

Analysis

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Read in data

```
# delay means number of days between medical visits  
# MRI and alzeheimers  
crossSectional <- read_csv("alzheimers/oasis_cross-sectional.csv")
```

```
## Parsed with column specification:  
## cols(  
##   ID = col_character(),  
##   `M/F` = col_character(),  
##   Hand = col_character(),  
##   Age = col_double(),  
##   Educ = col_double(),  
##   SES = col_double(),  
##   MMSE = col_double(),  
##   CDR = col_double(),  
##   eTIV = col_double(),  
##   nWBV = col_double(),  
##   ASF = col_double(),  
##   Delay = col_character()  
## )
```

```
long <- read_csv("alzheimers/oasis_longitudinal.csv")
```

```
## Parsed with column specification:  
## cols(  
##   `Subject ID` = col_character(),  
##   `MRI ID` = col_character(),  
##   Group = col_character(),  
##   Visit = col_double(),  
##   `MR Delay` = col_double(),  
##   `M/F` = col_character(),  
##   Hand = col_character(),  
##   Age = col_double(),  
##   EDUC = col_double(),  
##   SES = col_double(),  
##   MMSE = col_double(),  
##   CDR = col_double(),  
##   eTIV = col_double(),  
##   nWBV = col_double(),  
##   ASF = col_double()  
## )
```

```

# breast cancer
breast <- read_csv("data.csv")

## Warning: Missing column names filled in: 'X33' [33]

## Parsed with column specification:
## cols(
##   .default = col_double(),
##   diagnosis = col_character(),
##   X33 = col_character()
## )

## See spec(...) for full column specifications.

## Warning: 569 parsing failures.
## row col   expected   actual     file
##  1  -- 33 columns 32 columns 'data.csv'
##  2  -- 33 columns 32 columns 'data.csv'
##  3  -- 33 columns 32 columns 'data.csv'
##  4  -- 33 columns 32 columns 'data.csv'
##  5  -- 33 columns 32 columns 'data.csv'
## ... ..
## See problems(...) for more details.

# disease prediction
test <- read_csv("diseasePred/Testing.csv")

## Warning: Duplicated column names deduplicated: 'fluid_overload' =>
## 'fluid_overload_1' [118]

## Parsed with column specification:
## cols(
##   .default = col_double(),
##   prognosis = col_character()
## )

## See spec(...) for full column specifications.

train <- read_csv("diseasePred/Training.csv")

## Warning: Duplicated column names deduplicated: 'fluid_overload' =>
## 'fluid_overload_1' [118]

## Parsed with column specification:
## cols(
##   .default = col_double(),
##   prognosis = col_character()
## )

## See spec(...) for full column specifications.

# avocado
avocado <- read_csv("avocado.csv")

## Warning: Missing column names filled in: 'X1' [1]

## Parsed with column specification:
## cols(
##   X1 = col_double(),
##   Date = col_date(format = ""),
##   AveragePrice = col_double(),

```

```
## `Total Volume` = col_double(),
## `4046` = col_double(),
## `4225` = col_double(),
## `4770` = col_double(),
## `Total Bags` = col_double(),
## `Small Bags` = col_double(),
## `Large Bags` = col_double(),
## `XLarge Bags` = col_double(),
## type = col_character(),
## year = col_double(),
## region = col_character()
## )
```

- CDR: clinical dementia rating
- MMSE: Mini-Mental State Examination

```
table(train$prognosis)
```

```
##
## (vertigo) Paroymsal Positional Vertigo Acne
## 120 120
## AIDS Alcoholic hepatitis
## 120 120
## Allergy Arthritis
## 120 120
## Bronchial Asthma Cervical spondylosis
## 120 120
## Chicken pox Chronic cholestasis
## 120 120
## Common Cold Dengue
## 120 120
## Diabetes Dimorphic hemmorhoids(piles)
## 120 120
## Drug Reaction Fungal infection
## 120 120
## Gastroenteritis GERD
## 120 120
## Heart attack hepatitis A
## 120 120
## Hepatitis B Hepatitis C
## 120 120
## Hepatitis D Hepatitis E
## 120 120
## Hypertension Hyperthyroidism
## 120 120
## Hypoglycemia Hypothyroidism
## 120 120
## Impetigo Jaundice
## 120 120
## Malaria Migraine
## 120 120
## Osteoarthritis Paralysis (brain hemorrhage)
## 120 120
## Peptic ulcer disease Pneumonia
## 120 120
```

```
##                Psoriasis                Tuberculosis
##                120                120
##                Typhoid                Urinary tract infection
##                120                120
##                Varicose veins
##                120
```

```
table(test$prognosis)
```

```
##
## (vertigo) Paroymsal   Positional Vertigo                Acne
##                1                1
##                AIDS                Alcoholic hepatitis
##                1                1
##                Allergy                Arthritis
##                1                1
##                Bronchial Asthma                Cervical spondylosis
##                1                1
##                Chicken pox                Chronic cholestasis
##                1                1
##                Common Cold                Dengue
##                1                1
##                Diabetes                Dimorphic hemmorhoids(piles)
##                1                1
##                Drug Reaction                Fungal infection
##                1                1
##                Gastroenteritis                GERD
##                1                1
##                Heart attack                hepatitis A
##                1                1
##                Hepatitis B                Hepatitis C
##                1                1
##                Hepatitis D                Hepatitis E
##                1                1
##                Hypertension                Hyperthyroidism
##                1                1
##                Hypoglycemia                Hypothyroidism
##                1                1
##                Impetigo                Jaundice
##                1                1
##                Malaria                Migraine
##                1                1
##                Osteoarthristis                Paralysis (brain hemorrhage)
##                1                1
##                Peptic ulcer disease                Pneumonia
##                1                1
##                Psoriasis                Tuberculosis
##                1                1
##                Typhoid                Urinary tract infection
##                1                1
##                Varicose veins
##                1
```

```
# breast$diag <- ifelse(breast$diagnosis == "M", 1, 0)
breast1 <- breast %>% select(-X33)
```

