.910299e-02	-5.550417e-02	-6.133578e-02
`Tumor type`2	-1.957535e-02	-1.512434e-02	-1.106931e-02
`Tumor type`3	6.204000e-03	1.698256e-02	2.680213e-02
`Tumor type`4	-1.146666e-01	-1.106642e-01	-1.070177e-01
Radiotherapy1	1.966596e-01	1.995096e-01	2.021059e-01
Chemotherapy1	-2.229989e-02	-2.529325e-02	-2.802046e-02
Neurosurgery1	8.145682e-03	1.073944e-02	1.310230e-02
FSIQ	4.034800e-03	3.933219e-03	3.840682e-03
`TomA Raw scores`	6.498491e-02	6.534189e-02	6.566738e-02
`TomA-Tscores`	-5.605708e-02	-5.581242e-02	-5.558968e-02
`TomB Raw scores`	-2.438452e-01	-2.453672e-01	-2.467542e-01
`TomB-Tscores`	8.833475e-02	8.892998e-02	8.947237e-02
`Affect Rec. Raw scores`	-1.845402e-01	-1.862857e-01	-1.878763e-01
`Affect Rec.-Tscores`	1.467528e-01	1.482816e-01	1.496747e-01
`Accuracy Familiarization`	-6.105294e-01	-5.819211e-01	-5.558595e-01
`ATP 10%`	-2.579148e+00	-2.580781e+00	-2.582269e+00
`ATP 40%`	-1.431856e-01	-1.497493e-01	-1.557293e-01
`ATP 60%`	8.701068e-01	8.644982e-01	8.593895e-01
`ATP 90%`	2.568008e+00	2.557408e+00	2.547751e+00
(Intercept)	2.510722e+00	2.516952e+00	2.522632e+00
Id	4.616019e-03	4.677253e-03	4.733031e-03

Sex1	4.816690e-02	4.606693e-02	4.415441e-02
Age	8.615699e-01	9.202992e-01	9.737901e-01
AgeMonths	.	.	.
Location1	-2.455256e-01	-2.489291e-01	-2.520293e-01
Location2	3.903328e-12	4.393930e-12	4.842761e-12
`Age at diagnosis (months)`	-6.790489e-02	-7.273089e-02	-7.712641e-02
`Time since diagnosis (months)`	-6.664834e-02	-7.148895e-02	-7.589779e-02
`Tumor type` 2	-7.375128e-03	-4.009151e-03	-9.433124e-04
`Tumor type` 3	3.574777e-02	4.389869e-02	5.132268e-02
`Tumor type` 4	-1.036958e-01	-1.006690e-01	-9.791199e-02
Radiotherapy1	2.044711e-01	2.066261e-01	2.085888e-01
Chemotherapy1	-3.050509e-02	-3.276888e-02	-3.483095e-02
Neurosurgery1	1.525478e-02	1.721607e-02	1.900230e-02
FSIQ	3.756385e-03	3.679575e-03	3.609622e-03
`TomA Raw scores`	6.596412e-02	6.623440e-02	6.648090e-02
`TomA-Tscores`	-5.538688e-02	-5.520204e-02	-5.503386e-02
`TomB Raw scores`	-2.480180e-01	-2.491695e-01	-2.502189e-01
`TomB-Tscores`	8.996659e-02	9.041687e-02	9.082717e-02
`Affect Rec. Raw scores`	-1.893256e-01	-1.906459e-01	-1.918488e-01
`Affect Rec.-Tscores`	1.509440e-01	1.521003e-01	1.531539e-01
`Accuracy Familiarization`	-5.321185e-01	-5.104862e-01	-4.907849e-01
`ATP 10%`	-2.583624e+00	-2.584859e+00	-2.585984e+00
`ATP 40%`	-1.611774e-01	-1.661413e-01	-1.706630e-01
`ATP 60%`	8.547359e-01	8.504956e-01	8.466344e-01
`ATP 90%`	2.538954e+00	2.530939e+00	2.523639e+00
(Intercept)	2.531353e+00	2.535385e+00	2.539412e+00
Id	4.787246e-03	4.833101e-03	4.875032e-03
Sex1	4.243753e-02	4.083821e-02	3.938965e-02
Age	1.020609e+00	1.065231e+00	1.105856e+00
AgeMonths	.	.	.
Location1	-2.540636e-01	-2.566944e-01	-2.591049e-01
Location2	5.253289e-12	5.675738e-12	6.077915e-12
`Age at diagnosis (months)`	-8.097080e-02	-8.463808e-02	-8.797660e-02
`Time since diagnosis (months)`	-7.975366e-02	-8.343208e-02	-8.678073e-02
`Tumor type` 2	1.031782e-06	2.699608e-03	5.169844e-03
`Tumor type` 3	5.690234e-02	6.316667e-02	6.888012e-02
`Tumor type` 4	-9.658770e-02	-9.420978e-02	-9.202653e-02
Radiotherapy1	2.108851e-01	2.124866e-01	2.139292e-01
Chemotherapy1	-3.679122e-02	-3.848618e-02	-4.004001e-02
Neurosurgery1	2.001956e-02	2.156149e-02	2.296231e-02
FSIQ	3.552413e-03	3.493388e-03	3.439951e-03
`TomA Raw scores`	6.630873e-02	6.652630e-02	6.674615e-02
`TomA-Tscores`	-5.472478e-02	-5.458755e-02	-5.447354e-02
`TomB Raw scores`	-2.509108e-01	-2.517813e-01	-2.525981e-01
`TomB-Tscores`	9.113278e-02	9.147140e-02	9.178784e-02
`Affect Rec. Raw scores`	-1.929012e-01	-1.938757e-01	-1.947907e-01
`Affect Rec.-Tscores`	1.540663e-01	1.549193e-01	1.557215e-01
`Accuracy Familiarization`	-4.753136e-01	-4.586425e-01	-4.435402e-01
`ATP 10%`	-2.587551e+00	-2.588454e+00	-2.589261e+00
`ATP 40%`	-1.737613e-01	-1.775814e-01	-1.810866e-01

`ATP 60%`	8.435173e-01	8.402276e-01	8.372762e-01
`ATP 90%`	2.517151e+00	2.511032e+00	2.505498e+00
(Intercept)	2.543060e+00	2.546384e+00	2.549411e+00
Id	4.913265e-03	4.948073e-03	4.979759e-03
Sex1	3.806771e-02	3.686454e-02	3.576959e-02
Age	1.142917e+00	1.176654e+00	1.207360e+00
AgeMonths	.	.	.
Location1	-2.613031e-01	-2.633044e-01	-2.651262e-01
Location2	6.457022e-12	6.789483e-12	7.106790e-12
`Age at diagnosis (months)`	-9.102228e-02	-9.379472e-02	-9.631815e-02
`Time since diagnosis (months)`	-8.983565e-02	-9.261649e-02	-9.514758e-02
`Tumor type`2	7.422886e-03	9.474024e-03	1.134116e-02
`Tumor type`3	7.409193e-02	7.883636e-02	8.315486e-02
`Tumor type`4	-9.003560e-02	-8.822307e-02	-8.657314e-02
Radiotherapy1	2.152458e-01	2.164441e-01	2.175344e-01
Chemotherapy1	-4.145648e-02	-4.274598e-02	-4.391972e-02
Neurosurgery1	2.424072e-02	2.540436e-02	2.646343e-02
FSIQ	3.391180e-03	3.346791e-03	3.306394e-03
`TomA Raw scores`	6.694530e-02	6.712693e-02	6.729255e-02
`TomA-Tscores`	-5.436881e-02	-5.427366e-02	-5.418721e-02
`TomB Raw scores`	-2.533416e-01	-2.540190e-01	-2.546364e-01
`TomB-Tscores`	9.207597e-02	9.233847e-02	9.257760e-02
`Affect Rec. Raw scores`	-1.956235e-01	-1.963818e-01	-1.970722e-01
`Affect Rec.-Tscores`	1.564515e-01	1.571163e-01	1.577215e-01
`Accuracy Familiarization`	-4.297571e-01	-4.172120e-01	-4.057949e-01
`ATP 10%`	-2.589997e+00	-2.590667e+00	-2.591277e+00
`ATP 40%`	-1.842825e-01	-1.871921e-01	-1.898409e-01
`ATP 60%`	8.345804e-01	8.321274e-01	8.298956e-01
`ATP 90%`	2.500447e+00	2.495849e+00	2.491665e+00
(Intercept)	2.552146e+00	2.554621e+00	2.556875e+00
Id	5.008651e-03	5.034976e-03	5.058914e-03
Sex1	3.477004e-02	3.385857e-02	3.303041e-02
Age	1.235379e+00	1.260922e+00	1.284138e+00
AgeMonths	.	.	.
Location1	-2.667877e-01	-2.683019e-01	-2.696787e-01
Location2	7.409857e-12	7.683546e-12	7.938565e-12
`Age at diagnosis (months)`	-9.862073e-02	-1.007198e-01	-1.026278e-01
`Time since diagnosis (months)`	-9.745714e-02	-9.956261e-02	-1.014764e-01
`Tumor type`2	1.304438e-02	1.459684e-02	1.600833e-02
`Tumor type`3	8.709493e-02	9.068658e-02	9.395153e-02
`Tumor type`4	-8.506846e-02	-8.369726e-02	-8.245052e-02
Radiotherapy1	2.185299e-01	2.194377e-01	2.202623e-01
Chemotherapy1	-4.498958e-02	-4.596407e-02	-4.685005e-02
Neurosurgery1	2.743031e-02	2.831208e-02	2.911341e-02
FSIQ	3.269511e-03	3.235873e-03	3.205310e-03
`TomA Raw scores`	6.744221e-02	6.757773e-02	6.770154e-02
`TomA-Tscores`	-5.410759e-02	-5.403453e-02	-5.396846e-02
`TomB Raw scores`	-2.551980e-01	-2.557091e-01	-2.561750e-01
`TomB-Tscores`	9.279524e-02	9.299336e-02	9.317383e-02

`Affect Rec. Raw scores`	-1.977001e-01	-1.982710e-01	-1.987904e-01
`Affect Rec.-Tscores`	1.582718e-01	1.587721e-01	1.592273e-01
`Accuracy Familiarization`	-3.953712e-01	-3.858651e-01	-3.772273e-01
`ATP 10%`	-2.591835e+00	-2.592344e+00	-2.592807e+00
`ATP 40%`	-1.922560e-01	-1.944564e-01	-1.964575e-01
`ATP 60%`	8.278557e-01	8.259941e-01	8.243038e-01
`ATP 90%`	2.487845e+00	2.484361e+00	2.481195e+00
(Intercept)	2.558903e+00	2.560742e+00	2.562398e+00
Id	5.080759e-03	5.100626e-03	5.118753e-03
Sex1	3.227308e-02	3.158458e-02	3.095519e-02
Age	1.305353e+00	1.324643e+00	1.342265e+00
AgeMonths	.	.	.
Location1	-2.709357e-01	-2.720789e-01	-2.731224e-01
Location2	8.176759e-12	8.405477e-12	8.602740e-12
`Age at diagnosis (months)`	-1.043712e-01	-1.059565e-01	-1.074047e-01
`Time since diagnosis (months)`	-1.032251e-01	-1.048152e-01	-1.062678e-01
`Tumor type` 2	1.729743e-02	1.846983e-02	1.954030e-02
`Tumor type` 3	9.693431e-02	9.964674e-02	1.021241e-01
`Tumor type` 4	-8.131237e-02	-8.027734e-02	-7.933267e-02
Radiotherapy1	2.210166e-01	2.217022e-01	2.223290e-01
Chemotherapy1	-4.765823e-02	-4.839295e-02	-4.906302e-02
Neurosurgery1	2.984626e-02	3.051266e-02	3.112191e-02
FSIQ	3.177353e-03	3.151936e-03	3.128695e-03
`TomA Raw scores`	6.781282e-02	6.791413e-02	6.800524e-02
`TomA-Tscores`	-5.390714e-02	-5.385144e-02	-5.379984e-02
`TomB Raw scores`	-2.565984e-01	-2.569841e-01	-2.573348e-01
`TomB-Tscores`	9.333800e-02	9.348746e-02	9.362343e-02
`Affect Rec. Raw scores`	-1.992626e-01	-1.996916e-01	-2.000816e-01
`Affect Rec.-Tscores`	1.596409e-01	1.600168e-01	1.603583e-01
`Accuracy Familiarization`	-3.693270e-01	-3.621438e-01	-3.555763e-01
`ATP 10%`	-2.593231e+00	-2.593617e+00	-2.593970e+00
`ATP 40%`	-1.982835e-01	-1.999442e-01	-2.014594e-01
`ATP 60%`	8.227549e-01	8.213470e-01	8.200576e-01
`ATP 90%`	2.478298e+00	2.475665e+00	2.473257e+00
(Intercept)	2.563897e+00	2.565250e+00	2.566478e+00
Id	5.135238e-03	5.150266e-03	5.163923e-03
Sex1	3.038288e-02	2.986056e-02	2.938614e-02
Age	1.358290e+00	1.372910e+00	1.386193e+00
AgeMonths	.	.	.
Location1	-2.740714e-01	-2.749368e-01	-2.757233e-01
Location2	8.784054e-12	8.958443e-12	9.118279e-12
`Age at diagnosis (months)`	-1.087217e-01	-1.099232e-01	-1.110149e-01
`Time since diagnosis (months)`	-1.075888e-01	-1.087939e-01	-1.098889e-01
`Tumor type` 2	2.051394e-02	2.140193e-02	2.220896e-02
`Tumor type` 3	1.043771e-01	1.064323e-01	1.082998e-01
`Tumor type` 4	-7.847357e-02	-7.769026e-02	-7.697843e-02
Radiotherapy1	2.228990e-01	2.234191e-01	2.238915e-01
Chemotherapy1	-4.967213e-02	-5.022718e-02	-5.073140e-02
Neurosurgery1	3.167604e-02	3.218183e-02	3.264137e-02