[illegible]

```
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -1.565e+03  2.697e+05  -0.006    0.995
## id            -4.590e-07  9.659e-05  -0.005    0.996
## radius_mean   -3.066e+01  2.513e+05   0.000    1.000
## texture_mean    2.131e+01  5.796e+03   0.004    0.997
## perimeter_mean -7.435e+00  4.051e+04   0.000    1.000
## area_mean     -1.088e+00  4.909e+02  -0.002    0.998
## smoothness_mean -3.914e+03  9.742e+05  -0.004    0.997
## compactness_mean -9.859e+03  1.115e+06  -0.009    0.993
## concavity_mean  4.935e+03  6.388e+05   0.008    0.994
## `\\`concave points_mean\\`\\` 1.199e+04  1.331e+06   0.009    0.993
## symmetry_mean  4.275e+02  5.631e+05   0.001    0.999
## fractal_dimension_mean 1.049e+03  1.538e+06   0.001    0.999
## radius_se      6.321e+02  1.005e+06   0.001    0.999
## texture_se     -4.427e+01  4.800e+04  -0.001    0.999
## perimeter_se   -5.710e+01  1.092e+05  -0.001    1.000
## area_se        6.809e-01  2.316e+03   0.000    1.000
## smoothness_se  -6.891e+04  8.426e+06  -0.008    0.993
## compactness_se  8.389e+03  2.685e+06   0.003    0.998
## concavity_se   -1.119e+04  2.006e+06  -0.006    0.996
## `\\`concave points_se\\`\\` 5.612e+04  4.742e+06   0.012    0.991
## symmetry_se    1.029e+04  2.004e+06   0.005    0.996
## fractal_dimension_se -1.385e+05  2.986e+07  -0.005    0.996
## radius_worst   -3.422e+01  1.367e+05   0.000    1.000
## texture_worst    7.674e+00  6.752e+03   0.001    0.999
## perimeter_worst  8.274e+00  2.062e+04   0.000    1.000
## area_worst      1.364e+00  1.957e+02   0.007    0.994
## smoothness_worst 4.933e+03  5.479e+05   0.009    0.993
## compactness_worst -3.312e+02  2.243e+05  -0.001    0.999
## concavity_worst  9.435e+02  1.659e+05   0.006    0.995
## `\\`concave points_worst\\`\\` -3.249e+03  7.820e+05  -0.004    0.997
## symmetry_worst  4.490e+02  2.000e+05   0.002    0.998
## fractal_dimension_worst 1.426e+04  2.676e+06   0.005    0.996
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 5.982e+02  on 454  degrees of freedom
## Residual deviance: 1.159e-06  on 423  degrees of freedom
## AIC: 64
##
## Number of Fisher Scoring iterations: 25

pred1 <- predict(fit1, newdata = testBreast)
confusionMatrix(as.factor(testBreast$diagnosis), reference = pred1)

## Confusion Matrix and Statistics
##
##              Reference
## Prediction  B  M
##      B 68  1
##      M  2 43
##
##              Accuracy : 0.9737
##              95% CI : (0.925, 0.9945)
```

```
##      No Information Rate : 0.614
##      P-Value [Acc > NIR] : <2e-16
##
##              Kappa : 0.9447
##
##  Mcnemar's Test P-Value : 1
##
##              Sensitivity : 0.9714
##              Specificity : 0.9773
##              Pos Pred Value : 0.9855
##              Neg Pred Value : 0.9556
##              Prevalence : 0.6140
##              Detection Rate : 0.5965
##      Detection Prevalence : 0.6053
##              Balanced Accuracy : 0.9744
##
##      'Positive' Class : B
##
```

```
unique(train$prognosis)
```

```
## [1] "Fungal infection"
## [2] "Allergy"
## [3] "GERD"
## [4] "Chronic cholestasis"
## [5] "Drug Reaction"
## [6] "Peptic ulcer disease"
## [7] "AIDS"
## [8] "Diabetes"
## [9] "Gastroenteritis"
## [10] "Bronchial Asthma"
## [11] "Hypertension"
## [12] "Migraine"
## [13] "Cervical spondylosis"
## [14] "Paralysis (brain hemorrhage)"
## [15] "Jaundice"
## [16] "Malaria"
## [17] "Chicken pox"
## [18] "Dengue"
## [19] "Typhoid"
## [20] "hepatitis A"
## [21] "Hepatitis B"
## [22] "Hepatitis C"
## [23] "Hepatitis D"
## [24] "Hepatitis E"
## [25] "Alcoholic hepatitis"
## [26] "Tuberculosis"
## [27] "Common Cold"
## [28] "Pneumonia"
## [29] "Dimorphic hemmorhoids(piles)"
## [30] "Heart attack"
## [31] "Varicose veins"
## [32] "Hypothyroidism"
## [33] "Hyperthyroidism"
## [34] "Hypoglycemia"
```

```

## [35] "Osteoarthritis"
## [36] "Arthritis"
## [37] "(vertigo) Parosymal Positional Vertigo"
## [38] "Acne"
## [39] "Urinary tract infection"
## [40] "Psoriasis"
## [41] "Impetigo"

fit2 <- train(prognosis ~ ., data = train, method = "knn", trControl = trainControl(method = "cv", number = 10),
summary(fit2)

##           Length Class      Mode
## learn         2    -none-    list
## k              1    -none-   numeric
## theDots        0    -none-    list
## xNames       132    -none-   character
## problemType    1    -none-   character
## tuneValue      1  data.frame list
## obsLevels     41    -none-   character
## param          0    -none-    list

pred2 <- predict(fit2, test)
confusionMatrix(as.factor(test$prognosis), reference = pred2)

## Confusion Matrix and Statistics
##
##               Reference
## Prediction      (vertigo) Parosymal Positional Vertigo
## (vertigo) Parosymal Positional Vertigo      1
## Acne                                           0
## AIDS                                           0
## Alcoholic hepatitis                           0
## Allergy                                        0
## Arthritis                                     0
## Bronchial Asthma                             0
## Cervical spondylosis                        0
## Chicken pox                                  0
## Chronic cholestasis                         0
## Common Cold                                 0
## Dengue                                       0
## Diabetes                                    0
## Dimorphic hemorrhoids(piles)                0
## Drug Reaction                              0
## Fungal infection                           0
## Gastroenteritis                           0
## GERD                                        0
## Heart attack                               0
## hepatitis A                                0
## Hepatitis B                                0
## Hepatitis C                                0
## Hepatitis D                                0
## Hepatitis E                                0
## Hypertension                              0
## Hyperthyroidism                            0
## Hypoglycemia                               0

```


##	Hypothyroidism						0
##	Impetigo						0
##	Jaundice						0
##	Malaria						0
##	Migraine						0
##	Osteoarthritis						0
##	Paralysis (brain hemorrhage)						0
##	Peptic ulcer disease						0
##	Pneumonia						0
##	Psoriasis						0
##	Tuberculosis						0
##	Typhoid						0
##	Urinary tract infection						0
##	Varicose veins						0
##							
##							
##	Prediction						
##	(vertigo) Paroymsal Positional Vertigo	Acne	AIDS	Alcoholic hepatitis	Allergy		
##	Acne	0	0		0	0	
##	AIDS	1	0		0	0	
##	Alcoholic hepatitis	0	1		0	0	
##	Allergy	0	0		1	0	
##	Arthritis	0	0		0	0	
##	Bronchial Asthma	0	0		0	0	
##	Cervical spondylosis	0	0		0	0	
##	Chicken pox	0	0		0	0	
##	Chronic cholestasis	0	0		0	0	
##	Common Cold	0	0		0	0	
##	Dengue	0	0		0	0	
##	Diabetes	0	0		0	0	
##	Dimorphic hemmorhoids(piles)	0	0		0	0	
##	Drug Reaction	0	0		0	0	
##	Fungal infection	0	0		0	0	
##	Gastroenteritis	0	0		0	0	
##	GERD	0	0		0	0	
##	Heart attack	0	0		0	0	
##	hepatitis A	0	0		0	0	
##	Hepatitis B	0	0		0	0	
##	Hepatitis C	0	0		0	0	
##	Hepatitis D	0	0		0	0	
##	Hepatitis E	0	0		0	0	
##	Hypertension	0	0		0	0	
##	Hyperthyroidism	0	0		0	0	
##	Hypoglycemia	0	0		0	0	
##	Hypothyroidism	0	0		0	0	
##	Impetigo	0	0		0	0	
##	Jaundice	0	0		0	0	
##	Malaria	0	0		0	0	
##	Migraine	0	0		0	0	
##	Osteoarthritis	0	0		0	0	
##	Paralysis (brain hemorrhage)	0	0		0	0	
##	Peptic ulcer disease	0	0		0	0	
##	Pneumonia	0	0		0	0	
##	Psoriasis	0	0		0	0	
##	Tuberculosis	0	0		0	0	