FSIQ	3.107560e-03	3.088267e-03	3.070742e-03
`TomA Raw scores`	6.808805e-02	6.816284e-02	6.823097e-02
`TomA-Tscores`	-5.375289e-02	-5.370967e-02	-5.367050e-02
`TomB Raw scores`	-2.576540e-01	-2.579445e-01	-2.582090e-01
`TomB-Tscores`	9.374720e-02	9.385983e-02	9.396235e-02
`Affect Rec. Raw scores`	-2.004358e-01	-2.007579e-01	-2.010504e-01
`Affect Rec.-Tscores`	1.606685e-01	1.609505e-01	1.612066e-01
`Accuracy Familiarization`	-3.496036e-01	-3.441518e-01	-3.391993e-01
`ATP 10%`	-2.594292e+00	-2.594586e+00	-2.594853e+00
`ATP 40%`	-2.028373e-01	-2.040934e-01	-2.052350e-01
`ATP 60%`	8.188851e-01	8.178137e-01	8.168410e-01
`ATP 90%`	2.471067e+00	2.469068e+00	2.467252e+00
(Intercept)	2.567586e+00	2.568577e+00	
Id	5.176385e-03	5.187771e-03	
Sex1	2.895256e-02	2.855527e-02	
Age	1.398325e+00	1.409429e+00	
AgeMonths	.	.	
Location1	-2.764411e-01	-2.770973e-01	
Location2	9.257833e-12	9.394655e-12	
`Age at diagnosis (months)`	-1.120119e-01	-1.129246e-01	
`Time since diagnosis (months)`	-1.108890e-01	-1.118044e-01	
`Tumor type`^2	2.294577e-02	2.361964e-02	
`Tumor type`^3	1.100052e-01	1.115656e-01	
`Tumor type`^4	-7.632874e-02	-7.573485e-02	
Radiotherapy1	2.243233e-01	2.247191e-01	
Chemotherapy1	-5.119137e-02	-5.161142e-02	
Neurosurgery1	3.306136e-02	3.344622e-02	
FSIQ	3.054724e-03	3.040041e-03	
`TomA Raw scores`	6.829241e-02	6.834731e-02	
`TomA-Tscores`	-5.363433e-02	-5.360053e-02	
`TomB Raw scores`	-2.584496e-01	-2.586682e-01	
`TomB-Tscores`	9.405567e-02	9.414053e-02	
`Affect Rec. Raw scores`	-2.013165e-01	-2.015584e-01	
`Affect Rec.-Tscores`	1.614395e-01	1.616512e-01	
`Accuracy Familiarization`	-3.346727e-01	-3.305242e-01	
`ATP 10%`	-2.595098e+00	-2.595323e+00	
`ATP 40%`	-2.062766e-01	-2.072281e-01	
`ATP 60%`	8.159506e-01	8.151325e-01	
`ATP 90%`	2.465591e+00	2.464070e+00	

```
# with lasso we found mse is 0.29958
```

smaller error with lasso

```
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
# model 3 ridge
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
set.seed(123)
ridge_model <- glmnet(x_train, y_train, alpha=0)
```

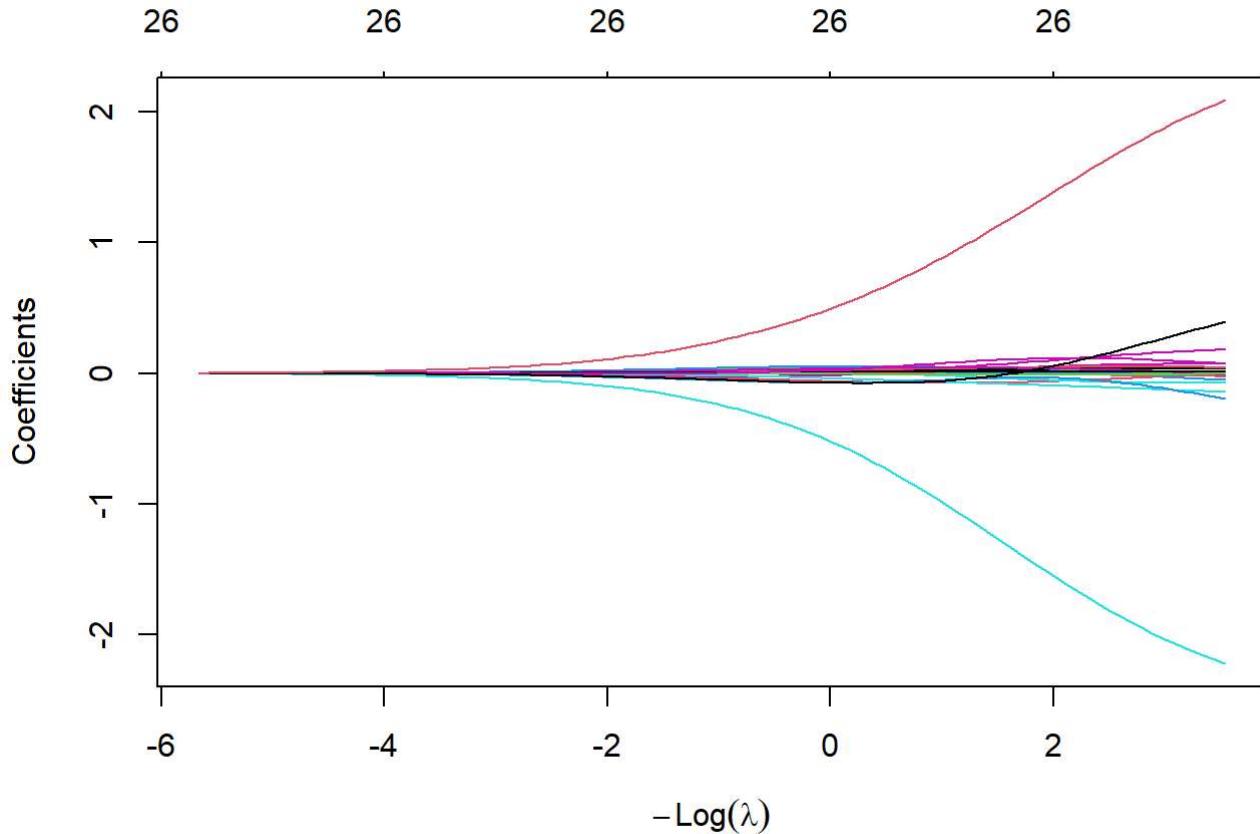
```

best_lambda_ridge <- ridge_model$lambda.min
pred_ridge <- predict(ridge_model, s= best_lambda_ridge, newx = x_test )
mse_ridge <- mean((y_test - pred_ridge)^2)
mse_ridge

```

[1] 0.2477862

```
plot(ridge_model)
```



```
coef(ridge_model)
```

27 x 100 sparse Matrix of class "dgCMatrix"

[[suppressing 100 column names 's0', 's1', 's2' ...]]

(Intercept)	-9.769231e-02	-1.032709e-01	-1.038118e-01
Id	1.400230e-38	2.936114e-05	3.220039e-05
Sex1	-2.613276e-37	-5.488816e-04	-6.020562e-04
Age	1.678555e-38	3.532108e-05	3.874988e-05
AgeMonths	1.398707e-39	2.943229e-06	3.228944e-06
Location1	2.907087e-37	6.066125e-04	6.649556e-04

Location2	-2.907087e-37	-6.066125e-04	-6.649566e-04
`Age at diagnosis (months)`	-1.960960e-39	-4.099866e-06	-4.495051e-06
`Time since diagnosis (months)`	3.842522e-39	8.054102e-06	8.832613e-06
`Tumor type`^2	2.121457e-37	4.452995e-04	4.884093e-04
`Tumor type`^3	3.926560e-37	8.219815e-04	9.013226e-04
`Tumor type`^4	-7.781385e-38	-1.651328e-04	-1.813106e-04
Radiotherapy1	-3.245559e-38	-6.702614e-05	-7.339801e-05
Chemotherapy1	-5.695346e-38	-1.181046e-04	-1.293852e-04
Neurosurgery1	1.588339e-37	3.321507e-04	3.641745e-04
FSIQ	2.561370e-39	5.403323e-06	5.929297e-06
`TomA Raw scores`	-1.459766e-38	-3.018768e-05	-3.306191e-05
`TomA-Tscores`	-2.417445e-38	-5.065634e-05	-5.555124e-05
`TomB Raw scores`	1.811307e-37	3.800907e-04	4.168764e-04
`TomB-Tscores`	4.413049e-38	9.253519e-05	1.014835e-04
`Affect Rec. Raw scores`	-9.768370e-39	-2.051075e-05	-2.249720e-05
`Affect Rec.-Tscores`	-2.050353e-38	-4.305274e-05	-4.722243e-05
`Accuracy Familiarization`	-4.970715e-37	-1.041572e-03	-1.142218e-03
`ATP 10%`	-1.417677e-36	-2.986089e-03	-3.276282e-03
`ATP 40%`	-9.753559e-38	-2.015073e-04	-2.206728e-04
`ATP 60%`	-4.191014e-37	-8.786748e-04	-9.636314e-04
`ATP 90%`	1.691751e-36	3.556743e-03	3.901687e-03
(Intercept)	-1.044050e-01	-1.050552e-01	-1.057679e-01
Id	3.531179e-05	3.872085e-05	4.245547e-05
Sex1	-6.603468e-04	-7.242377e-04	-7.942583e-04
Age	4.250992e-05	4.663288e-05	5.115340e-05
AgeMonths	3.542259e-06	3.885816e-06	4.262499e-06
Location1	7.288269e-04	7.987312e-04	8.752179e-04
Location2	-7.288281e-04	-7.987328e-04	-8.752201e-04
`Age at diagnosis (months)`	-4.927853e-06	-5.401750e-06	-5.920527e-06
`Time since diagnosis (months)`	9.685662e-06	1.062024e-05	1.164396e-05
`Tumor type`^2	5.356604e-04	5.874438e-04	6.441863e-04
`Tumor type`^3	9.882377e-04	1.083432e-03	1.187674e-03
`Tumor type`^4	-1.990815e-04	-2.186036e-04	-2.400514e-04
Radiotherapy1	-8.035819e-05	-8.795737e-05	-9.624994e-05
Chemotherapy1	-1.417180e-04	-1.551964e-04	-1.699206e-04
Neurosurgery1	3.992479e-04	4.376536e-04	4.796988e-04
FSIQ	6.506377e-06	7.139511e-06	7.834122e-06
`TomA Raw scores`	-3.620254e-05	-3.963267e-05	-4.337716e-05
`TomA-Tscores`	-6.091450e-05	-6.678997e-05	-7.322542e-05
`TomB Raw scores`	4.571933e-04	5.013747e-04	5.497838e-04
`TomB-Tscores`	1.112892e-04	1.220331e-04	1.338028e-04
`Affect Rec. Raw scores`	-2.467467e-05	-2.706123e-05	-2.967661e-05
`Affect Rec.-Tscores`	-5.179304e-05	-5.680249e-05	-6.229224e-05
`Accuracy Familiarization`	-1.252493e-03	-1.373299e-03	-1.505618e-03
`ATP 10%`	-3.594577e-03	-3.943674e-03	-4.326530e-03
`ATP 40%`	-2.416095e-04	-2.644708e-04	-2.894209e-04
`ATP 60%`	-1.056727e-03	-1.158725e-03	-1.270461e-03
`ATP 90%`	4.279891e-03	4.694523e-03	5.149043e-03
(Intercept)	-1.065492e-01	-1.074053e-01	-1.083434e-01

Id	4.654601e-05	5.102553e-05	5.592999e-05
Sex1	-8.709861e-04	-9.550509e-04	-1.047139e-03
Age	5.610934e-05	6.154207e-05	6.749678e-05
AgeMonths	4.675466e-06	5.128162e-06	5.624352e-06
Location1	9.588820e-04	1.050367e-03	1.150369e-03
Location2	-9.588848e-04	-1.050371e-03	-1.150374e-03
`Age at diagnosis (months)`	-6.488296e-06	-7.109515e-06	-7.789016e-06
`Time since diagnosis (months)`	1.276513e-05	1.399276e-05	1.533667e-05
`Tumor type`2	7.063534e-04	7.744524e-04	8.490356e-04
`Tumor type`3	1.301798e-03	1.426712e-03	1.563401e-03
`Tumor type`4	-2.636169e-04	-2.895118e-04	-3.179694e-04
Radiotherapy1	-1.052940e-04	-1.151514e-04	-1.258878e-04
Chemotherapy1	-1.859983e-04	-2.035452e-04	-2.226850e-04
Neurosurgery1	5.257175e-04	5.760719e-04	6.311547e-04
FSIQ	8.596152e-06	9.432110e-06	1.034913e-05
`TomA Raw scores`	-4.746268e-05	-5.191766e-05	-5.677240e-05
`TomA-Tscores`	-8.027288e-05	-8.798893e-05	-9.643503e-05
`TomB Raw scores`	6.028169e-04	6.609055e-04	7.245193e-04
`TomB-Tscores`	1.466942e-04	1.608113e-04	1.762674e-04
`Affect Rec. Raw scores`	-3.254237e-05	-3.568201e-05	-3.912112e-05
`Affect Rec.-Tscores`	-6.830746e-05	-7.489746e-05	-8.211592e-05
`Accuracy Familiarization`	-1.650521e-03	-1.809169e-03	-1.982827e-03
`ATP 10%`	-4.746380e-03	-5.206765e-03	-5.711557e-03
`ATP 40%`	-3.166354e-04	-3.463015e-04	-3.786182e-04
`ATP 60%`	-1.392839e-03	-1.526850e-03	-1.673566e-03
`ATP 90%`	5.647234e-03	6.193223e-03	6.791515e-03
(Intercept)	-1.093712e-01	-1.104970e-01	-1.117299e-01
Id	6.129845e-05	6.717335e-05	7.360068e-05
Sex1	-1.147999e-03	-1.258444e-03	-1.379358e-03
Age	7.402279e-05	8.117393e-05	8.900887e-05
AgeMonths	6.168148e-06	6.764032e-06	7.416897e-06
Location1	1.259638e-03	1.378981e-03	1.509266e-03
Location2	-1.259644e-03	-1.378989e-03	-1.509277e-03
`Age at diagnosis (months)`	-8.532028e-06	-9.344200e-06	-1.023162e-05
`Time since diagnosis (months)`	1.680751e-05	1.841685e-05	2.017721e-05
`Tumor type`2	9.307040e-04	1.020111e-03	1.117967e-03
`Tumor type`3	1.712930e-03	1.876457e-03	2.055230e-03
`Tumor type`4	-3.492468e-04	-3.836277e-04	-4.214249e-04
Radiotherapy1	-1.375726e-04	-1.502789e-04	-1.640828e-04
Chemotherapy1	-2.435495e-04	-2.662788e-04	-2.910214e-04
Neurosurgery1	6.913909e-04	7.572402e-04	8.291984e-04
FSIQ	1.135502e-05	1.245833e-05	1.366843e-05
`TomA Raw scores`	-6.205901e-05	-6.781141e-05	-7.406525e-05
`TomA-Tscores`	-1.056779e-04	-1.157900e-04	-1.268497e-04
`TomB Raw scores`	7.941695e-04	8.704114e-04	9.538480e-04
`TomB-Tscores`	1.931857e-04	2.116997e-04	2.319542e-04
`Affect Rec. Raw scores`	-4.288761e-05	-4.701184e-05	-5.152683e-05
`Affect Rec.-Tscores`	-9.002134e-05	-9.867735e-05	-1.081531e-04
`Accuracy Familiarization`	-2.172867e-03	-2.380776e-03	-2.608166e-03
`ATP 10%`	-6.264987e-03	-6.871684e-03	-7.536702e-03