##	Typhoid	0	0	0	0
##	Urinary tract infection	0	0	0	0
##	Varicose veins	0	0	0	0
##		Reference			
##	Prediction	Arthritis	Bronchial	Asthma	
##	(vertigo) Paroymsal Positional Vertigo	0		0	
##	Acne	0		0	
##	AIDS	0		0	
##	Alcoholic hepatitis	0		0	
##	Allergy	0		0	
##	Arthritis	1		0	
##	Bronchial Asthma	0		1	
##	Cervical spondylosis	0		0	
##	Chicken pox	0		0	
##	Chronic cholestasis	0		0	
##	Common Cold	0		0	
##	Dengue	0		0	
##	Diabetes	0		0	
##	Dimorphic hemmorhoids(piles)	0		0	
##	Drug Reaction	0		0	
##	Fungal infection	0		0	
##	Gastroenteritis	0		0	
##	GERD	0		0	
##	Heart attack	0		0	
##	hepatitis A	0		0	
##	Hepatitis B	0		0	
##	Hepatitis C	0		0	
##	Hepatitis D	0		0	
##	Hepatitis E	0		0	
##	Hypertension	0		0	
##	Hyperthyroidism	0		0	
##	Hypoglycemia	0		0	
##	Hypothyroidism	0		0	
##	Impetigo	0		0	
##	Jaundice	0		0	
##	Malaria	0		0	
##	Migraine	0		0	
##	Osteoarthritis	0		0	
##	Paralysis (brain hemorrhage)	0		0	
##	Peptic ulcer disease	0		0	
##	Pneumonia	0		0	
##	Psoriasis	0		0	
##	Tuberculosis	0		0	
##	Typhoid	0		0	
##	Urinary tract infection	0		0	
##	Varicose veins	0		0	
##		Reference			
##	Prediction	Cervical spondylosis	Chicken	pox	
##	(vertigo) Paroymsal Positional Vertigo		0	0	
##	Acne		0	0	
##	AIDS		0	0	
##	Alcoholic hepatitis		0	0	
##	Allergy		0	0	
##	Arthritis		0	0	

##	Bronchial Asthma	0	0
##	Cervical spondylosis	1	0
##	Chicken pox	0	1
##	Chronic cholestasis	0	0
##	Common Cold	0	0
##	Dengue	0	0
##	Diabetes	0	0
##	Dimorphic hemmorhoids(piles)	0	0
##	Drug Reaction	0	0
##	Fungal infection	0	0
##	Gastroenteritis	0	0
##	GERD	0	0
##	Heart attack	0	0
##	hepatitis A	0	0
##	Hepatitis B	0	0
##	Hepatitis C	0	0
##	Hepatitis D	0	0
##	Hepatitis E	0	0
##	Hypertension	0	0
##	Hyperthyroidism	0	0
##	Hypoglycemia	0	0
##	Hypothyroidism	0	0
##	Impetigo	0	0
##	Jaundice	0	0
##	Malaria	0	0
##	Migraine	0	0
##	Osteoarthritis	0	0
##	Paralysis (brain hemorrhage)	0	0
##	Peptic ulcer disease	0	0
##	Pneumonia	0	0
##	Psoriasis	0	0
##	Tuberculosis	0	0
##	Typhoid	0	0
##	Urinary tract infection	0	0
##	Varicose veins	0	0
##	Reference		
##	Prediction	Chronic cholestasis	Common Cold
##	(vertigo) Paroymsal Positional Vertigo	0	0
##	Acne	0	0
##	AIDS	0	0
##	Alcoholic hepatitis	0	0
##	Allergy	0	0
##	Arthritis	0	0
##	Bronchial Asthma	0	0
##	Cervical spondylosis	0	0
##	Chicken pox	0	0
##	Chronic cholestasis	1	0
##	Common Cold	0	1
##	Dengue	0	0
##	Diabetes	0	0
##	Dimorphic hemmorhoids(piles)	0	0
##	Drug Reaction	0	0
##	Fungal infection	0	0
##	Gastroenteritis	0	0

##	GERD	0	0
##	Heart attack	0	0
##	hepatitis A	0	0
##	Hepatitis B	0	0
##	Hepatitis C	0	0
##	Hepatitis D	0	0
##	Hepatitis E	0	0
##	Hypertension	0	0
##	Hyperthyroidism	0	0
##	Hypoglycemia	0	0
##	Hypothyroidism	0	0
##	Impetigo	0	0
##	Jaundice	0	0
##	Malaria	0	0
##	Migraine	0	0
##	Osteoarthritis	0	0
##	Paralysis (brain hemorrhage)	0	0
##	Peptic ulcer disease	0	0
##	Pneumonia	0	0
##	Psoriasis	0	0
##	Tuberculosis	0	0
##	Typhoid	0	0
##	Urinary tract infection	0	0
##	Varicose veins	0	0
##			
##		Reference	
##	Prediction	Dengue	Diabetes
##	(vertigo) Paroymsal Positional Vertigo	0	0
##	Acne	0	0
##	AIDS	0	0
##	Alcoholic hepatitis	0	0
##	Allergy	0	0
##	Arthritis	0	0
##	Bronchial Asthma	0	0
##	Cervical spondylosis	0	0
##	Chicken pox	0	0
##	Chronic cholestasis	0	0
##	Common Cold	0	0
##	Dengue	1	0
##	Diabetes	0	1
##	Dimorphic hemmorhoids(piles)	0	0
##	Drug Reaction	0	0
##	Fungal infection	0	0
##	Gastroenteritis	0	0
##	GERD	0	0
##	Heart attack	0	0
##	hepatitis A	0	0
##	Hepatitis B	0	0
##	Hepatitis C	0	0
##	Hepatitis D	0	0
##	Hepatitis E	0	0
##	Hypertension	0	0
##	Hyperthyroidism	0	0
##	Hypoglycemia	0	0
##	Hypothyroidism	0	0

##	Impetigo	0	0
##	Jaundice	0	0
##	Malaria	0	0
##	Migraine	0	0
##	Osteoarthritis	0	0
##	Paralysis (brain hemorrhage)	0	0
##	Peptic ulcer disease	0	0
##	Pneumonia	0	0
##	Psoriasis	0	0
##	Tuberculosis	0	0
##	Typhoid	0	0
##	Urinary tract infection	0	0
##	Varicose veins	0	0
##		Reference	
##	Prediction	Dimorphic hemorrhoids(piles)	
##	(vertigo) Parosmia Positional Vertigo		0
##	Acne		0
##	AIDS		0
##	Alcoholic hepatitis		0
##	Allergy		0
##	Arthritis		0
##	Bronchial Asthma		0
##	Cervical spondylosis		0
##	Chicken pox		0
##	Chronic cholestasis		0
##	Common Cold		0
##	Dengue		0
##	Diabetes		0
##	Dimorphic hemorrhoids(piles)		1
##	Drug Reaction		0
##	Fungal infection		0
##	Gastroenteritis		0
##	GERD		0
##	Heart attack		0
##	hepatitis A		0
##	Hepatitis B		0
##	Hepatitis C		0
##	Hepatitis D		0
##	Hepatitis E		0
##	Hypertension		0
##	Hyperthyroidism		0
##	Hypoglycemia		0
##	Hypothyroidism		0
##	Impetigo		0
##	Jaundice		0
##	Malaria		0
##	Migraine		0
##	Osteoarthritis		0
##	Paralysis (brain hemorrhage)		0
##	Peptic ulcer disease		0
##	Pneumonia		0
##	Psoriasis		0
##	Tuberculosis		0
##	Typhoid		0

##	Urinary tract infection		0
##	Varicose veins		0
##		Reference	
##	Prediction	Drug Reaction Fungal infection	
##	(vertigo) Paroymsal Positional Vertigo	0	0
##	Acne	0	0
##	AIDS	0	0
##	Alcoholic hepatitis	0	0
##	Allergy	0	0
##	Arthritis	0	0
##	Bronchial Asthma	0	0
##	Cervical spondylosis	0	0
##	Chicken pox	0	0
##	Chronic cholestasis	0	0
##	Common Cold	0	0
##	Dengue	0	0
##	Diabetes	0	0
##	Dimorphic hemmorhoids(piles)	0	0
##	Drug Reaction	1	0
##	Fungal infection	0	1
##	Gastroenteritis	0	0
##	GERD	0	0
##	Heart attack	0	0
##	hepatitis A	0	0
##	Hepatitis B	0	0
##	Hepatitis C	0	0
##	Hepatitis D	0	0
##	Hepatitis E	0	0
##	Hypertension	0	0
##	Hyperthyroidism	0	0
##	Hypoglycemia	0	0
##	Hypothyroidism	0	0
##	Impetigo	0	0
##	Jaundice	0	0
##	Malaria	0	0
##	Migraine	0	0
##	Osteoarthritis	0	0
##	Paralysis (brain hemorrhage)	0	0
##	Peptic ulcer disease	0	0
##	Pneumonia	0	0
##	Psoriasis	0	0
##	Tuberculosis	0	0
##	Typhoid	0	0
##	Urinary tract infection	0	0
##	Varicose veins	0	0
##		Reference	
##	Prediction	Gastroenteritis GERD Heart attack	
##	(vertigo) Paroymsal Positional Vertigo	0 0	0
##	Acne	0 0	0
##	AIDS	0 0	0
##	Alcoholic hepatitis	0 0	0
##	Allergy	0 0	0
##	Arthritis	0 0	0
##	Bronchial Asthma	0 0	0