`ATP 40%`	-4.137958e-04	-4.520560e-04	-4.936308e-04
`ATP 60%`	-1.834154e-03	-2.009881e-03	-2.202121e-03
`ATP 90%`	7.447024e-03	8.165104e-03	8.951590e-03
(Intercept)	-1.130800e-01	-1.145579e-01	-1.161756e-01
Id	8.063027e-05	8.831602e-05	9.671787e-05
Sex1	-1.511704e-03	-1.656525e-03	-1.814970e-03
Age	9.759157e-05	1.069917e-04	1.172844e-04
AgeMonths	8.132069e-06	8.915353e-06	9.773001e-06
Location1	1.651422e-03	1.806445e-03	1.975438e-03
Location2	-1.651437e-03	-1.806464e-03	-1.975438e-03
`Age at diagnosis (months)`	-1.120087e-05	-1.225898e-05	-1.341370e-05
`Time since diagnosis (months)`	2.210215e-05	2.420632e-05	2.650558e-05
`Tumor type`2	1.225042e-03	1.342171e-03	1.470264e-03
`Tumor type`3	2.250597e-03	2.464012e-03	2.697051e-03
`Tumor type`4	-4.629835e-04	-5.086846e-04	-5.589545e-04
Radiotherapy1	-1.790637e-04	-1.953031e-04	-2.128848e-04
Chemotherapy1	-3.179337e-04	-3.471797e-04	-3.789269e-04
Neurosurgery1	9.078000e-04	9.936198e-04	1.087279e-03
FSIQ	1.499557e-05	1.645096e-05	1.804682e-05
`TomA Raw scores`	-8.085774e-05	-8.822753e-05	-9.621740e-05
`TomA-Tscores`	-1.389417e-04	-1.521577e-04	-1.665969e-04
`TomB Raw scores`	1.045133e-03	1.144976e-03	1.254141e-03
`TomB-Tscores`	2.541063e-04	2.783256e-04	3.047951e-04
`Affect Rec. Raw scores`	-5.646848e-05	-6.187576e-05	-6.779160e-05
`Affect Rec.-Tscores`	-1.185239e-04	-1.298711e-04	-1.422835e-04
`Accuracy Familiarization`	-2.856780e-03	-3.128500e-03	-3.425344e-03
`ATP 10%`	-8.265561e-03	-9.064289e-03	-9.939457e-03
`ATP 40%`	-5.387617e-04	-5.876980e-04	-6.406918e-04
`ATP 60%`	-2.412359e-03	-2.642204e-03	-2.893392e-03
`ATP 90%`	9.812831e-03	1.075573e-02	1.178780e-02
(Intercept)	-1.179455e-01	-1.198815e-01	-1.219985e-01
Id	1.058958e-04	1.159186e-04	1.268592e-04
Sex1	-1.988234e-03	-2.177656e-03	-2.384668e-03
Age	1.285530e-04	1.408866e-04	1.543822e-04
AgeMonths	1.071198e-05	1.173970e-05	1.286423e-05
Location1	2.159451e-03	2.359712e-03	2.577475e-03
Location2	-2.159451e-03	-2.359711e-03	-2.577475e-03
`Age at diagnosis (months)`	-1.467282e-05	-1.604513e-05	-1.753980e-05
`Time since diagnosis (months)`	2.901689e-05	3.175859e-05	3.475035e-05
`Tumor type`2	1.610288e-03	1.763301e-03	1.930442e-03
`Tumor type`3	2.951367e-03	3.228768e-03	3.531172e-03
`Tumor type`4	-6.142482e-04	-6.750835e-04	-7.420274e-04
Radiotherapy1	-2.318918e-04	-2.524075e-04	-2.745129e-04
Chemotherapy1	-4.133577e-04	-4.506510e-04	-4.909908e-04
Neurosurgery1	1.189431e-03	1.300785e-03	1.422092e-03
FSIQ	1.979664e-05	2.171505e-05	2.381805e-05
`TomA Raw scores`	-1.048627e-04	-1.142067e-04	-1.242899e-04
`TomA-Tscores`	-1.823647e-04	-1.995759e-04	-2.183528e-04
`TomB Raw scores`	1.373459e-03	1.503822e-03	1.646191e-03

`TomB-Tscores`	3.337129e-04	3.652915e-04	3.997594e-04
`Affect Rec. Raw scores`	-7.426075e-05	-8.133333e-05	-8.906303e-05
`Affect Rec.-Tscores`	-1.558565e-04	-1.706938e-04	-1.869072e-04
`Accuracy Familiarization`	-3.749516e-03	-4.103354e-03	-4.489373e-03
`ATP 10%`	-1.089824e-02	-1.194845e-02	-1.309860e-02
`ATP 40%`	-6.980060e-04	-7.598955e-04	-8.266119e-04
`ATP 60%`	-3.167796e-03	-3.467429e-03	-3.794457e-03
`ATP 90%`	1.291719e-02	1.415273e-02	1.550400e-02
(Intercept)	-1.243126e-01	-1.268412e-01	-1.296031e-01
Id	1.387954e-04	1.518107e-04	1.659942e-04
Sex1	-2.610813e-03	-2.857754e-03	-3.127274e-03
Age	1.691449e-04	1.852886e-04	2.029360e-04
AgeMonths	1.409435e-05	1.543954e-05	1.691003e-05
Location1	2.814062e-03	3.070846e-03	3.349253e-03
Location2	-2.814061e-03	-3.070845e-03	-3.349251e-03
`Age at diagnosis (months)`	-1.916659e-05	-2.093579e-05	-2.285821e-05
`Time since diagnosis (months)`	3.801320e-05	4.156961e-05	4.544349e-05
`Tumor type` 2	2.112933e-03	2.312088e-03	2.529311e-03
`Tumor type` 3	3.860621e-03	4.219285e-03	4.609456e-03
`Tumor type` 4	-8.157070e-04	-8.968151e-04	-9.861176e-04
Radiotherapy1	-2.982843e-04	-3.237911e-04	-3.510925e-04
Chemotherapy1	-5.345615e-04	-5.815448e-04	-6.321160e-04
Neurosurgery1	1.554150e-03	1.697804e-03	1.853943e-03
FSIQ	2.612315e-05	2.864941e-05	3.141765e-05
`TomA Raw scores`	-1.351517e-04	-1.468294e-04	-1.593572e-04
`TomA-Tscores`	-2.388263e-04	-2.611362e-04	-2.854309e-04
`TomB Raw scores`	1.801600e-03	1.971158e-03	2.156051e-03
`TomB-Tscores`	4.373614e-04	4.783595e-04	5.230327e-04
`Affect Rec. Raw scores`	-9.750784e-05	-1.067303e-04	-1.167980e-04
`Affect Rec.-Tscores`	-2.046175e-04	-2.239546e-04	-2.450580e-04
`Accuracy Familiarization`	-4.910261e-03	-5.368887e-03	-5.868296e-03
`ATP 10%`	-1.435795e-02	-1.573658e-02	-1.724544e-02
`ATP 40%`	-8.983954e-04	-9.754674e-04	-1.058022e-03
`ATP 60%`	-4.151196e-03	-4.540128e-03	-4.963894e-03
`ATP 90%`	1.698136e-02	1.859601e-02	2.036002e-02
(Intercept)	-1.326183e-01	-1.359085e-01	-1.394969e-01
Id	1.814407e-04	1.982507e-04	2.165305e-04
Sex1	-3.421289e-03	-3.741846e-03	-4.091128e-03
Age	2.222199e-04	2.432830e-04	2.662787e-04
AgeMonths	1.851687e-05	2.027197e-05	2.218809e-05
Location1	3.650749e-03	3.976828e-03	4.328998e-03
Location2	-3.650747e-03	-3.976826e-03	-4.328994e-03
`Age at diagnosis (months)`	-2.494520e-05	-2.720855e-05	-2.966047e-05
`Time since diagnosis (months)`	4.966025e-05	5.424672e-05	5.923121e-05
`Tumor type` 2	2.766106e-03	3.024075e-03	3.304916e-03
`Tumor type` 3	5.033548e-03	5.494093e-03	5.993729e-03
`Tumor type` 4	-1.084461e-03	-1.192782e-03	-1.312114e-03
Radiotherapy1	-3.802338e-04	-4.112418e-04	-4.441188e-04
Chemotherapy1	-6.864395e-04	-7.446629e-04	-8.069101e-04

Neurosurgery1	2.023501e-03	2.207452e-03	2.406808e-03
FSIQ	3.445057e-05	3.777286e-05	4.141140e-05
`TomA Raw scores`	-1.727643e-04	-1.870738e-04	-2.023000e-04
`TomA-Tscores`	-3.118678e-04	-3.406131e-04	-3.718415e-04
`TomB Raw scores`	2.357544e-03	2.576984e-03	2.815798e-03
`TomB-Tscores`	5.716779e-04	6.246095e-04	6.821595e-04
`Affect Rec. Raw scores`	-1.277833e-04	-1.397642e-04	-1.528246e-04
`Affect Rec.-Tscores`	-2.680778e-04	-2.931742e-04	-3.205187e-04
`Accuracy Familiarization`	-6.411717e-03	-7.002556e-03	-7.644391e-03
`ATP 10%`	-1.889641e-02	-2.070239e-02	-2.267737e-02
`ATP 40%`	-1.146213e-03	-1.240145e-03	-1.339853e-03
`ATP 60%`	-5.425306e-03	-5.927340e-03	-6.473140e-03
`ATP 90%`	2.228642e-02	2.438920e-02	2.668340e-02
(Intercept)	-1.434080e-01	-1.476682e-01	-1.523054e-01
Id	2.363922e-04	2.579532e-04	2.813363e-04
Sex1	-4.471461e-03	-4.885310e-03	-5.335281e-03
Age	2.913715e-04	3.187372e-04	3.485633e-04
AgeMonths	2.427894e-05	2.655918e-05	2.904443e-05
Location1	4.708757e-03	5.117571e-03	5.556846e-03
Location2	-4.708752e-03	-5.117564e-03	-5.556836e-03
`Age at diagnosis (months)`	-3.231349e-05	-3.518039e-05	-3.827405e-05
`Time since diagnosis (months)`	6.464337e-05	7.051417e-05	7.687575e-05
`Tumor type`2	3.610432e-03	3.942519e-03	4.303173e-03
`Tumor type`3	6.535190e-03	7.121288e-03	7.754893e-03
`Tumor type`4	-1.443598e-03	-1.588497e-03	-1.748202e-03
Radiotherapy1	-4.788370e-04	-5.153299e-04	-5.534839e-04
Chemotherapy1	-8.732737e-04	-9.438048e-04	-1.018502e-03
Neurosurgery1	2.622612e-03	2.855932e-03	3.107852e-03
FSIQ	4.539543e-05	4.975666e-05	5.452953e-05
`TomA Raw scores`	-2.184464e-04	-2.355027e-04	-2.534414e-04
`TomA-Tscores`	-4.057359e-04	-4.424865e-04	-4.822904e-04
`TomB Raw scores`	3.075497e-03	3.357668e-03	3.663977e-03
`TomB-Tscores`	7.446768e-04	8.125263e-04	8.860877e-04
`Affect Rec. Raw scores`	-1.670539e-04	-1.825483e-04	-1.994101e-04
`Affect Rec.-Tscores`	-3.502941e-04	-3.826945e-04	-4.179262e-04
`Accuracy Familiarization`	-8.340964e-03	-9.096164e-03	-9.914007e-03
`ATP 10%`	-2.483646e-02	-2.719604e-02	-2.977377e-02
`ATP 40%`	-1.445287e-03	-1.556289e-03	-1.672567e-03
`ATP 60%`	-7.066010e-03	-7.709408e-03	-8.406934e-03
`ATP 90%`	2.918511e-02	3.191156e-02	3.488110e-02
(Intercept)	-1.573490e-01	-1.628301e-01	-1.687814e-01
Id	3.066686e-04	3.340819e-04	3.637108e-04
Sex1	-5.824117e-03	-6.354697e-03	-6.930024e-03
Age	3.810490e-04	4.164053e-04	4.548547e-04
AgeMonths	3.175127e-05	3.469729e-05	3.790102e-05
Location1	6.027890e-03	6.531870e-03	7.069766e-03
Location2	-6.027876e-03	-6.531850e-03	-7.069739e-03
`Age at diagnosis (months)`	-4.160732e-05	-4.519285e-05	-4.904285e-05
`Time since diagnosis (months)`	8.376123e-05	9.120452e-05	9.924005e-05