##	Cervical spondylosis	0	0	0
##	Chicken pox	0	0	0
##	Chronic cholestasis	0	0	0
##	Common Cold	0	0	0
##	Dengue	0	0	0
##	Diabetes	0	0	0
##	Dimorphic hemmorhoids(piles)	0	0	0
##	Drug Reaction	0	0	0
##	Fungal infection	0	0	0
##	Gastroenteritis	1	0	0
##	GERD	0	1	0
##	Heart attack	0	0	1
##	hepatitis A	0	0	0
##	Hepatitis B	0	0	0
##	Hepatitis C	0	0	0
##	Hepatitis D	0	0	0
##	Hepatitis E	0	0	0
##	Hypertension	0	0	0
##	Hyperthyroidism	0	0	0
##	Hypoglycemia	0	0	0
##	Hypothyroidism	0	0	0
##	Impetigo	0	0	0
##	Jaundice	0	0	0
##	Malaria	0	0	0
##	Migraine	0	0	0
##	Osteoarthritis	0	0	0
##	Paralysis (brain hemorrhage)	0	0	0
##	Peptic ulcer disease	0	0	0
##	Pneumonia	0	0	0
##	Psoriasis	0	0	0
##	Tuberculosis	0	0	0
##	Typhoid	0	0	0
##	Urinary tract infection	0	0	0
##	Varicose veins	0	0	0
##				
##		Reference		
##	Prediction	hepatitis A	Hepatitis B	Hepatitis C
##	(vertigo) Paroymsal Positional Vertigo	0	0	0
##	Acne	0	0	0
##	AIDS	0	0	0
##	Alcoholic hepatitis	0	0	0
##	Allergy	0	0	0
##	Arthritis	0	0	0
##	Bronchial Asthma	0	0	0
##	Cervical spondylosis	0	0	0
##	Chicken pox	0	0	0
##	Chronic cholestasis	0	0	0
##	Common Cold	0	0	0
##	Dengue	0	0	0
##	Diabetes	0	0	0
##	Dimorphic hemmorhoids(piles)	0	0	0
##	Drug Reaction	0	0	0
##	Fungal infection	0	0	0
##	Gastroenteritis	0	0	0
##	GERD	0	0	0

##	Heart attack	0	0	0
##	hepatitis A	1	0	0
##	Hepatitis B	0	1	0
##	Hepatitis C	0	0	1
##	Hepatitis D	0	0	0
##	Hepatitis E	0	0	0
##	Hypertension	0	0	0
##	Hyperthyroidism	0	0	0
##	Hypoglycemia	0	0	0
##	Hypothyroidism	0	0	0
##	Impetigo	0	0	0
##	Jaundice	0	0	0
##	Malaria	0	0	0
##	Migraine	0	0	0
##	Osteoarthritis	0	0	0
##	Paralysis (brain hemorrhage)	0	0	0
##	Peptic ulcer disease	0	0	0
##	Pneumonia	0	0	0
##	Psoriasis	0	0	0
##	Tuberculosis	0	0	0
##	Typhoid	0	0	0
##	Urinary tract infection	0	0	0
##	Varicose veins	0	0	0
##		Reference		
##	Prediction	Hepatitis D	Hepatitis E	Hypertension
##	(vertigo) Parosmal Positional Vertigo	0	0	0
##	Acne	0	0	0
##	AIDS	0	0	0
##	Alcoholic hepatitis	0	0	0
##	Allergy	0	0	0
##	Arthritis	0	0	0
##	Bronchial Asthma	0	0	0
##	Cervical spondylosis	0	0	0
##	Chicken pox	0	0	0
##	Chronic cholestasis	0	0	0
##	Common Cold	0	0	0
##	Dengue	0	0	0
##	Diabetes	0	0	0
##	Dimorphic hemmorhoids(piles)	0	0	0
##	Drug Reaction	0	0	0
##	Fungal infection	0	0	0
##	Gastroenteritis	0	0	0
##	GERD	0	0	0
##	Heart attack	0	0	0
##	hepatitis A	0	0	0
##	Hepatitis B	0	0	0
##	Hepatitis C	0	0	0
##	Hepatitis D	1	0	0
##	Hepatitis E	0	1	0
##	Hypertension	0	0	1
##	Hyperthyroidism	0	0	0
##	Hypoglycemia	0	0	0
##	Hypothyroidism	0	0	0
##	Impetigo	0	0	0

##	Jaundice	0	0	0
##	Malaria	0	0	0
##	Migraine	0	0	0
##	Osteoarthritis	0	0	0
##	Paralysis (brain hemorrhage)	0	0	0
##	Peptic ulcer disease	0	0	0
##	Pneumonia	0	0	0
##	Psoriasis	0	0	0
##	Tuberculosis	0	0	0
##	Typhoid	0	0	0
##	Urinary tract infection	0	0	0
##	Varicose veins	0	0	0
##		Reference		
##	Prediction	Hyperthyroidism Hypoglycemia		
##	(vertigo) Paroymsal Positional Vertigo	0	0	
##	Acne	0	0	
##	AIDS	0	0	
##	Alcoholic hepatitis	0	0	
##	Allergy	0	0	
##	Arthritis	0	0	
##	Bronchial Asthma	0	0	
##	Cervical spondylosis	0	0	
##	Chicken pox	0	0	
##	Chronic cholestasis	0	0	
##	Common Cold	0	0	
##	Dengue	0	0	
##	Diabetes	0	0	
##	Dimorphic hemmorhoids(piles)	0	0	
##	Drug Reaction	0	0	
##	Fungal infection	0	0	
##	Gastroenteritis	0	0	
##	GERD	0	0	
##	Heart attack	0	0	
##	hepatitis A	0	0	
##	Hepatitis B	0	0	
##	Hepatitis C	0	0	
##	Hepatitis D	0	0	
##	Hepatitis E	0	0	
##	Hypertension	0	0	
##	Hyperthyroidism	1	0	
##	Hypoglycemia	0	1	
##	Hypothyroidism	0	0	
##	Impetigo	0	0	
##	Jaundice	0	0	
##	Malaria	0	0	
##	Migraine	0	0	
##	Osteoarthritis	0	0	
##	Paralysis (brain hemorrhage)	0	0	
##	Peptic ulcer disease	0	0	
##	Pneumonia	0	0	
##	Psoriasis	0	0	
##	Tuberculosis	0	0	
##	Typhoid	0	0	
##	Urinary tract infection	0	0	