`Tumor type`2	4.694476e-03	5.118594e-03	5.577763e-03
`Tumor type`3	8.438905e-03	9.176218e-03	9.969685e-03
`Tumor type`4	-1.924245e-03	-2.118315e-03	-2.332266e-03
Radiotherapy1	-5.931279e-04	-6.340210e-04	-6.758395e-04
Chemotherapy1	-1.097299e-03	-1.180049e-03	-1.266507e-03
Neurosurgery1	3.379463e-03	3.671847e-03	3.986065e-03
FSIQ	5.975131e-05	6.546233e-05	7.170613e-05
`TomA Raw scores`	-2.722144e-04	-2.917484e-04	-3.119401e-04
`TomA-Tscores`	-5.253500e-04	-5.718718e-04	-6.220642e-04
`TomB Raw scores`	3.996158e-03	4.356011e-03	4.745389e-03
`TomB-Tscores`	9.657537e-04	1.051928e-03	1.145020e-03
`Affect Rec. Raw scores`	-2.177490e-04	-2.376815e-04	-2.593319e-04
`Affect Rec.-Tscores`	-4.562067e-04	-4.977657e-04	-5.428444e-04
`Accuracy Familiarization`	-1.079861e-02	-1.175416e-02	-1.278487e-02
`ATP 10%`	-3.258871e-02	-3.566140e-02	-3.901392e-02
`ATP 40%`	-1.793666e-03	-1.918937e-03	-2.047495e-03
`ATP 60%`	-9.162313e-03	-9.979374e-03	-1.086202e-02
`ATP 90%`	3.811326e-02	4.162877e-02	4.544954e-02
(Intercept)	-1.752367e-01	-1.822313e-01	-1.898016e-01
Id	3.956926e-04	4.301660e-04	4.672692e-04
Sex1	-7.553216e-03	-8.227491e-03	-8.956149e-03
Age	4.966305e-04	5.419765e-04	5.911456e-04
AgeMonths	4.138192e-05	4.516028e-05	4.925718e-05
Location1	7.642316e-03	8.249949e-03	8.892715e-03
Location2	-7.642278e-03	-8.249896e-03	-8.892643e-03
`Age at diagnosis (months)`	-5.316887e-05	-5.758157e-05	-6.229032e-05
`Time since diagnosis (months)`	1.079024e-04	1.172260e-04	1.272444e-04
`Tumor type`2	6.074276e-03	6.610467e-03	7.188686e-03
`Tumor type`3	1.082206e-02	1.173596e-02	1.271378e-02
`Tumor type`4	-2.568134e-03	-2.828147e-03	-3.114738e-03
Radiotherapy1	-7.181612e-04	-7.604487e-04	-8.020298e-04
Chemotherapy1	-1.356313e-03	-1.448971e-03	-1.543824e-03
Neurosurgery1	4.323141e-03	4.684038e-03	5.069643e-03
FSIQ	7.852963e-05	8.598330e-05	9.412134e-05
`TomA Raw scores`	-3.326514e-04	-3.537033e-04	-3.748697e-04
`TomA-Tscores`	-6.761358e-04	-7.342926e-04	-7.967347e-04
`TomB Raw scores`	5.166187e-03	5.620324e-03	6.109729e-03
`TomB-Tscores`	1.245446e-03	1.353618e-03	1.469945e-03
`Affect Rec. Raw scores`	-2.828324e-04	-3.083235e-04	-3.359545e-04
`Affect Rec.-Tscores`	-5.916953e-04	-6.445816e-04	-7.017771e-04
`Accuracy Familiarization`	-1.389492e-02	-1.508839e-02	-1.636921e-02
`ATP 10%`	-4.266999e-02	-4.665502e-02	-5.099624e-02
`ATP 40%`	-2.178176e-03	-2.309493e-03	-2.439581e-03
`ATP 60%`	-1.181421e-02	-1.283988e-02	-1.394294e-02
`ATP 90%`	4.959869e-02	5.410052e-02	5.898043e-02
(Intercept)	-1.979847e-01	-2.068185e-01	-2.163410e-01
Id	5.071393e-04	5.499095e-04	5.957081e-04
Sex1	-9.742547e-03	-1.059007e-02	-1.150211e-02
Age	6.443983e-04	7.020008e-04	7.642226e-04

AgeMonths	5.369431e-05	5.849387e-05	6.367830e-05
Location1	9.570213e-03	1.028150e-02	1.102499e-02
Location2	-9.570114e-03	-1.028136e-02	-1.102481e-02
`Age at diagnosis (months)`	-6.730296e-05	-7.262543e-05	-7.826137e-05
`Time since diagnosis (months)`	1.379902e-04	1.494940e-04	1.617837e-04
`Tumor type`2	7.811274e-03	8.480530e-03	9.198676e-03
`Tumor type`3	1.375762e-02	1.486921e-02	1.604984e-02
`Tumor type`4	-3.430554e-03	-3.778468e-03	-4.161579e-03
Radiotherapy1	-8.420773e-04	-8.795863e-04	-9.133501e-04
Chemotherapy1	-1.640032e-03	-1.736544e-03	-1.832076e-03
Neurosurgery1	5.480739e-03	5.917986e-03	6.381891e-03
FSIQ	1.030017e-04	1.126864e-04	1.232412e-04
`TomA Raw scores`	-3.958715e-04	-4.163692e-04	-4.359571e-04
`TomA-Tscores`	-8.636533e-04	-9.352264e-04	-1.011615e-03
`TomB Raw scores`	6.636313e-03	7.201946e-03	7.808428e-03
`TomB-Tscores`	1.594821e-03	1.728622e-03	1.871694e-03
`Affect Rec. Raw scores`	-3.658844e-04	-3.982821e-04	-4.333273e-04
`Affect Rec.-Tscores`	-7.635648e-04	-8.302365e-04	-9.020913e-04
`Accuracy Familiarization`	-1.774106e-02	-1.920725e-02	-2.077065e-02
`ATP 10%`	-5.572273e-02	-6.086547e-02	-6.645749e-02
`ATP 40%`	-2.566137e-03	-2.686363e-03	-2.796896e-03
`ATP 60%`	-1.512719e-02	-1.639624e-02	-1.775348e-02
`ATP 90%`	6.426498e-02	6.998170e-02	7.615911e-02
(Intercept)	-2.265900e-01	-2.376026e-01	-2.494148e-01
Id	6.446556e-04	6.968629e-04	7.524289e-04
Sex1	-1.248199e-02	-1.353297e-02	-1.465814e-02
Age	8.313331e-04	9.035985e-04	9.812768e-04
AgeMonths	6.927007e-05	7.529135e-05	8.176366e-05
Location1	1.179841e-02	1.259862e-02	1.342160e-02
Location2	-1.179816e-02	-1.259830e-02	-1.342117e-02
`Age at diagnosis (months)`	-8.421176e-05	-9.047456e-05	-9.704436e-05
`Time since diagnosis (months)`	1.748844e-04	1.888167e-04	2.035966e-04
`Tumor type`2	9.967814e-03	1.078987e-02	1.166657e-02
`Tumor type`3	1.730022e-02	1.862041e-02	2.000969e-02
`Tumor type`4	-4.583221e-03	-5.046955e-03	-5.556562e-03
Radiotherapy1	-9.419345e-04	-9.636514e-04	-9.765316e-04
Chemotherapy1	-1.925078e-03	-2.013713e-03	-2.095832e-03
Neurosurgery1	6.872786e-03	7.390808e-03	7.935871e-03
FSIQ	1.347362e-04	1.472452e-04	1.608460e-04
`TomA Raw scores`	-4.541564e-04	-4.704099e-04	-4.840768e-04
`TomA-Tscores`	-1.092958e-03	-1.179368e-03	-1.270927e-03
`TomB Raw scores`	8.457450e-03	9.150561e-03	9.889125e-03
`TomB-Tscores`	2.024348e-03	2.186847e-03	2.359397e-03
`Affect Rec. Raw scores`	-4.712118e-04	-5.121402e-04	-5.563314e-04
`Affect Rec.-Tscores`	-9.794348e-04	-1.062577e-03	-1.151833e-03
`Accuracy Familiarization`	-2.243350e-02	-2.419733e-02	-2.606278e-02
`ATP 10%`	-7.253380e-02	-7.913156e-02	-8.629003e-02
`ATP 40%`	-2.893744e-03	-2.972213e-03	-3.026840e-03
`ATP 60%`	-1.920195e-02	-2.074428e-02	-2.238255e-02
`ATP 90%`	8.282654e-02	9.001409e-02	9.775243e-02

(Intercept)	-2.620607e-01	-2.755719e-01	-0.2899676970
Id	8.114377e-04	8.739568e-04	0.0009399660
Sex1	-1.586043e-02	-1.714245e-02	-0.0185058652
Age	1.064613e-03	1.153835e-03	0.0012492130
AgeMonths	8.870746e-05	9.614164e-05	0.0001040842
Location1	1.426232e-02	1.511463e-02	0.0159707450
Location2	-1.426175e-02	-1.511391e-02	-0.0159707119
`Age at diagnosis (months)`	-1.039121e-04	-1.110647e-04	-0.0001184862
`Time since diagnosis (months)`	2.192341e-04	2.357330e-04	0.0002530913
`Tumor type`2	1.259931e-02	1.358918e-02	0.0146369617
`Tumor type`3	2.146646e-02	2.298817e-02	0.0245714877
`Tumor type`4	-6.116026e-03	-6.729510e-03	-0.0074014278
Radiotherapy1	-9.782973e-04	-9.663346e-04	-0.0009376937
Chemotherapy1	-2.168953e-03	-2.230243e-03	-0.0022763138
Neurosurgery1	8.507655e-03	9.105590e-03	0.0097291636
FSIQ	1.756203e-04	1.916532e-04	0.0002090385
`TomA Raw scores`	-4.944297e-04	-5.006527e-04	-0.0005019114
`TomA-Tscores`	-1.367679e-03	-1.469628e-03	-0.0015767627
`TomB Raw scores`	1.067428e-02	1.150687e-02	0.0123875534
`TomB-Tscores`	2.542133e-03	2.735113e-03	0.0029382981
`Affect Rec. Raw scores`	-6.040202e-04	-6.554588e-04	-0.0007109804
`Affect Rec.-Tscores`	-1.247517e-03	-1.349947e-03	-0.0014594722
`Accuracy Familiarization`	-2.802941e-02	-3.009555e-02	-0.0322584644
`ATP 10%`	-9.405061e-02	-1.024569e-01	-0.1115545413
`ATP 40%`	-3.051326e-03	-3.038470e-03	-0.0029798949
`ATP 60%`	-2.411823e-02	-2.595199e-02	-0.0278836018
`ATP 90%`	1.060727e-01	1.150064e-01	0.1245852621
(Intercept)	-0.3052880678	-0.3215457183	-0.3387547745
Id	0.0010096100	0.0010828388	0.0011596308
Sex1	-0.0199537092	-0.0214868659	-0.0231061601
Age	0.0013507962	0.0014587687	0.0015732119
AgeMonths	0.0001125471	0.0001215419	0.0001310756
Location1	0.0168231852	0.0176617565	0.0184754974
Location2	-0.0168231283	-0.0176616613	-0.0184753416
`Age at diagnosis (months)`	-0.0001261540	-0.0001340434	-0.0001421253
`Time since diagnosis (months)`	0.0002712938	0.0002903211	0.0003101429
`Tumor type`2	0.0157426288	0.0169058574	0.0181255967
`Tumor type`3	0.0262110712	0.0279010917	0.0296342008
`Tumor type`4	-0.0081360301	-0.0089378380	-0.0098112795
Radiotherapy1	-0.0008889556	-0.0008163677	-0.0007157189
Chemotherapy1	-0.0023039123	-0.0023089891	-0.0022872878
Neurosurgery1	0.0103768133	0.0110474593	0.0117395959
FSIQ	0.0002278578	0.0002482090	0.0002701873
`TomA Raw scores`	-0.0004971164	-0.0004852535	-0.0004652003
`TomA-Tscores`	-0.0016889470	-0.0018060621	-0.0019279167
`TomB Raw scores`	0.0133162869	0.0142928922	0.0153166329
`TomB-Tscores`	0.0031515517	0.0033746195	0.0036071245
`Affect Rec. Raw scores`	-0.0007707795	-0.0008352181	-0.0009046404
`Affect Rec.-Tscores`	-0.0015763433	-0.0017008936	-0.0018334218

`Accuracy Familiarization`	-0.0345127309	-0.0368520940	-0.0392679595
`ATP 10%`	-0.1213914081	-0.1320173639	-0.1434842502
`ATP 40%`	-0.0028667745	-0.0026887718	-0.0024346487
`ATP 60%`	-0.0299119708	-0.0320347164	-0.0342482270
`ATP 90%`	0.1348406633	0.1458042350	0.1575072341
 (Intercept)	 -0.3569230794	 -0.3760514569	 -0.3961330248
Id	0.0012399382	0.0013236866	0.0014107748
Sex1	-0.0248117537	-0.0266030559	-0.0284786314
Age	0.0016941510	0.0018215460	0.0019552831
AgeMonths	0.0001411502	0.0001517622	0.0001629022
Location1	0.0192522340	0.0199786452	0.0206403658
Location2	-0.0192519847	-0.0199782543	-0.0206397644
`Age at diagnosis (months)`	-0.0001503670	-0.0001587328	-0.0001671848
`Time since diagnosis (months)`	0.0003307190	0.0003519995	0.0003739240
`Tumor type` 2	0.0194000702	0.0207267003	0.0221020380
`Tumor type` 3	0.0314017309	0.0331937002	0.0349988529
`Tumor type` 4	-0.0107606758	-0.0117901485	-0.0129035190
Radiotherapy1	-0.0005823450	-0.0004111125	-0.0001964038
Chemotherapy1	-0.0022342442	-0.0021450313	-0.0020146178
Neurosurgery1	0.0124515454	0.0131815059	0.0139276115
FSIQ	0.0002938891	0.0003194107	0.0003468477
`TomA Raw scores`	-0.0004357871	-0.0003958181	-0.0003440976
`TomA-Tscores`	-0.0020542680	-0.0021848236	-0.0023192455
`TomB Raw scores`	0.0163862592	0.0174999685	0.0186553739
`TomB-Tscores`	0.0038485575	0.0040982709	0.0043554749
`Affect Rec. Raw scores`	-0.0009794182	-0.0010599525	-0.0011466741
`Affect Rec.-Tscores`	-0.0019742163	-0.0021235533	-0.0022816924
`Accuracy Familiarization`	-0.0417495192	-0.0442835798	-0.0468544157
`ATP 10%`	-0.1558457522	-0.1691572366	-0.1834755417
`ATP 40%`	-0.0020921349	-0.0016479660	-0.0010879536
`ATP 60%`	-0.0365474801	-0.0389259089	-0.0413752706
`ATP 90%`	0.1699805617	0.1832546840	0.1973595839
 (Intercept)	 -4.171526e-01	 -0.4390860072	 -0.4618998967
Id	1.501074e-03	0.0015944303	0.0016906616
Sex1	-3.043611e-02	-0.0324720931	-0.0345820715
Age	2.095167e-03	0.0022409152	0.0023921482
AgeMonths	1.745539e-04	0.0001866936	0.0001992898
Location1	2.122213e-02	0.0217079579	0.0220813758
Location2	-2.122122e-02	-0.0217066140	-0.0220794242
`Age at diagnosis (months)`	-1.756837e-04	-0.0001841896	-0.0001926635
`Time since diagnosis (months)`	3.964225e-04	0.0004194158	0.0004428158
`Tumor type` 2	2.352170e-02	0.0249803152	0.0264714902
`Tumor type` 3	3.680474e-02	0.0385978290	0.0403636833
`Tumor type` 4	-1.410420e-02	-0.0153950751	-0.0167784011
Radiotherapy1	6.789469e-05	0.0003884029	0.0007722553
Chemotherapy1	-1.837843e-03	-0.0016095051	-0.0013244644
Neurosurgery1	1.468800e-02	0.0154608967	0.0162446835
FSIQ	3.762943e-04	0.0004078410	0.0004415747
`TomA Raw scores`	-2.794615e-04	-0.0002008133	-0.0001071648

`TomA-Tscores`	-2.457156e-03	-0.0025981476	-0.0027417898
`TomB Raw scores`	1.984948e-02	0.0210786607	0.0223386670
`TomB-Tscores`	4.619236e-03	0.0048884781	0.0051619888
`Affect Rec. Raw scores`	-1.240043e-03	-0.0013405495	-0.0014487077
`Affect Rec.-Tscores`	-2.448874e-03	-0.0026253128	-0.0028111956
`Accuracy Familiarization`	-4.944366e-02	-0.0520302339	-0.0545903620
`ATP 10%`	-1.988587e-01	-0.2153656818	-0.2330558642
`ATP 40%`	-3.970907e-04	0.0004403008	0.0014403798
`ATP 60%`	-4.388552e-02	-0.0464446794	-0.0490387330
`ATP 90%`	2.123247e-01	0.2281791630	0.2449513967
(Intercept)	-4.855511e-01	-0.5099862746	-0.5351419507
Id	1.789562e-03	0.0018909004	0.0019944214
Sex1	-3.676034e-02	-0.0389999065	-0.0412924545
Age	2.548389e-03	0.0027090585	0.0028734756
AgeMonths	2.123027e-04	0.0002256841	0.0002393774
Location1	2.232568e-02	0.0224242184	0.0223607184
Location2	-2.232290e-02	-0.0224203437	-0.0223554302
`Age at diagnosis (months)`	-2.010678e-04	-0.0002093683	-0.0002175348
`Time since diagnosis (months)`	4.665266e-04	0.0004904458	0.0005144657
`Tumor type` 2	2.798779e-02	0.0295207180	0.0310607869
`Tumor type` 3	4.208714e-02	0.0437525745	0.0453441260
`Tumor type` 4	-1.825568e-02	-0.0198275869	-0.0214938472
Radiotherapy1	1.227108e-03	0.0017611428	0.0023830715
Chemotherapy1	-9.777573e-04	-0.0005647223	-0.0000811312
Neurosurgery1	1.703799e-02	0.0178397835	0.0186494064
FSIQ	4.775763e-04	0.0005159194	0.0005566690
`TomA Raw scores`	2.319613e-06	0.0001282765	0.0002710948
`TomA-Tscores`	-2.887644e-03	-0.0030352773	-0.0031842742
`TomB Raw scores`	2.362462e-02	0.0249310224	0.0262518051
`TomB-Tscores`	5.438426e-03	0.0057163313	0.0059941434
`Affect Rec. Raw scores`	-1.565055e-03	-0.0016901460	-0.0018245434
`Affect Rec.-Tscores`	-3.006672e-03	-0.0032118468	-0.0034267752
`Accuracy Familiarization`	-5.709763e-02	-0.0595231770	-0.0618359454
`ATP 10%`	-2.519887e-01	-0.2722231005	-0.2938168142
`ATP 40%`	2.619547e-03	0.0039941557	0.0055801779
`ATP 60%`	-5.165150e-02	-0.0542645330	-0.0568570112
`ATP 90%`	2.626696e-01	0.2813617415	0.3010554140
(Intercept)	-0.5608993920	-0.5872487524	-0.6140618000
Id	0.0020995498	0.0022064840	0.0023146710
Sex1	-0.0436259844	-0.0459933230	-0.0483801039
Age	0.0030411617	0.0032107165	0.0033814060
AgeMonths	0.0002533263	0.0002674405	0.0002816474
Location1	0.0221165317	0.0216835179	0.0210458657
Location2	-0.0221156233	-0.0216819611	-0.0210433126
`Age at diagnosis (months)`	-0.0002255458	-0.0002333829	-0.0002410347
`Time since diagnosis (months)`	0.0005384869	0.0005623760	0.0005860266
`Tumor type` 2	0.0325973971	0.0341196950	0.0356153618
`Tumor type` 3	0.0468473572	0.0482450972	0.0495234238
`Tumor type` 4	-0.0232535469	-0.0251042458	-0.0270428057

Radiotherapy1	0.0030998564	0.0039253814	0.0048681359
Chemotherapy1	0.0004775283	0.0011133749	0.0018289819
Neurosurgery1	0.0194690935	0.0202952465	0.0211303251
FSIQ	0.0005999046	0.0006456178	0.0006938577
`TomA Raw scores`	0.0004306904	0.0006070075	0.0007993257
`TomA-Tscores`	-0.0033343731	-0.0034850589	-0.0036361444
`TomB Raw scores`	0.0275812808	0.0289107126	0.0302332391
`TomB-Tscores`	0.0062702232	0.0065428199	0.0068102020
`Affect Rec. Raw scores`	-0.0019693388	-0.0021242508	-0.0022901782
`Affect Rec.-Tscores`	-0.0036517434	-0.0038861454	-0.0041300394
`Accuracy Familiarization`	-0.0640088715	-0.0659960536	-0.0677673814
`ATP 10%`	-0.3168255504	-0.3413019409	-0.3672956364
`ATP 40%`	0.0073958022	0.0094511089	0.0117603213
`ATP 60%`	-0.0594042470	-0.0618825703	-0.0642625733
`ATP 90%`	0.3217802046	0.3435597745	0.3664229062
(Intercept)	-0.6412323640	-0.6686434523	-0.6961671014
Id	0.0024237533	0.0025333452	0.0026430290
Sex1	-0.0507722844	-0.0531544028	-0.0555096354
Age	0.0035521853	0.0037219434	0.0038895194
AgeMonths	0.0002958597	0.0003099849	0.0003239261
Location1	0.0201924696	0.0191143224	0.0178047904
Location2	-0.0201884458	-0.0191082100	-0.0177958276
`Age at diagnosis (months)`	-0.0002484986	-0.0002557796	-0.0002628907
`Time since diagnosis (months)`	0.0006093247	0.0006321583	0.0006544186
`Tumor type` 2	0.0370717206	0.0384756624	0.0398138505
`Tumor type` 3	0.0506686551	0.0516683294	0.0525114208
`Tumor type` 4	-0.0290650638	-0.0311659527	-0.0333395966
Radiotherapy1	0.0059389650	0.0071491900	0.0085105485
Chemotherapy1	0.0026256661	0.0035036929	0.0044621735
Neurosurgery1	0.0219755790	0.0228326651	0.0237035693
FSIQ	0.0007446334	0.0007979350	0.0008537312
`TomA Raw scores`	0.0010065745	0.0012272335	0.0014593138
`TomA-Tscores`	-0.0037874379	-0.0039388312	-0.0040903051
`TomB Raw scores`	0.0315408971	0.0328254048	0.0340782374
`TomB-Tscores`	0.0070706022	0.0073222668	0.0075634860
`Affect Rec. Raw scores`	-0.0024676225	-0.0026570335	-0.0028587962
`Affect Rec.-Tscores`	-0.0043831519	-0.0046450972	-0.0049153663
`Accuracy Familiarization`	-0.0692874618	-0.0705217761	-0.0714377477
`ATP 10%`	-0.3948514110	-0.4240084128	-0.4547991020
`ATP 40%`	0.0143338707	0.0171795095	0.0203017694
`ATP 60%`	-0.0665130752	-0.0686001435	-0.0704870456
`ATP 90%`	0.3903964737	0.4155069102	0.4417799540
(Intercept)	-0.7236641984	-0.7509842990	-0.7779654965
Id	0.0027523526	0.0028608260	0.0029679188
Sex1	-0.0578198869	-0.0600659174	-0.0622275104
Age	0.0040537211	0.0042133457	0.0043672014
AgeMonths	0.0003375836	0.0003508567	0.0003636452
Location1	0.0162598463	0.0144782512	0.0124616834
Location2	-0.0162471538	-0.0144609002	-0.0124388177

`Age at diagnosis (months)`	-0.0002698524	-0.0002766919	-0.0002834422
`Time since diagnosis (months)`	0.0006760016	0.0006968085	0.0007167469
`Tumor type`2	0.0410729459	0.0422398486	0.0433019436
`Tumor type`3	0.0531885035	0.0536918588	0.0540155177
`Tumor type`4	-0.0355794374	-0.0378783854	-0.0402289924
Radiotherapy1	0.0100351064	0.0117351353	0.0136229539
Chemotherapy1	0.0054989790	0.0066106791	0.0077925107
Neurosurgery1	0.0245905058	0.0254958000	0.0264217618
FSIQ	0.0009119678	0.0009725648	0.0010354148
`TomA Raw scores`	0.0017003494	0.0019474011	0.0021970726
`TomA-Tscores`	-0.0042419318	-0.0043938719	-0.0045463684
`TomB Raw scores`	0.0352907069	0.0364540465	0.0375594979
`TomB-Tscores`	0.0077926242	0.0080081513	0.0082086737
`Affect Rec. Raw scores`	-0.0030732185	-0.0033005221	-0.0035408377
`Affect Rec.-Tscores`	-0.0051933176	-0.0054781690	-0.0057689929
`Accuracy Familiarization`	-0.0720059450	-0.0722013933	-0.0720049519
`ATP 10%`	-0.4872481693	-0.5213714575	-0.5571749081
`ATP 40%`	0.0237014335	0.0273750553	0.0313145552
`ATP 60%`	-0.0721342113	-0.0734992098	-0.0745367497
`ATP 90%`	0.4692403037	0.4979111822	0.5278138099
(Intercept)	-0.8044344339	-0.8302065791	-0.8549462315
Id	0.0030730577	0.0031756260	0.0032738943
Sex1	-0.0642836836	-0.0662129452	-0.0679921130
Age	0.0045141302	0.0046530301	0.0047832782
AgeMonths	0.0003758512	0.0003873809	0.0003981563
Location1	0.0102148120	0.0077453178	0.0050713729
Location2	-0.0101858361	-0.0077101552	-0.0050496709
`Age at diagnosis (months)`	-0.0002901408	-0.0002968284	-0.0003036274
`Time since diagnosis (months)`	0.0007357316	0.0007536846	0.0007706074
`Tumor type`2	0.0442473417	0.0450651036	0.0457461636
`Tumor type`3	0.0541552365	0.0541084081	0.0538845837
`Tumor type`4	-0.0426236413	-0.0450547487	-0.0475260653
Radiotherapy1	0.0157107296	0.0180102443	0.0205249535
Chemotherapy1	0.0090383848	0.0103409378	0.0117080224
Neurosurgery1	0.0273705568	0.0283440805	0.0293558789
FSIQ	0.0011003805	0.0011672934	0.0012358712
`TomA Raw scores`	0.0024455392	0.0026885895	0.0029198241
`TomA-Tscores`	-0.0046997350	-0.0048543406	-0.0050111006
`TomB Raw scores`	0.0385984000	0.0395622777	0.0404468416
`TomB-Tscores`	0.0083929650	0.0085599946	0.0087082611
`Affect Rec. Raw scores`	-0.0037942038	-0.0040605702	-0.0043429782
`Affect Rec.-Tscores`	-0.0060647138	-0.0063641069	-0.0066658808
`Accuracy Familiarization`	-0.0714046924	-0.0703971968	-0.0689430198
`ATP 10%`	-0.5946535557	-0.6337905942	-0.6745309990
`ATP 40%`	0.0355069308	0.0399341111	0.0446168336
`ATP 60%`	-0.0751987171	-0.0754342749	-0.0751911289
`ATP 90%`	0.5589667906	0.5913854084	0.6250754280
(Intercept)	-0.8787409522	-0.9012476794	-0.9222535349
Id	0.0033692060	0.0034599219	0.0035453150

Sex1	-0.0696043479	-0.0710262743	-0.0722378460
Age	0.0049031431	0.0050122321	0.0051099031
AgeMonths	0.0004080810	0.0004170952	0.0004251412
Location1	0.0022021271	-0.0008453403	-0.0040517383
Location2	-0.0021725918	0.0008835090	0.0040985493
`Age at diagnosis (months)`	-0.0003104700	-0.0003174428	-0.0003245853
`Time since diagnosis (months)`	0.0007863176	0.0008008149	0.0008140539
`Tumor type` 2	0.0462812512	0.0466630851	0.0468857369
`Tumor type` 3	0.0534650648	0.0528586526	0.0520667072
`Tumor type` 4	-0.0500153771	-0.0525228847	-0.0550434478
Radiotherapy1	0.0232821936	0.0262827187	0.0295339872
Chemotherapy1	0.0131042764	0.0145297284	0.0159730235
Neurosurgery1	0.0303819761	0.0314331735	0.0325082401
FSIQ	0.0013059966	0.0013773675	0.0014496913
`TomA Raw scores`	0.0031374083	0.0033350963	0.0035077826
`TomA-Tscores`	-0.0051694921	-0.0053303284	-0.0054939660
`TomB Raw scores`	0.0412365796	0.0419275444	0.0425127371
`TomB-Tscores`	0.0088382440	0.0089492481	0.0090412910
`Affect Rec. Raw scores`	-0.0046352411	-0.0049396683	-0.0052558470
`Affect Rec.-Tscores`	-0.0069678069	-0.0072686276	-0.0075665447
`Accuracy Familiarization`	-0.0671067850	-0.0648978903	-0.0623540664
`ATP 10%`	-0.7168709986	-0.7607379489	-0.8060613845
`ATP 40%`	0.0494491129	0.0544295979	0.0595188307
`ATP 60%`	-0.0744185574	-0.0730572976	-0.0710495243
`ATP 90%`	0.6600421928	0.6962863335	0.7338001498
(Intercept)	-0.9415419845	-0.9588960779	-0.9741023902
Id	0.0036246485	0.0036971899	0.0037622290
Sex1	-0.0732202774	-0.0739564635	-0.0744313957
Age	0.0051956696	0.0052692119	0.0053303835
AgeMonths	0.0004321738	0.0004381625	0.0004430919
Location1	-0.0073957021	-0.0108540252	-0.0144019634
Location2	0.0074498897	0.0109126331	0.0144600343
`Age at diagnosis (months)`	-0.0003319320	-0.0003395110	-0.0003473428
`Time since diagnosis (months)`	0.0008259981	0.0008366197	0.0008459001
`Tumor type` 2	0.0469445818	0.0468362400	0.0465584517
`Tumor type` 3	0.0510908891	0.0499328966	0.0485942127
`Tumor type` 4	-0.0575728059	-0.0601077417	-0.0626461921
Radiotherapy1	0.0330413767	0.0368078655	0.0408337376
Chemotherapy1	0.0174222643	0.0188653687	0.0202904092
Neurosurgery1	0.0336051424	0.0347210678	0.0358524347
FSIQ	0.0015226459	0.0015958821	0.0016690264
`TomA Raw scores`	0.0036503548	0.0037577813	0.0038252039
`TomA-Tscores`	-0.0056606978	-0.0058307271	-0.0060041441
`TomB Raw scores`	0.0429857419	0.0433407831	0.0435727729
`TomB-Tscores`	0.0091147092	0.0091701696	0.0092086783
`Affect Rec. Raw scores`	-0.0055833359	-0.0059216910	-0.0062704862
`Affect Rec.-Tscores`	-0.0078596604	-0.0081459863	-0.0084234538
`Accuracy Familiarization`	-0.0595256196	-0.0564749174	-0.0532754395
`ATP 10%`	-0.8527569134	-0.9007263272	-0.9498579900
`ATP 40%`	0.0646732414	0.0698460664	0.0749882939