##	Varicose veins		0	0
##		Reference		
##	Prediction	Hypothyroidism	Impetigo	Jaundice
##	(vertigo) Paroymsal Positional Vertigo	0	0	0
##	Acne	0	0	0
##	AIDS	0	0	0
##	Alcoholic hepatitis	0	0	0
##	Allergy	0	0	0
##	Arthritis	0	0	0
##	Bronchial Asthma	0	0	0
##	Cervical spondylosis	0	0	0
##	Chicken pox	0	0	0
##	Chronic cholestasis	0	0	0
##	Common Cold	0	0	0
##	Dengue	0	0	0
##	Diabetes	0	0	0
##	Dimorphic hemmorhoids(piles)	0	0	0
##	Drug Reaction	0	0	0
##	Fungal infection	0	0	0
##	Gastroenteritis	0	0	0
##	GERD	0	0	0
##	Heart attack	0	0	0
##	hepatitis A	0	0	0
##	Hepatitis B	0	0	0
##	Hepatitis C	0	0	0
##	Hepatitis D	0	0	0
##	Hepatitis E	0	0	0
##	Hypertension	0	0	0
##	Hyperthyroidism	0	0	0
##	Hypoglycemia	0	0	0
##	Hypothyroidism	1	0	0
##	Impetigo	0	1	0
##	Jaundice	0	0	1
##	Malaria	0	0	0
##	Migraine	0	0	0
##	Osteoarthritis	0	0	0
##	Paralysis (brain hemorrhage)	0	0	0
##	Peptic ulcer disease	0	0	0
##	Pneumonia	0	0	0
##	Psoriasis	0	0	0
##	Tuberculosis	0	0	0
##	Typhoid	0	0	0
##	Urinary tract infection	0	0	0
##	Varicose veins	0	0	0
##		Reference		
##	Prediction	Malaria	Migraine	Osteoarthritis
##	(vertigo) Paroymsal Positional Vertigo	0	0	0
##	Acne	0	0	0
##	AIDS	0	0	0
##	Alcoholic hepatitis	0	0	0
##	Allergy	0	0	0
##	Arthritis	0	0	0
##	Bronchial Asthma	0	0	0
##	Cervical spondylosis	0	0	0

##	Chicken pox	0	0	0
##	Chronic cholestasis	0	0	0
##	Common Cold	0	0	0
##	Dengue	0	0	0
##	Diabetes	0	0	0
##	Dimorphic hemmorhoids(piles)	0	0	0
##	Drug Reaction	0	0	0
##	Fungal infection	0	0	0
##	Gastroenteritis	0	0	0
##	GERD	0	0	0
##	Heart attack	0	0	0
##	hepatitis A	0	0	0
##	Hepatitis B	0	0	0
##	Hepatitis C	0	0	0
##	Hepatitis D	0	0	0
##	Hepatitis E	0	0	0
##	Hypertension	0	0	0
##	Hyperthyroidism	0	0	0
##	Hypoglycemia	0	0	0
##	Hypothyroidism	0	0	0
##	Impetigo	0	0	0
##	Jaundice	0	0	0
##	Malaria	1	0	0
##	Migraine	0	1	0
##	Osteoarthritis	0	0	1
##	Paralysis (brain hemorrhage)	0	0	0
##	Peptic ulcer disease	0	0	0
##	Pneumonia	0	0	0
##	Psoriasis	0	0	0
##	Tuberculosis	0	0	0
##	Typhoid	0	0	0
##	Urinary tract infection	0	0	0
##	Varicose veins	0	0	0
##		Reference		
##	Prediction	Paralysis (brain hemorrhage)		
##	(vertigo) Paroymsal Positional Vertigo		0	
##	Acne		0	
##	AIDS		0	
##	Alcoholic hepatitis		0	
##	Allergy		0	
##	Arthritis		0	
##	Bronchial Asthma		0	
##	Cervical spondylosis		0	
##	Chicken pox		0	
##	Chronic cholestasis		0	
##	Common Cold		0	
##	Dengue		0	
##	Diabetes		0	
##	Dimorphic hemmorhoids(piles)		0	
##	Drug Reaction		0	
##	Fungal infection		0	
##	Gastroenteritis		0	
##	GERD		0	
##	Heart attack		0	

##	hepatitis A	0
##	Hepatitis B	0
##	Hepatitis C	0
##	Hepatitis D	0
##	Hepatitis E	0
##	Hypertension	0
##	Hyperthyroidism	0
##	Hypoglycemia	0
##	Hypothyroidism	0
##	Impetigo	0
##	Jaundice	0
##	Malaria	0
##	Migraine	0
##	Osteoarthritis	0
##	Paralysis (brain hemorrhage)	1
##	Peptic ulcer disease	0
##	Pneumonia	0
##	Psoriasis	0
##	Tuberculosis	0
##	Typhoid	0
##	Urinary tract infection	0
##	Varicose veins	0
##	Reference	
##	Prediction	Peptic ulcer disease Pneumonia
##	(vertigo) Parosmal Positional Vertigo	0 0
##	Acne	0 0
##	AIDS	0 0
##	Alcoholic hepatitis	0 0
##	Allergy	0 0
##	Arthritis	0 0
##	Bronchial Asthma	0 0
##	Cervical spondylosis	0 0
##	Chicken pox	0 0
##	Chronic cholestasis	0 0
##	Common Cold	0 0
##	Dengue	0 0
##	Diabetes	0 0
##	Dimorphic hemmorhoids(piles)	0 0
##	Drug Reaction	0 0
##	Fungal infection	0 0
##	Gastroenteritis	0 0
##	GERD	0 0
##	Heart attack	0 0
##	hepatitis A	0 0
##	Hepatitis B	0 0
##	Hepatitis C	0 0
##	Hepatitis D	0 0
##	Hepatitis E	0 0
##	Hypertension	0 0
##	Hyperthyroidism	0 0
##	Hypoglycemia	0 0
##	Hypothyroidism	0 0
##	Impetigo	0 0
##	Jaundice	0 0

##	Malaria		0	0
##	Migraine		0	0
##	Osteoarthritis		0	0
##	Paralysis (brain hemorrhage)		0	0
##	Peptic ulcer disease		1	0
##	Pneumonia		0	1
##	Psoriasis		0	0
##	Tuberculosis		0	0
##	Typhoid		0	0
##	Urinary tract infection		0	0
##	Varicose veins		0	0
##		Reference		
##	Prediction	Psoriasis	Tuberculosis	Typhoid
##	(vertigo) Paroymsal Positional Vertigo	0	0	0
##	Acne	0	0	0
##	AIDS	0	0	0
##	Alcoholic hepatitis	0	0	0
##	Allergy	0	0	0
##	Arthritis	0	0	0
##	Bronchial Asthma	0	0	0
##	Cervical spondylosis	0	0	0
##	Chicken pox	0	0	0
##	Chronic cholestasis	0	0	0
##	Common Cold	0	0	0
##	Dengue	0	0	0
##	Diabetes	0	0	0
##	Dimorphic hemmorhoids(piles)	0	0	0
##	Drug Reaction	0	0	0
##	Fungal infection	0	0	0
##	Gastroenteritis	0	0	0
##	GERD	0	0	0
##	Heart attack	0	0	0
##	hepatitis A	0	0	0
##	Hepatitis B	0	0	0
##	Hepatitis C	0	0	0
##	Hepatitis D	0	0	0
##	Hepatitis E	0	0	0
##	Hypertension	0	0	0
##	Hyperthyroidism	0	0	0
##	Hypoglycemia	0	0	0
##	Hypothyroidism	0	0	0
##	Impetigo	0	0	0
##	Jaundice	0	0	0
##	Malaria	0	0	0
##	Migraine	0	0	0
##	Osteoarthritis	0	0	0
##	Paralysis (brain hemorrhage)	0	0	0
##	Peptic ulcer disease	0	0	0
##	Pneumonia	0	0	0
##	Psoriasis	1	0	0
##	Tuberculosis	0	1	0
##	Typhoid	0	0	1
##	Urinary tract infection	0	0	0
##	Varicose veins	0	0	0

##	Reference
## Prediction	Urinary tract infection
## (vertigo) Paroymsal Positional Vertigo	0
## Acne	0
## AIDS	0
## Alcoholic hepatitis	0
## Allergy	0
## Arthritis	0
## Bronchial Asthma	0
## Cervical spondylosis	0
## Chicken pox	0
## Chronic cholestasis	0
## Common Cold	0
## Dengue	0
## Diabetes	0
## Dimorphic hemmorhoids(piles)	0
## Drug Reaction	0
## Fungal infection	0
## Gastroenteritis	0
## GERD	0
## Heart attack	0
## hepatitis A	0
## Hepatitis B	0
## Hepatitis C	0
## Hepatitis D	0
## Hepatitis E	0
## Hypertension	0
## Hyperthyroidism	0
## Hypoglycemia	0
## Hypothyroidism	0
## Impetigo	0
## Jaundice	0
## Malaria	0
## Migraine	0
## Osteoarthritis	0
## Paralysis (brain hemorrhage)	0
## Peptic ulcer disease	0
## Pneumonia	0
## Psoriasis	0
## Tuberculosis	0
## Typhoid	0
## Urinary tract infection	1
## Varicose veins	0
##	Reference
## Prediction	Varicose veins
## (vertigo) Paroymsal Positional Vertigo	0
## Acne	0
## AIDS	0
## Alcoholic hepatitis	0
## Allergy	0
## Arthritis	0
## Bronchial Asthma	0
## Cervical spondylosis	0
## Chicken pox	0

```

## Chronic cholestasis 0
## Common Cold 0
## Dengue 0
## Diabetes 0
## Dimorphic hemmorhoids(piles) 0
## Drug Reaction 0
## Fungal infection 0
## Gastroenteritis 0
## GERD 0
## Heart attack 0
## hepatitis A 0
## Hepatitis B 0
## Hepatitis C 0
## Hepatitis D 0
## Hepatitis E 0
## Hypertension 0
## Hyperthyroidism 0
## Hypoglycemia 0
## Hypothyroidism 0
## Impetigo 0
## Jaundice 0
## Malaria 0
## Migraine 0
## Osteoarthritis 0
## Paralysis (brain hemorrhage) 0
## Peptic ulcer disease 0
## Pneumonia 0
## Psoriasis 0
## Tuberculosis 0
## Typhoid 0
## Urinary tract infection 0
## Varicose veins 1
##
## Overall Statistics
##
## Accuracy : 1
## 95% CI : (0.914, 1)
## No Information Rate : 0.0244
## P-Value [Acc > NIR] : < 2.2e-16
##
## Kappa : 1
##
## McNemar's Test P-Value : NA
##
## Statistics by Class:
##
## Class: (vertigo) Paroymsal Positional Vertigo Class: Acne
## Sensitivity 1.00000 1.00000
## Specificity 1.00000 1.00000
## Pos Pred Value 1.00000 1.00000
## Neg Pred Value 1.00000 1.00000
## Prevalence 0.02439 0.02439
## Detection Rate 0.02439 0.02439
## Detection Prevalence 0.02439 0.02439

```

## Balanced Accuracy		1.00000	1.00000
##	Class: AIDS Class: Alcoholic hepatitis Class: Allergy		
## Sensitivity	1.00000	1.00000	1.00000
## Specificity	1.00000	1.00000	1.00000
## Pos Pred Value	1.00000	1.00000	1.00000
## Neg Pred Value	1.00000	1.00000	1.00000
## Prevalence	0.02439	0.02439	0.02439
## Detection Rate	0.02439	0.02439	0.02439
## Detection Prevalence	0.02439	0.02439	0.02439
## Balanced Accuracy	1.00000	1.00000	1.00000
##	Class: Arthritis Class: Bronchial Asthma		
## Sensitivity	1.00000	1.00000	
## Specificity	1.00000	1.00000	
## Pos Pred Value	1.00000	1.00000	
## Neg Pred Value	1.00000	1.00000	
## Prevalence	0.02439	0.02439	
## Detection Rate	0.02439	0.02439	
## Detection Prevalence	0.02439	0.02439	
## Balanced Accuracy	1.00000	1.00000	
##	Class: Cervical spondylosis Class: Chicken pox		
## Sensitivity	1.00000	1.00000	
## Specificity	1.00000	1.00000	
## Pos Pred Value	1.00000	1.00000	
## Neg Pred Value	1.00000	1.00000	
## Prevalence	0.02439	0.02439	
## Detection Rate	0.02439	0.02439	
## Detection Prevalence	0.02439	0.02439	
## Balanced Accuracy	1.00000	1.00000	
##	Class: Chronic cholestasis Class: Common Cold		
## Sensitivity	1.00000	1.00000	
## Specificity	1.00000	1.00000	
## Pos Pred Value	1.00000	1.00000	
## Neg Pred Value	1.00000	1.00000	
## Prevalence	0.02439	0.02439	
## Detection Rate	0.02439	0.02439	
## Detection Prevalence	0.02439	0.02439	
## Balanced Accuracy	1.00000	1.00000	
##	Class: Dengue Class: Diabetes		
## Sensitivity	1.00000	1.00000	
## Specificity	1.00000	1.00000	
## Pos Pred Value	1.00000	1.00000	
## Neg Pred Value	1.00000	1.00000	
## Prevalence	0.02439	0.02439	
## Detection Rate	0.02439	0.02439	
## Detection Prevalence	0.02439	0.02439	
## Balanced Accuracy	1.00000	1.00000	
##	Class: Dimorphic hemmorhoids(piles) Class: Drug Reaction		
## Sensitivity	1.00000	1.00000	
## Specificity	1.00000	1.00000	
## Pos Pred Value	1.00000	1.00000	
## Neg Pred Value	1.00000	1.00000	
## Prevalence	0.02439	0.02439	
## Detection Rate	0.02439	0.02439	
## Detection Prevalence	0.02439	0.02439	