`ATP 60%`	-0.0683367111	-0.0648605196	-0.0605639097
`ATP 90%`	0.7725684084	0.8125674239	0.8537641496
(Intercept)	-0.9869437298	-0.9973312813	-1.0050085617
Id	0.0038179655	0.0038662030	0.0039052215
Sex1	-0.0746456415	-0.0745688326	-0.0742022497
Age	0.0053792452	0.0054163500	0.0054420160
AgeMonths	0.0004470729	0.0004499498	0.0004518360
Location1	-0.0179694642	-0.0215981713	-0.0252347985
Location2	0.0180273265	0.0216603647	0.0252951379
`Age at diagnosis (months)`	-0.0003556658	-0.0003641483	-0.0003729246
`Time since diagnosis (months)`	0.0008539623	0.0008605665	0.0008658278
`Tumor type` 2	0.0461095996	0.0454889449	0.0446957331
`Tumor type` 3	0.0470878808	0.0453883728	0.0435071411
`Tumor type` 4	-0.0652254636	-0.0677829168	-0.0703463506
Radiotherapy1	0.0451163914	0.0496559909	0.0544378087
Chemotherapy1	0.0217220464	0.0230835368	0.0243937578
Neurosurgery1	0.0369966728	0.0381333594	0.0392657148
FSIQ	0.0017414767	0.0018132981	0.0018838937
`TomA Raw scores`	0.0038448390	0.0038179454	0.0037383136
`TomA-Tscores`	-0.0061811931	-0.0063610381	-0.0065436728
`TomB Raw scores`	0.0436821088	0.0436545653	0.0434925254
`TomB-Tscores`	0.0092298559	0.0092384711	0.0092352514
`Affect Rec. Raw scores`	-0.0066333024	-0.0070012723	-0.0073783192
`Affect Rec.-Tscores`	-0.0086874873	-0.0089396553	-0.0091763907
`Accuracy Familiarization`	-0.0497528115	-0.0464120905	-0.0431854928
`ATP 10%`	-0.9999535301	-1.0510098906	-1.1028236161
`ATP 40%`	0.0801108547	0.0850232720	0.0897396640
`ATP 60%`	-0.0554474829	-0.0493745952	-0.0423328312
`ATP 90%`	0.8960470959	0.9394649936	0.9839131020
(Intercept)	-1.0098166585	-1.0116184314	-1.0103046095
Id	0.0039346073	0.0039540520	0.0039633780
Sex1	-0.0735422540	-0.0725885379	-0.0713442387
Age	0.0054569200	0.0054619187	0.0054580631
AgeMonths	0.0004527869	0.0004528776	0.0004522017
Location1	-0.0288529440	-0.0324269708	-0.0359322359
Location2	0.0289036380	0.0324586239	0.0359344726
`Age at diagnosis (months)`	-0.0003819860	-0.0003913163	-0.0004008946
`Time since diagnosis (months)`	0.0008697625	0.0008723955	0.0008737599
`Tumor type` 2	0.0437301702	0.0425926208	0.0412836823
`Tumor type` 3	0.0414429405	0.0391940705	0.0367586220
`Tumor type` 4	-0.0729180605	-0.0755011598	-0.0780994534
Radiotherapy1	0.0594490537	0.0646733082	0.0700908965
Chemotherapy1	0.0256438732	0.0268265998	0.0279363653
Neurosurgery1	0.0403870419	0.0414903880	0.0425685172
FSIQ	0.0019528755	0.0020198693	0.0020845243
`TomA Raw scores`	0.0036026279	0.0034081394	0.0031527137
`TomA-Tscores`	-0.0067285888	-0.0069151175	-0.0071024360
`TomB Raw scores`	0.0431936876	0.0427565107	0.0421801016
`TomB-Tscores`	0.0092225871	0.0092031851	0.0091800425

`Affect Rec. Raw scores`	-0.0077642246	-0.0081589180	-0.0085624439
`Affect Rec.-Tscores`	-0.0093955198	-0.0095948856	-0.0097723524
`Accuracy Familiarization`	-0.0401784081	-0.0374994309	-0.0352564732
`ATP 10%`	-1.1552408391	-1.2081004727	-1.2612361619
`ATP 40%`	0.0942086817	0.0983823456	0.1022163949
`ATP 60%`	-0.0342821145	-0.0251901508	-0.0150340957
`ATP 90%`	1.0293154658	1.0755848736	1.1226226135
(Intercept)	-1.0057966339	-0.9980483101	-0.9873853581
Id	0.0039625497	0.0039516789	0.0039312512
Sex1	-0.0698158858	-0.0680132399	-0.0659919819
Age	0.0054466019	0.0054289807	0.0054115751
AgeMonths	0.0004508700	0.0004490084	0.0004471843
Location1	-0.0393455341	-0.0426455392	-0.0456996332
Location2	0.0393077575	0.0425577140	0.0456742198
`Age at diagnosis (months)`	-0.0004106970	-0.0004206990	-0.0004317640
`Time since diagnosis (months)`	0.0008738958	0.0008728493	0.0008708591
`Tumor type` 2	0.0398041650	0.0381551218	0.0363219761
`Tumor type` 3	0.0341347797	0.0313211911	0.0282963850
`Tumor type` 4	-0.0807171752	-0.0833586839	-0.0861217454
Radiotherapy1	0.0756790885	0.0814123698	0.0872862387
Chemotherapy1	0.0289693479	0.0299234594	0.0308249843
Neurosurgery1	0.0436139708	0.0446191467	0.0454930707
FSIQ	0.0021465238	0.0022055956	0.0022623325
`TomA Raw scores`	0.0028348761	0.0024538467	0.0020042134
`TomA-Tscores`	-0.0072895860	-0.0074755029	-0.0076595723
`TomB Raw scores`	0.0414641493	0.0406088467	0.0396070996
`TomB-Tscores`	0.0091564183	0.0091357995	0.0091202599
`Affect Rec. Raw scores`	-0.0089749660	-0.0093967748	-0.0098301912
`Affect Rec.-Tscores`	-0.0099258249	-0.0100532677	-0.0101453762
`Accuracy Familiarization`	-0.0335541634	-0.0324915329	-0.0314374655
`ATP 10%`	-1.3144783845	-1.3676566597	-1.4205039766
`ATP 40%`	0.1056709010	0.1087108223	0.1111259580
`ATP 60%`	-0.0038017558	0.0085075301	0.0217304236
`ATP 90%`	1.1703188777	1.2185535553	1.2669814124
(Intercept)	-0.9731574202	-0.9557219737	-0.9351486168
Id	0.0039015036	0.0038629066	0.0038160983
Sex1	-0.0636829215	-0.0611444872	-0.0583954206
Age	0.0053881554	0.0053643952	0.0053420540
AgeMonths	0.0004447304	0.0004421937	0.0004397309
Location1	-0.0487081607	-0.0515540004	-0.0542287256
Location2	0.0486369400	0.0514331054	0.0540533421
`Age at diagnosis (months)`	-0.0004422669	-0.0004529222	-0.0004636967
`Time since diagnosis (months)`	0.0008676343	0.0008633815	0.0008581694
`Tumor type` 2	0.0343292309	0.0321710524	0.0298503211
`Tumor type` 3	0.0250900682	0.0216952595	0.0181167652
`Tumor type` 4	-0.0888335040	-0.0915807182	-0.0943641544
Radiotherapy1	0.0932248013	0.0992178554	0.1052326157
Chemotherapy1	0.0316160916	0.0323317660	0.0329756898
Neurosurgery1	0.0463689062	0.0471804922	0.0479216907

FSIQ	0.0023153938	0.0023651167	0.0024114673
`TomA Raw scores`	0.0014965105	0.0009272663	0.0002987455
`TomA-Tscores`	-0.0078401176	-0.0080160559	-0.0081863573
`TomB Raw scores`	0.0384701784	0.0371951292	0.0357833213
`TomB-Tscores`	0.0091172139	0.0091288809	0.0091592652
`Affect Rec. Raw scores`	-0.0102717558	-0.0107248235	-0.0111903963
`Affect Rec.-Tscores`	-0.0102140500	-0.0102508348	-0.0102540444
`Accuracy Familiarization`	-0.0318645818	-0.0331841856	-0.0354665382
`ATP 10%`	-1.4730617001	-1.5250646683	-1.5763612921
`ATP 40%`	0.1131715856	0.1147248274	0.1157787762
`ATP 60%`	0.0361523640	0.0515878354	0.0679918624
`ATP 90%`	1.3158835467	1.3649202346	1.4139481374
(Intercept)	-0.9118020302	-0.8852384435	-0.8559093922
Id	0.0037625184	0.0037018340	0.0036354638
Sex1	-0.0555026427	-0.0523955360	-0.0491432235
Age	0.0053297101	0.0053175006	0.0053140818
AgeMonths	0.0004380642	0.0004363109	0.0004351115
Location1	-0.0566339201	-0.0589426433	-0.0610665177
Location2	0.0565165872	0.0587769806	0.0608542155
`Age at diagnosis (months)`	-0.0004755333	-0.0004866275	-0.0004978486
`Time since diagnosis (months)`	0.0008522195	0.0008453052	0.0008375794
`Tumor type`2	0.0273512208	0.0247101460	0.0219237090
`Tumor type`3	0.0143322935	0.0104000937	0.0063145117
`Tumor type`4	-0.0972715295	-0.1001365725	-0.1030370458
Radiotherapy1	0.1112572016	0.1172167005	0.1231010208
Chemotherapy1	0.0335524933	0.0340638811	0.0345234063
Neurosurgery1	0.0484877695	0.0490495904	0.0495251812
FSIQ	0.0024557701	0.0024959498	0.0025330506
`TomA Raw scores`	-0.0003892896	-0.0011275211	-0.0019149078
`TomA-Tscores`	-0.0083517722	-0.0085089148	-0.0086579595
`TomB Raw scores`	0.0342168405	0.0325273984	0.0307020829
`TomB-Tscores`	0.0092136552	0.0092948070	0.0094072027
`Affect Rec. Raw scores`	-0.0116749201	-0.0121707988	-0.0126838452
`Affect Rec.-Tscores`	-0.0102129326	-0.0101422025	-0.0100324350
`Accuracy Familiarization`	-0.0380538641	-0.0423681655	-0.0477387182
`ATP 10%`	-1.6267376063	-1.6762148845	-1.7245887307
`ATP 40%`	0.1160537719	0.1160438603	0.1155486159
`ATP 60%`	0.0851816510	0.1033545433	0.1222922235
`ATP 90%`	1.4626239576	1.5111886506	1.5593008557
(Intercept)	-0.8239737894	-0.7896894420	-0.7530057733
Id	0.0035643428	0.0034905548	0.0034130893
Sex1	-0.0457680400	-0.0423352632	-0.0387805676
Age	0.0053209539	0.0053482115	0.0053817836
AgeMonths	0.0004346378	0.0004357783	0.0004373496
Location1	-0.0630071902	-0.0647058561	-0.0662901742
Location2	0.0627497397	0.0644981259	0.0660493835
`Age at diagnosis (months)`	-0.0005091732	-0.0005215999	-0.0005332265
`Time since diagnosis (months)`	0.0008291079	0.0008200819	0.0008102991
`Tumor type`2	0.0189999581	0.0159236072	0.0127493219

`Tumor type`3	0.0020916990	-0.0022842233	-0.0067307289
`Tumor type`4	-0.1059694063	-0.1090074721	-0.1119961057
Radiotherapy1	0.1288805663	0.1345427449	0.1400313322
Chemotherapy1	0.0349383022	0.0352912592	0.0356333312
Neurosurgery1	0.0499115134	0.0500937161	0.0502764869
FSIQ	0.0025672611	0.0026006280	0.0026301913
`TomA Raw scores`	-0.0027463598	-0.0036167708	-0.0045183959
`TomA-Tscores`	-0.0087985915	-0.0089344962	-0.0090597090
`TomB Raw scores`	0.0287417825	0.0266075194	0.0243660723
`TomB-Tscores`	0.0095547015	0.0097477156	0.0099791554
`Affect Rec. Raw scores`	-0.0132161398	-0.0137810811	-0.0143619193
`Affect Rec.-Tscores`	-0.0098818582	-0.0096757375	-0.0094350458
`Accuracy Familiarization`	-0.0541754464	-0.0610480813	-0.0695647969
`ATP 10%`	-1.7717493966	-1.8175654297	-1.8620374595
`ATP 40%`	0.1145946000	0.1128519125	0.1110147293
`ATP 60%`	0.1419078078	0.1620407946	0.1827482828
`ATP 90%`	1.6068175191	1.6534476793	1.6993689874
(Intercept)	-0.7142954598	-0.6737542394	-0.6315905109
Id	0.0033338851	0.0032539052	0.0031740871
Sex1	-0.0351699505	-0.0315242047	-0.0278630171
Age	0.0054335977	0.0055043281	0.0055957607
AgeMonths	0.0004400099	0.0004439478	0.0004492636
Location1	-0.0677097584	-0.0689715201	-0.0700856460
Location2	0.0674381708	0.0686740582	0.0697674879
`Age at diagnosis (months)`	-0.0005450679	-0.0005571307	-0.0005694614
`Time since diagnosis (months)`	0.0007998349	0.0007887244	0.0007769766
`Tumor type`2	0.0094749452	0.0061148690	0.0026856776
`Tumor type`3	-0.0112511219	-0.0158197284	-0.0204103304
`Tumor type`4	-0.1149995966	-0.1180112075	-0.1210226007
Radiotherapy1	0.1453393001	0.1504488481	0.1553442496
Chemotherapy1	0.0359550691	0.0362620684	0.0365600541
Neurosurgery1	0.0503651969	0.0503597140	0.0502606133
FSIQ	0.0026576647	0.0026833579	0.0027075868
`TomA Raw scores`	-0.0054465413	-0.0063935191	-0.0073515480
`TomA-Tscores`	-0.0091768722	-0.0092870296	-0.0093914410
`TomB Raw scores`	0.0219870083	0.0194692313	0.0168114132
`TomB-Tscores`	0.0102570482	0.0105847462	0.0109652514
`Affect Rec. Raw scores`	-0.0149686813	-0.0156047834	-0.0162730604
`Affect Rec.-Tscores`	-0.0091480681	-0.0088123529	-0.0084258463
`Accuracy Familiarization`	-0.0790543480	-0.0894643402	-0.1007254334
`ATP 10%`	-1.9050486331	-1.9465406955	-1.9864698579
`ATP 40%`	0.1088070884	0.1062762682	0.1034623227
`ATP 60%`	0.2038378181	0.2252024911	0.2467369387
`ATP 90%`	1.7442983698	1.7881192587	1.8307269711
(Intercept)	-0.5880087353	-0.5427568080	-0.4967245575
Id	0.0030953165	0.0030201397	0.0029461940
Sex1	-0.0242047426	-0.0205912627	-0.0169842970
Age	0.0057097202	0.0058602341	0.0060205447
AgeMonths	0.0004560444	0.0004656200	0.0004760922