##	Balanced Accuracy	1.00000	1.00000
##		Class: Fungal infection	Class: Gastroenteritis
##	Sensitivity	1.00000	1.00000
##	Specificity	1.00000	1.00000
##	Pos Pred Value	1.00000	1.00000
##	Neg Pred Value	1.00000	1.00000
##	Prevalence	0.02439	0.02439
##	Detection Rate	0.02439	0.02439
##	Detection Prevalence	0.02439	0.02439
##	Balanced Accuracy	1.00000	1.00000
##		Class: Heart attack	Class: hepatitis A
##	Sensitivity	1.00000	1.00000
##	Specificity	1.00000	1.00000
##	Pos Pred Value	1.00000	1.00000
##	Neg Pred Value	1.00000	1.00000
##	Prevalence	0.02439	0.02439
##	Detection Rate	0.02439	0.02439
##	Detection Prevalence	0.02439	0.02439
##	Balanced Accuracy	1.00000	1.00000
##		Class: Hepatitis C	Class: Hepatitis D
##	Sensitivity	1.00000	1.00000
##	Specificity	1.00000	1.00000
##	Pos Pred Value	1.00000	1.00000
##	Neg Pred Value	1.00000	1.00000
##	Prevalence	0.02439	0.02439
##	Detection Rate	0.02439	0.02439
##	Detection Prevalence	0.02439	0.02439
##	Balanced Accuracy	1.00000	1.00000
##		Class: Hypertension	Class: Hyperthyroidism
##	Sensitivity	1.00000	1.00000
##	Specificity	1.00000	1.00000
##	Pos Pred Value	1.00000	1.00000
##	Neg Pred Value	1.00000	1.00000
##	Prevalence	0.02439	0.02439
##	Detection Rate	0.02439	0.02439
##	Detection Prevalence	0.02439	0.02439
##	Balanced Accuracy	1.00000	1.00000
##		Class: Hypoglycemia	Class: Hypothyroidism
##	Sensitivity	1.00000	1.00000
##	Specificity	1.00000	1.00000
##	Pos Pred Value	1.00000	1.00000
##	Neg Pred Value	1.00000	1.00000
##	Prevalence	0.02439	0.02439
##	Detection Rate	0.02439	0.02439
##	Detection Prevalence	0.02439	0.02439
##	Balanced Accuracy	1.00000	1.00000
##		Class: Jaundice	Class: Malaria
##	Sensitivity	1.00000	1.00000
##	Specificity	1.00000	1.00000
##	Pos Pred Value	1.00000	1.00000
##	Neg Pred Value	1.00000	1.00000
##	Prevalence	0.02439	0.02439
##	Detection Rate	0.02439	0.02439
##	Detection Prevalence	0.02439	0.02439

```

## Balanced Accuracy          1.00000      1.00000      1.00000
##                               Class: Osteoarthritis Class: Paralysis (brain hemorrhage)
## Sensitivity                  1.00000                  1.00000
## Specificity                  1.00000                  1.00000
## Pos Pred Value               1.00000                  1.00000
## Neg Pred Value               1.00000                  1.00000
## Prevalence                   0.02439                  0.02439
## Detection Rate               0.02439                  0.02439
## Detection Prevalence         0.02439                  0.02439
## Balanced Accuracy            1.00000                  1.00000
##                               Class: Peptic ulcer disease Class: Pneumonia
## Sensitivity                  1.00000                  1.00000
## Specificity                  1.00000                  1.00000
## Pos Pred Value               1.00000                  1.00000
## Neg Pred Value               1.00000                  1.00000
## Prevalence                   0.02439                  0.02439
## Detection Rate               0.02439                  0.02439
## Detection Prevalence         0.02439                  0.02439
## Balanced Accuracy            1.00000                  1.00000
##                               Class: Psoriasis Class: Tuberculosis Class: Typhoid
## Sensitivity                  1.00000                  1.00000      1.00000
## Specificity                  1.00000                  1.00000      1.00000
## Pos Pred Value               1.00000                  1.00000      1.00000
## Neg Pred Value               1.00000                  1.00000      1.00000
## Prevalence                   0.02439                  0.02439      0.02439
## Detection Rate               0.02439                  0.02439      0.02439
## Detection Prevalence         0.02439                  0.02439      0.02439
## Balanced Accuracy            1.00000                  1.00000      1.00000
##                               Class: Urinary tract infection Class: Varicose veins
## Sensitivity                  1.00000                  1.00000
## Specificity                  1.00000                  1.00000
## Pos Pred Value               1.00000                  1.00000
## Neg Pred Value               1.00000                  1.00000
## Prevalence                   0.02439                  0.02439
## Detection Rate               0.02439                  0.02439
## Detection Prevalence         0.02439                  0.02439
## Balanced Accuracy            1.00000                  1.00000

```

```

train3 <- sample(1:nrow(avocado), size = nrow(avocado)*0.8)
test3 <- setdiff(1:nrow(avocado), train3)
trainAvo <- avocado[train3,]
testAvo <- avocado[-train3,]

fit3 <- train(AveragePrice ~ ., trainAvo, method = "glm", trControl = trainControl(method = "cv", number = 10))
pred3 <- predict(fit3, testAvo)
postResample(pred3, testAvo$AveragePrice)

```

```

##      RMSE Rsquared      MAE
## 0.2552108 0.5948687 0.1942861

```

```

cross <- crossSectional[!is.na(crossSectional$CDR),]
cross <- cross[!is.na(cross$SES),]
cross$dementia <- as.factor(cross$CDR)
# cross$dementia <- factor(ifelse(cross$CDR == 0, "normal",
#                                ifelse(cross$CDR == 0.5, "very_mild",

```

```

#                                     ifelse(cross$CDR == 1, "mild",
#                                     ifelse(cross$CDR == 2, "moderate", "severe")))))
cross <- select(cross, -Delay, -CDR, -ID, -Hand)
train4 <- sample(1:nrow(cross), size = nrow(cross)*0.8)
test4 <- setdiff(1:nrow(cross), train4)
trainCross <- cross[train4,]
testCross <- cross[-train4,]

fit4 <- train(dementia ~ ., data = trainCross, method = "multinom", trControl = trainControl(method = "

## # weights:  40 (27 variable)
## initial  value 214.875626
## iter   10 value 104.602195
## iter   20 value 79.760493
## iter   30 value 75.674860
## iter   40 value 73.869689
## iter   50 value 73.778670
## iter   60 value 73.668053
## iter   70 value 73.549402
## iter   80 value 73.407325
## iter   90 value 73.231272
## iter  100 value 72.721654
## final   value 72.721654
## stopped after 100 iterations
## # weights:  40 (27 variable)
## initial  value 214.875626
## iter   10 value 103.720499
## iter   20 value 82.665980
## iter   30 value 82.223246
## iter   40 value 82.050405
## final   value 82.050324
## converged
## # weights:  40 (27 variable)
## initial  value 214.875626
## iter   10 value 104.601095
## iter   20 value 79.765205
## iter   30 value 75.760692
## iter   40 value 74.112875
## iter   50 value 74.026577
## iter   60 value 73.932281
## iter   70 value 73.824358
## iter   80 value 73.714727
## iter   90 value 73.674469
## iter  100 value 73.576444
## final   value 73.576444
## stopped after 100 iterations
## # weights:  40 (27 variable)
## initial  value 213.489332
## iter   10 value 96.785093
## iter   20 value 75.992282
## iter   30 value 73.410638
## iter   40 value 72.436085
## iter   50 value 72.134990
## iter   60 value 71.956514

```

```

## iter 70 value 71.788117
## iter 80 value 71.584972
## iter 90 value 71.557354
## iter 100 value 71.313329
## final value 71.313329
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 213.489332
## iter 10 value 96.956193
## iter 20 value 78.860838
## iter 30 value 78.323849
## iter 40 value 78.260767
## final value 78.260765
## converged
## # weights: 40 (27 variable)
## initial value 213.489332
## iter 10 value 96.785266
## iter 20 value 76.001314
## iter 30 value 73.445821
## iter 40 value 72.529554
## iter 50 value 72.251800
## iter 60 value 72.124737
## iter 70 value 71.918046
## iter 80 value 71.836478
## iter 90 value 71.782216
## iter 100 value 71.765812
## final value 71.765812
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 217.648215
## iter 10 value 112.336606
## iter 20 value 86.036963
## iter 30 value 80.514620
## iter 40 value 78.679735
## iter 50 value 78.259276
## iter 60 value 77.828203
## iter 70 value 77.689490
## iter 80 value 77.457021
## iter 90 value 77.408332
## iter 100 value 76.816092
## final value 76.816092
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 217.648215
## iter 10 value 112.386801
## iter 20 value 88.707724
## iter 30 value 85.612201
## iter 40 value 85.021967
## iter 50 value 85.016503
## final value 85.012746
## converged
## # weights: 40 (27 variable)
## initial value 217.648215
## iter 10 value 112.336656

```

```

## iter 20 value 86.041586
## iter 30 value 80.586695
## iter 40 value 78.851992
## iter 50 value 78.448808
## iter 60 value 78.091791
## iter 70 value 77.925655
## iter 80 value 77.774252
## iter 90 value 77.736042
## iter 100 value 77.709943
## final value 77.709943
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 110.902521
## iter 20 value 79.731535
## iter 30 value 74.501038
## iter 40 value 73.340700
## iter 50 value 73.040770
## iter 60 value 72.830359
## iter 70 value 72.445052
## iter 80 value 72.140951
## iter 90 value 72.076927
## iter 100 value 71.124461
## final value 71.124461
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 110.963139
## iter 20 value 83.626472
## iter 30 value 80.011405
## iter 40 value 79.387622
## iter 50 value 79.378195
## final value 79.376695
## converged
## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 110.902582
## iter 20 value 79.740980
## iter 30 value 74.558141
## iter 40 value 73.452746
## iter 50 value 73.167302
## iter 60 value 72.959024
## iter 70 value 72.569730
## iter 80 value 72.420399
## iter 90 value 72.319542
## iter 100 value 72.267192
## final value 72.267192
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 213.489332
## iter 10 value 109.807264
## iter 20 value 81.182711
## iter 30 value 75.652150
## iter 40 value 74.242747