Location1	-0.0710632630	-0.0718906543	-0.0726284261
Location2	0.0707296055	0.0715960561	0.0723352525
`Age at diagnosis (months)`	-0.0005821249	-0.0005963527	-0.0006099091
`Time since diagnosis (months)`	0.0007645804	0.0007515661	0.0007378618
`Tumor type`2	-0.0007951444	-0.0043550546	-0.0078900162
`Tumor type`3	-0.0249962093	-0.0295949735	-0.0340913582
`Tumor type`4	-0.1240249188	-0.1270852184	-0.1300471361
Radiotherapy1	0.1600129392	0.1644440759	0.1686331024
Chemotherapy1	0.0368538965	0.0371012926	0.0373860767
Neurosurgery1	0.0500692339	0.0496441140	0.0492575902
FSIQ	0.0027306668	0.0027557782	0.0027779392
`TomA Raw scores`	-0.0083125823	-0.0092648797	-0.0101996750
`TomA-Tscores`	-0.0094916592	-0.0095984099	-0.0097005438
`TomB Raw scores`	0.0140119272	0.0109724500	0.0078578708
`TomB-Tscores`	0.0114013240	0.0119181334	0.0124798458
`Affect Rec. Raw scores`	-0.0169764823	-0.0177468042	-0.0185411993
`Affect Rec.-Tscores`	-0.0079864267	-0.0074645714	-0.0069029649
`Accuracy Familiarization`	-0.1127597322	-0.1250914121	-0.1384594188
`ATP 10%`	-2.0248050309	-2.0615644677	-2.0966771215
`ATP 40%`	0.1004057048	0.0966828292	0.0932310923
`ATP 60%`	0.2683381638	0.2899815350	0.3114595704
`ATP 90%`	1.8720288554	1.9118820816	1.9503592093
(Intercept)	-0.4493444312	-0.4010875500	-0.3525575763
Id	0.0028772241	0.0028124714	0.0027506106
Sex1	-0.0134449683	-0.0099606364	-0.0065204425
Age	0.0062212936	0.0064444667	0.0066879691
AgeMonths	0.0004893612	0.0005049721	0.0005212420
Location1	-0.0732642065	-0.0738208498	-0.0743051897
Location2	0.0729926769	0.0735672776	0.0740539247
`Age at diagnosis (months)`	-0.0006250817	-0.0006408255	-0.0006565960
`Time since diagnosis (months)`	0.0007233307	0.0007079464	0.0006917447
`Tumor type`2	-0.0114532252	-0.0149830565	-0.0184561713
`Tumor type`3	-0.0385314406	-0.0428441969	-0.0470196710
`Tumor type`4	-0.1330277778	-0.1359502542	-0.1387687103
Radiotherapy1	0.1725711506	0.1762625813	0.1796961134
Chemotherapy1	0.0376315088	0.0378708368	0.0381585419
Neurosurgery1	0.0486709192	0.0480120973	0.0473614879
FSIQ	0.0028022892	0.0028266629	0.0028494629
`TomA Raw scores`	-0.0111046010	-0.0119641165	-0.0127874159
`TomA-Tscores`	-0.0098145190	-0.0099396644	-0.0100671873
`TomB Raw scores`	0.0044955001	0.0009572189	-0.0026556368
`TomB-Tscores`	0.0131290901	0.0138510136	0.0146185164
`Affect Rec. Raw scores`	-0.0194111337	-0.0203436997	-0.0213049096
`Affect Rec.-Tscores`	-0.0062528858	-0.0055284280	-0.0047604687
`Accuracy Familiarization`	-0.1520565382	-0.1661784989	-0.1809522708
`ATP 10%`	-2.1302068201	-2.1621244235	-2.1924470157
`ATP 40%`	0.0892712633	0.0852789075	0.0814936272
`ATP 60%`	0.3328053638	0.3538755680	0.3745748941
`ATP 90%`	1.9872911472	2.0226924489	2.0565998106

```
(Intercept) -0.3030736028
Id 0.0026952794
Sex1 -0.0031722346
Age 0.0069739381
AgeMonths 0.0005405144
Location1 -0.0747405808
Location2 0.0744865698
`Age at diagnosis (months)` -0.0006742246
`Time since diagnosis (months)` 0.0006742367
`Tumor type`2 -0.0218824285
`Tumor type`3 -0.0510441554
`Tumor type`4 -0.1415542245
Radiotherapy1 0.1828840917
Chemotherapy1 0.0384068584
Neurosurgery1 0.0465603006
FSIQ 0.0028745446
`TomA Raw scores` -0.0135442755
`TomA-Tscores` -0.0102181407
`TomB Raw scores` -0.0065272414
`TomB-Tscores` 0.0154813796
`Affect Rec. Raw scores` -0.0223588617
`Affect Rec.-Tscores` -0.0038910411
`Accuracy Familiarization` -0.1958210347
`ATP 10%` -2.2212297849
`ATP 40%` 0.0774303175
`ATP 60%` 0.3949183813
`ATP 90%` 2.0888956773
```

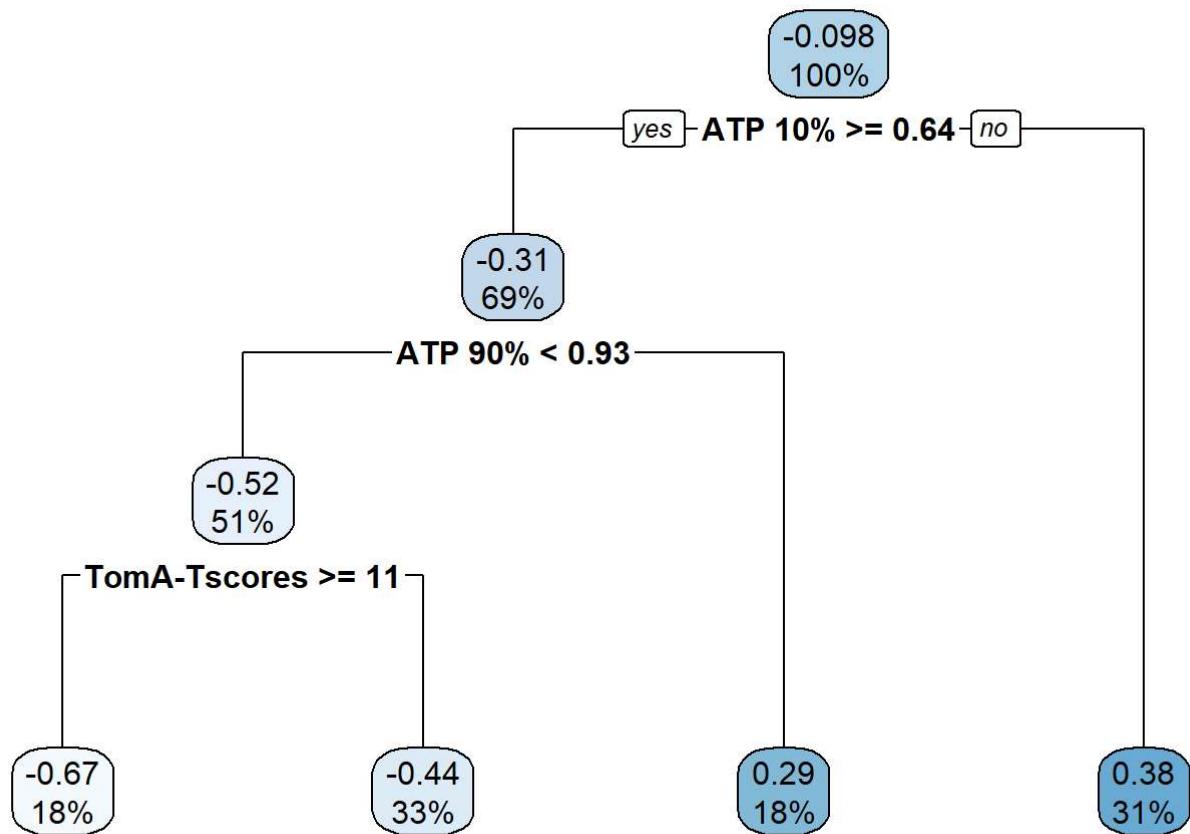
```
# ridge mse is 0.2477862
```

smaller error with ridge

```
library(rpart)
# install.packages("rpart.plot")
library(rpart.plot)
```

Warning: package 'rpart.plot' was built under R version 4.5.2

```
set.seed(123)
tree_model <- rpart(`BETA index` ~ ., data = data_train, method = "anova" )
rpart.plot(tree_model)
```



```
# gives the important variables ATP 10%, ATP 90% and TomA-Tscores >= 11
```

```
pred_tree <- predict(tree_model, newdata= data_test)

mse_tree <- mean((y_test -pred_tree)^2)
mse_tree
```

```
[1] 0.9976152
```

```
# decision tree mse is 0.9976152 - very high
```

```
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
# model 5 KNN
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

library(class)
library(caret)
```

```
Loading required package: lattice
```

```
preProc <- preProcess(data_train, method=c("center","scale"))
train_scaled <- predict(preProc, data_train)
```

```
test_scaled <- predict(preProc, data_test)

set.seed(123)
knn_model <- train(`BETA index` ~ ., data=train_scaled)
pred_knn <- predict(knn_model, newdata=test_scaled)
mse_knn <- mean((y_test - pred_knn)^2)
mse_knn
```

[1] 0.2467025

```
# KNN Mse is 0.2208941.
```

```
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
# model 6 svm
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
```

```
library(e1071)
```

Attaching package: 'e1071'

The following object is masked from 'package:ggplot2':

element

```
set.seed(123)
svm_model <- svm(`BETA index`~ ., data = train_scaled, kernel = "radial")
pre_svm <- predict(svm_model, newdata = test_scaled)
mse_svm <- mean((y_test - pre_svm)^2)
mse_svm
```

[1] 0.1318393

```
# SVM mse is 0.1318
```

8 No Model Set.seed MSE

9 1. Linear Regression 123. 0.42166

10 2. Lasso 123. 0.29958

11 3. Ridge 123. 0.24778

12 4 Decision tree. 123. 0.9976

13 5. KNN. 123. 0.22089

14 6 SVM. 123. 0.1318

15 final selection isssssssssssssssssssssssssss SVM

16 the lowest root mean squared error MSE is 0.1318 in SVM model.

```
cv5 <- trainControl(method = "cv", number=5)

# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
# 1 LR with 5 fold cv model on split dataset
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
set.seed(123)
full_model_cv <- lm(`BETA index` ~ . , data = train_scaled, method = "lm", trControl= cv5)
```

Warning in lm(`BETA index` ~ . , data = train_scaled, method = "lm", trControl = cv5): method = 'lm' is not supported. Using 'qr'

Warning: In lm.fit(x, y, offset = offset, singular.ok = singular.ok, ...) :
extra argument 'trControl' will be disregarded

```
pred_full_cv <- predict(full_model_cv, newdata = test_scaled)
mse_lm_cv <- mean((y_test - pred_full_cv)^2)
mse_lm_cv
```

[1] 0.6085835

```
# mse for lr with K= 5 fold cross validation is 0.6085835.
```

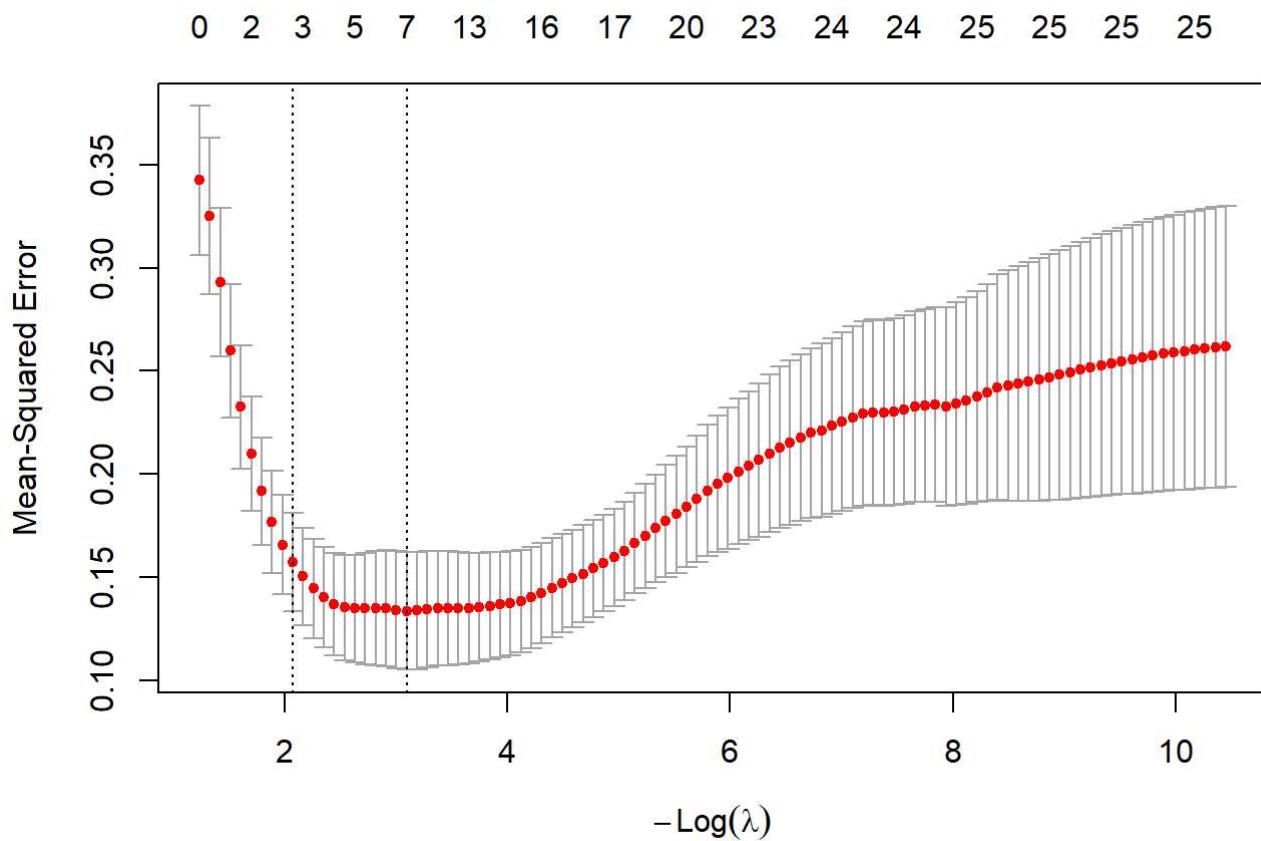
```
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
# model 2 Lasso CV
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
set.seed(123)
lasso_model_cv <- cv.glmnet(x_train, y_train, alpha=1, trControl = cv5)
best_lambda_lasso_cv <- lasso_model_cv$lambda.min
pred_lasso_cv <- predict(lasso_model_cv, s= best_lambda_lasso_cv, newx = x_test )
mse_lasso_cv <- mean((y_test - pred_lasso_cv)^2)
mse_lasso_cv
```

```
[1] 0.1653343
```

```
coef(lasso_model_cv)
```

```
27 x 1 sparse Matrix of class "dgCMatrix"
                               lambda.1se
(Intercept)           -0.296509403
Id                  .
Sex1                 .
Age                  .
AgeMonths            .
Location1            .
Location2            .
`Age at diagnosis (months)`   .
`Time since diagnosis (months)`   .
`Tumor type`2          .
`Tumor type`3          .
`Tumor type`4          .
Radiotherapy1         .
Chemotherapy1        .
Neurosurgery1        .
FSIQ                 .
`TomA Raw scores`    .
`TomA-Tscores`       .
`TomB Raw scores`    0.004840866
`TomB-Tscores`       .
`Affect Rec. Raw scores`   .
`Affect Rec.-Tscores`   .
`Accuracy Familiarization`   .
`ATP 10%`             -1.110624769
`ATP 40%`              .
`ATP 60%`              .
`ATP 90%`              1.310263431
```

```
plot(lasso_model_cv)
```



```
# mse for lasso with K= 5 fold cross validation is 0.1653343.
```

```
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
# model 3 ridge cv
# xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
set.seed(123)
ridge_model_cv <- cv.glmnet(x_train, y_train, alpha=0, trControl = cv5)
best_lambda_ridge_cv <- ridge_model_cv$lambda.min
pred_ridge_cv <- predict(ridge_model_cv, s= best_lambda_ridge_cv, newx = x_test )
mse_ridge_cv <- mean((y_test - pred_ridge_cv)^2)
mse_ridge_cv
```

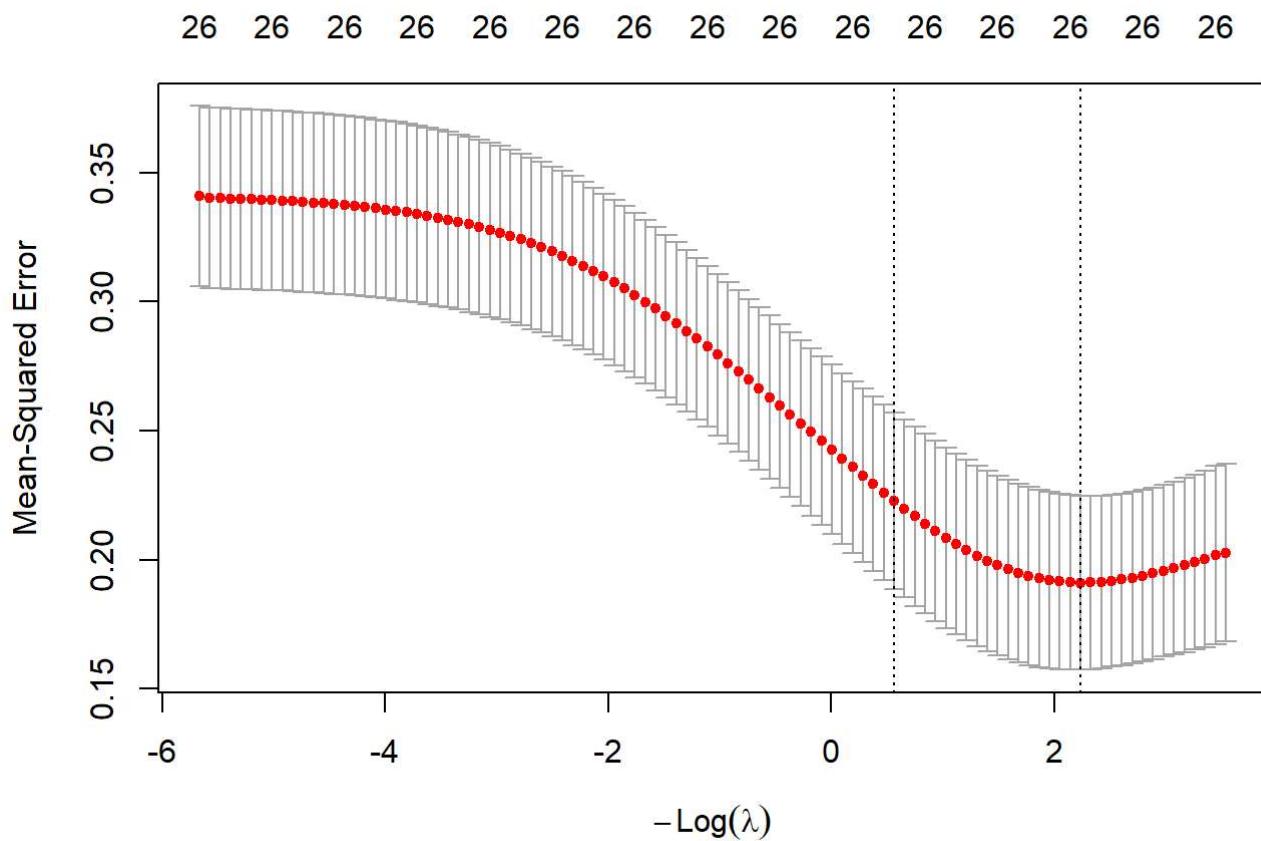
```
[1] 0.2464714
```

```
coef(ridge_model_cv)
```

```
27 x 1 sparse Matrix of class "dgCMatrix"
                                         lambda.1se
(Intercept)                  -0.9012476794
Id                      0.0034599219
Sex1                   -0.0710262743
Age                     0.0050122321
```

AgeMonths	0.0004170952
Location1	-0.0008453403
Location2	0.0008835090
`Age at diagnosis (months)`	-0.0003174428
`Time since diagnosis (months)`	0.0008008149
`Tumor type`2	0.0466630851
`Tumor type`3	0.0528586526
`Tumor type`4	-0.0525228847
Radiotherapy1	0.0262827187
Chemotherapy1	0.0145297284
Neurosurgery1	0.0314331735
FSIQ	0.0013773675
`TomA Raw scores`	0.0033350963
`TomA-Tscores`	-0.0053303284
`TomB Raw scores`	0.0419275444
`TomB-Tscores`	0.0089492481
`Affect Rec. Raw scores`	-0.0049396683
`Affect Rec.-Tscores`	-0.0072686276
`Accuracy Familiarization`	-0.0648978903
`ATP 10%`	-0.7607379489
`ATP 40%`	0.0544295979
`ATP 60%`	-0.0730572976
`ATP 90%`	0.6962863335

```
plot(ridge_model_cv)
```



```
# mse for ridge with K= 5 fold cross validation is 0.2464714 .
```

Implementing Jackknife LOOCV with Linear Model 95%/5% split

```
library(glmnet)

x = rbind(x_train, x_test)
y = rbind(y_train, y_test)
n <- nrow(x)    # use full data x,y for LOOCV
pred_loo <- numeric(n)

set.seed(123)
for (i in seq_len(n)) {
  # training indices
  train_idx <- setdiff(seq_len(n), i)
  x_train_loo <- x[train_idx, , drop = FALSE]
  y_train_loo <- y[train_idx]
  x_test_loo <- x[i, , drop = FALSE]

  # choose lambda using CV on the training set
  cvfit <- cv.glmnet(x_train_loo, y_train_loo, alpha = 1, nfolds = min(10, length(train_idx)))
  lambda_i <- cvfit$lambda.min
```

```

# fit on training set with chosen lambda and predict the left-out point
fit_i <- glmnet(x_train_loo, y_train_loo, alpha = 1)
pred_loo[i] <- predict(fit_i, s = lambda_i, newx = x_test_loo)
}

# observed values are y
loo_errors <- as.numeric(y - pred_loo)

```

Warning in y - pred_loo: longer object length is not a multiple of shorter object length

```

loo_mse <- mean(loo_errors^2)
loo_mae <- mean(abs(loo_errors))
cat("LOOCV (explicit) MSE:", loo_mse, " MAE:", loo_mae, "\n")

```

LOOCV (explicit) MSE: 0.2580678 MAE: 0.4279564

more stable estimate than Linear Regression model with 95% 5% split shows sensitivity of model performance to removal of data point providing new evaluation scheme, better than one way split

Implement Jackknife (LOOCV) for kNN

```

library(class)
library(caret)

# -----
# Jackknife (LOOCV) for kNN
# -----


# y variable
y <- data_train$`BETA index` 

n <- nrow(data_train)
pred_loo <- numeric(n)

set.seed(123)

for (i in 1:n) {
  # Split data
  train_i <- data_train[-i, ]
  test_i <- data_train[i, , drop = FALSE]

  # Preprocess (center + scale) on training fold only
  pre_i <- preprocess(train_i, method = c("center", "scale"))
  train_i_scaled <- predict(pre_i, train_i)
  test_i_scaled <- predict(pre_i, test_i)

  # Train kNN model on the training fold
  fit_i <- train(
    `BETA index` ~ .,

```

```

    data = train_i_scaled,
    method = "knn"
)

# Predict on the left-out observation
pred_loo[i] <- predict(fit_i, newdata = test_i_scaled)
}

# Compute jackknife (LOOCV) prediction error
jackknife_mse <- mean((y - pred_loo)^2)
jackknife_mae <- mean(abs(y - pred_loo))

cat("Jackknife (LOOCV) MSE:", jackknife_mse, "\n")

```

Jackknife (LOOCV) MSE: 0.2887738
0.2467025 (knn)

bootstrap for resampling

```

library(caret)

B <- 500 # number of bootstrap samples
boot_mse <- numeric(B)

set.seed(123)

for (b in 1:B) {
  # sample rows with replacement
  idx <- sample(1:nrow(data_train), replace = TRUE)
  boot_train <- data_train[idx, ]

  # preprocess inside bootstrap sample
  pre_b <- preprocess(boot_train, method = c("center", "scale"))
  boot_train_scaled <- predict(pre_b, boot_train)
  boot_test_scaled <- predict(pre_b, data_test)

  # fit KNN
  fit_b <- train(`BETA index` ~ ., data = boot_train_scaled, method = "knn")

  # predict on test set
  pred_b <- predict(fit_b, newdata = boot_test_scaled)

  boot_mse[b] <- mean((y_test - pred_b)^2)
}

# Bootstrap estimate of prediction error
bootstrap_mse <- mean(boot_mse)
bootstrap_se <- sd(boot_mse)

```

```
cat("Bootstrap MSE:", bootstrap_mse, "\n")
```

Bootstrap MSE: 0.3360549

```
quantile(boot_mse, c(.025, .975))
```

```
2.5%      97.5%
0.05203608 0.84971720
```

ANALYSIS Manual bootstrap for prediction MSE (classic bootstrap) This gives a bootstrap distribution of the prediction MSE on your test set. Idea 1) Resample training data with replacement 2) Preprocess 3) Fit model 4) Predict on test set 5) Compute test MSE 6) Repeat B times 7) Get bootstrap Confidence Interval

PCA=> PCR => PLS; PCA maximize covariance to find direction of greatest variance in data set

```
library(pls)
```

Attaching package: 'pls'

The following object is masked from 'package:caret':

R2

The following object is masked from 'package:stats':

loadings

```
# -----
# Preprocess (same as your KNN code)
# -----
preProc <- preprocess(data_train, method = c("center", "scale"))
train_scaled <- predict(preProc, data_train)
test_scaled <- predict(preProc, data_test)

# -----
# PCR model with cross-validation
# -----
set.seed(123)
pcr_model <- train(
  `BETA index` ~ .,
  data = train_scaled,
  method = "pcr",
  trControl = trainControl(method = "cv", number = 10),
  tuneLength = 15    # number of components to try
)

pred_pcr <- predict(pcr_model, newdata = test_scaled)
```

```
mse_pcr <- mean((y_test - pred_pcr)^2)
mse_pcr
```

[1] 0.4314126

```
# -----
# PLS model with cross-validation
# -----
set.seed(123)
pls_model <- train(
  `BETA index` ~ .,
  data = train_scaled,
  method = "pls",
  trControl = trainControl(method = "cv", number = 10),
  tuneLength = 15      # number of latent components
)
pred_pls <- predict(pls_model, newdata = test_scaled)
mse_pls <- mean((y_test - pred_pls)^2)
mse_pls
```

[1] 0.3929873