```

```

## iter 50 value 73.976227
## iter 60 value 73.787336
## iter 70 value 73.748155
## iter 80 value 73.672823
## iter 90 value 73.598207
## iter 100 value 73.417061
## final value 73.417061
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 213.489332
## iter 10 value 109.866261
## iter 20 value 83.916456
## iter 30 value 80.440914
## iter 40 value 80.218443
## iter 50 value 80.213801
## final value 80.212274
## converged
## # weights: 40 (27 variable)
## initial value 213.489332
## iter 10 value 109.807323
## iter 20 value 81.188345
## iter 30 value 75.720566
## iter 40 value 74.405620
## iter 50 value 74.172570
## iter 60 value 74.034727
## iter 70 value 73.989059
## iter 80 value 73.947266
## iter 90 value 73.888860
## iter 100 value 73.833307
## final value 73.833307
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 106.321294
## iter 20 value 79.664643
## iter 30 value 75.165161
## iter 40 value 73.336071
## iter 50 value 73.203931
## iter 60 value 73.007044
## iter 70 value 72.739441
## iter 80 value 72.511535
## iter 90 value 72.398939
## iter 100 value 71.858909
## final value 71.858909
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 106.454867
## iter 20 value 83.108110
## iter 30 value 80.135166
## iter 40 value 79.768597
## iter 50 value 79.764879
## final value 79.763919
## converged

```

```

## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 106.321427
## iter 20 value 79.673535
## iter 30 value 75.228086
## iter 40 value 73.526970
## iter 50 value 73.388581
## iter 60 value 73.237209
## iter 70 value 72.967430
## iter 80 value 72.764520
## iter 90 value 72.719706
## iter 100 value 72.682497
## final value 72.682497
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 110.188768
## iter 20 value 79.974425
## iter 30 value 75.710687
## iter 40 value 73.840279
## iter 50 value 73.249501
## iter 60 value 72.945537
## iter 70 value 72.539165
## iter 80 value 72.390581
## iter 90 value 72.267056
## iter 100 value 71.641726
## final value 71.641726
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 110.239280
## iter 20 value 83.536020
## iter 30 value 80.512815
## iter 40 value 79.965632
## iter 50 value 79.961627
## final value 79.960291
## converged
## # weights: 40 (27 variable)
## initial value 214.875626
## iter 10 value 110.188818
## iter 20 value 79.982215
## iter 30 value 75.760002
## iter 40 value 73.997190
## iter 50 value 73.451308
## iter 60 value 73.257656
## iter 70 value 72.847619
## iter 80 value 72.772620
## iter 90 value 72.703835
## iter 100 value 72.664249
## final value 72.664249
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 213.489332
## iter 10 value 107.253858

```

```

## iter 20 value 79.472248
## iter 30 value 75.586705
## iter 40 value 73.968839
## iter 50 value 73.792198
## iter 60 value 73.672682
## iter 70 value 73.313906
## iter 80 value 73.010644
## iter 90 value 72.948174
## iter 100 value 72.721309
## final value 72.721309
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 213.489332
## iter 10 value 107.309834
## iter 20 value 82.544028
## iter 30 value 79.657480
## iter 40 value 79.203535
## iter 50 value 79.195839
## final value 79.193240
## converged
## # weights: 40 (27 variable)
## initial value 213.489332
## iter 10 value 107.253914
## iter 20 value 79.478812
## iter 30 value 75.632346
## iter 40 value 74.112072
## iter 50 value 73.941193
## iter 60 value 73.836040
## iter 70 value 73.541920
## iter 80 value 73.289640
## iter 90 value 73.233358
## iter 100 value 73.201119
## final value 73.201119
## stopped after 100 iterations

## Warning in nnet::multinom(.outcome ~ ., data = dat, decay = param$decay, : group
## '2' is empty

## # weights: 30 (18 variable)
## initial value 168.087680
## iter 10 value 94.636775
## iter 20 value 74.507289
## iter 30 value 72.377990
## iter 40 value 71.655338
## iter 50 value 71.636039
## iter 60 value 71.415715
## iter 70 value 70.756574
## final value 70.704622
## converged

## Warning in nnet::multinom(.outcome ~ ., data = dat, decay = param$decay, : group
## '2' is empty

## # weights: 30 (18 variable)
## initial value 168.087680
## iter 10 value 94.866251

```



```

## iter 20 value 77.919729
## final value 77.916783
## converged

## Warning in nnet::multinom(.outcome ~ ., data = dat, decay = param$decay, : group
## '2' is empty

## # weights: 30 (18 variable)
## initial value 168.087680
## iter 10 value 94.637010
## iter 20 value 74.517959
## iter 30 value 72.480374
## iter 40 value 71.836217
## iter 50 value 71.820581
## iter 60 value 71.631073
## iter 70 value 71.374300
## iter 80 value 71.349005
## iter 90 value 71.336071
## iter 100 value 71.309042
## final value 71.309042
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 216.261920
## iter 10 value 106.652054
## iter 20 value 78.124511
## iter 30 value 73.404595
## iter 40 value 71.274556
## iter 50 value 70.562804
## iter 60 value 70.386727
## iter 70 value 70.109202
## iter 80 value 69.830999
## iter 90 value 69.663156
## iter 100 value 69.115932
## final value 69.115932
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 216.261920
## iter 10 value 106.724104
## iter 20 value 82.867851
## iter 30 value 79.656008
## iter 40 value 79.196593
## iter 50 value 79.185298
## final value 79.182843
## converged
## # weights: 40 (27 variable)
## initial value 216.261920
## iter 10 value 106.652127
## iter 20 value 78.135775
## iter 30 value 73.461816
## iter 40 value 71.457159
## iter 50 value 70.810809
## iter 60 value 70.625228
## iter 70 value 70.290709
## iter 80 value 70.185134
## iter 90 value 70.122031

```

```
## iter 100 value 70.083062
## final value 70.083062
## stopped after 100 iterations
## # weights: 40 (27 variable)
## initial value 238.442630
## iter 10 value 114.624987
## iter 20 value 90.018126
## iter 30 value 84.645278
## iter 40 value 83.024859
## iter 50 value 82.639304
## iter 60 value 82.488806
## iter 70 value 82.202426
## iter 80 value 81.972689
## iter 90 value 81.926126
## iter 100 value 81.866296
## final value 81.866296
## stopped after 100 iterations
```

```
pred4 <- predict(fit4, newdata = testCross)
confusionMatrix(testCross$dementia, reference = pred4)
```

```
## Confusion Matrix and Statistics
##
##           Reference
## Prediction 0 0.5 1 2
##           0 23  2 0 0
##           0.5 8  3 1 0
##           1  0  3 3 0
##           2  0  0 0 1
##
## Overall Statistics
##
##           Accuracy : 0.6818
##           95% CI : (0.5242, 0.8139)
##           No Information Rate : 0.7045
##           P-Value [Acc > NIR] : 0.6957
##
##           Kappa : 0.4077
##
##           McNemar's Test P-Value : NA
##
## Statistics by Class:
##
##           Class: 0 Class: 0.5 Class: 1 Class: 2
## Sensitivity          0.7419    0.37500 0.75000 1.00000
## Specificity          0.8462    0.75000 0.92500 1.00000
## Pos Pred Value       0.9200    0.25000 0.50000 1.00000
## Neg Pred Value       0.5789    0.84375 0.97368 1.00000
## Prevalence           0.7045    0.18182 0.09091 0.02273
## Detection Rate       0.5227    0.06818 0.06818 0.02273
## Detection Prevalence 0.5682    0.27273 0.13636 0.02273
## Balanced Accuracy     0.7940    0.56250 0.83750 1.00000
```