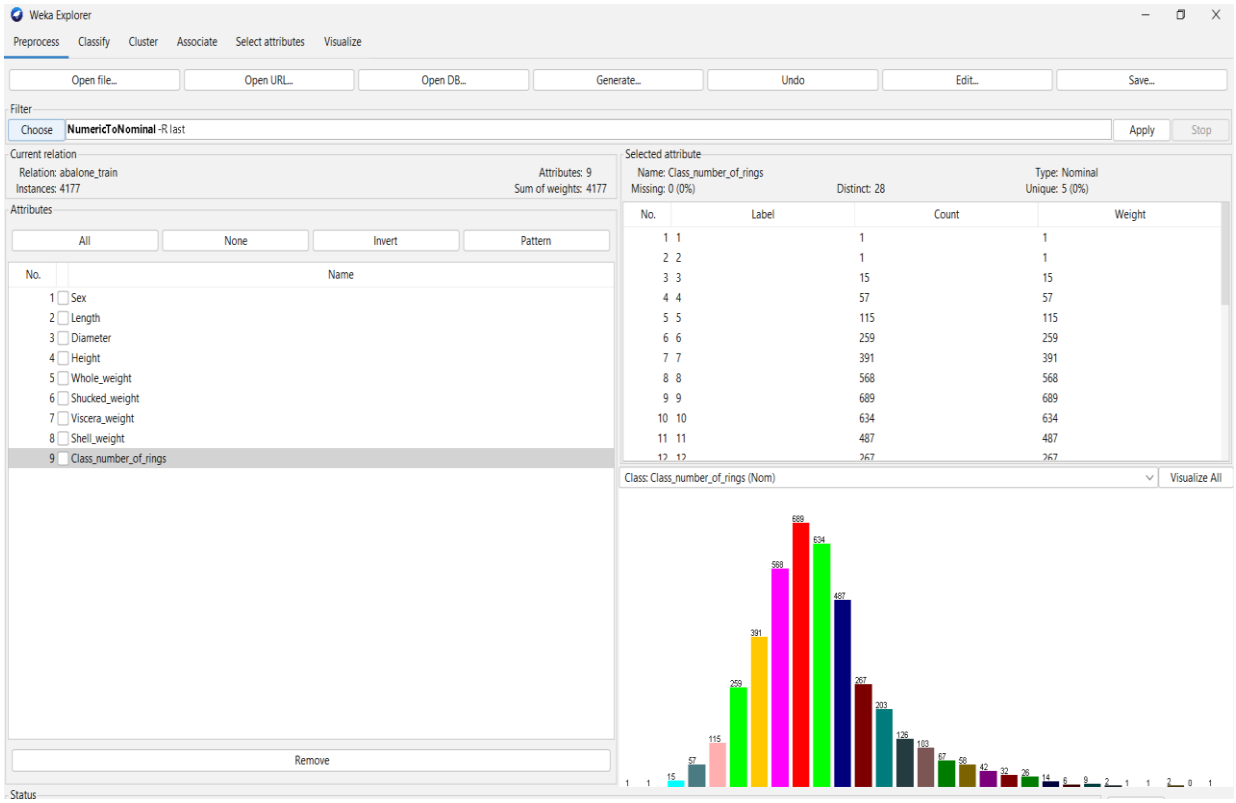
# Approach 1: Predicting the number of rings

## Case 1:

### Data Pre-processing

Filter: NumerictoNominal

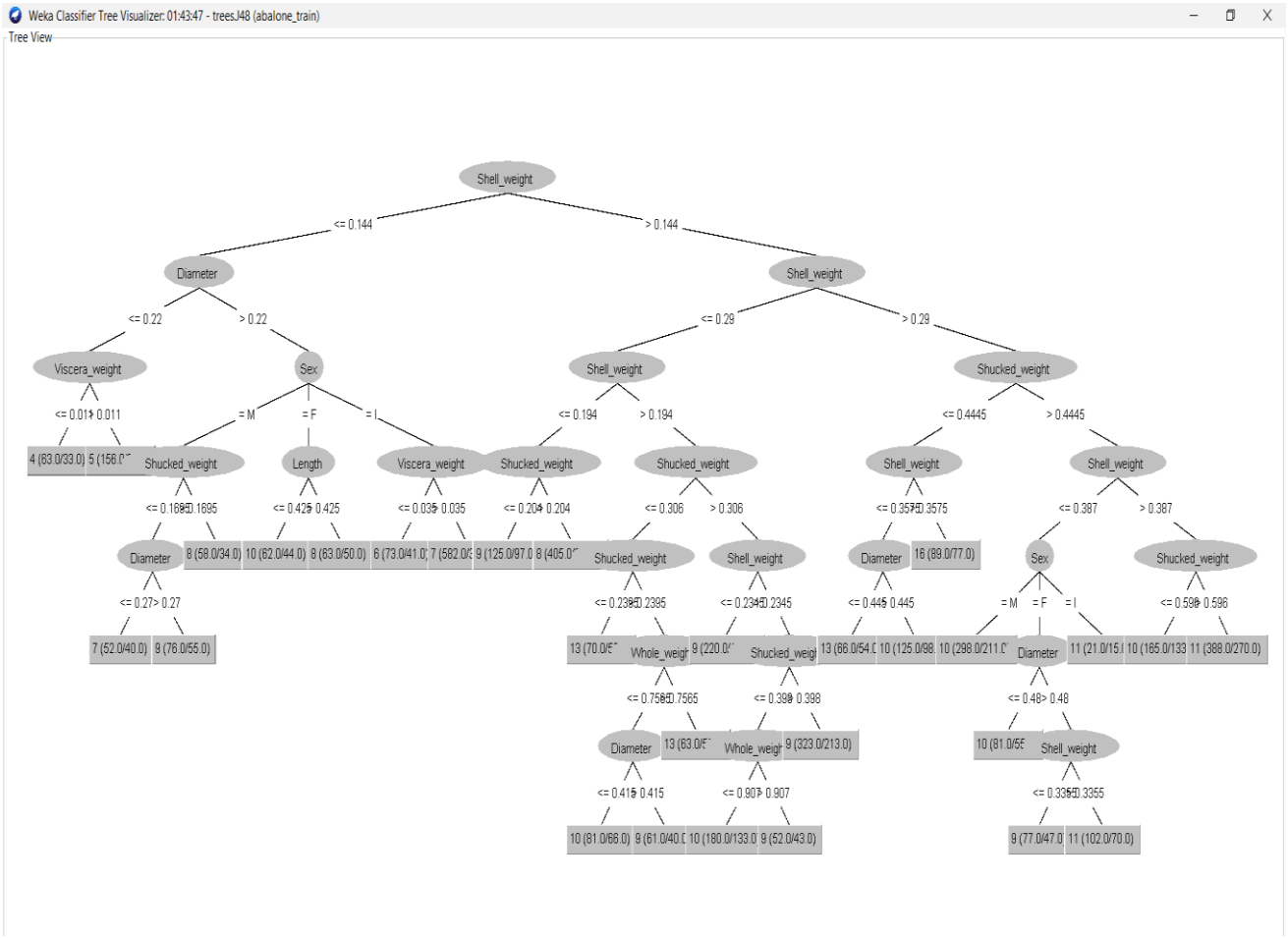


# Building the classification model

## Training:

### Algorithm: J48 Decision Tree

### Decision tree generated



## Testing:

Using the model built above

Prediction of number of rings

(taken 35 instances for screenshot)

Classifier output

```
=== Predictions on test data ===

    inst#     actual  predicted error prediction
        1      16:16      11:11   +    0.323
        2      16:16      10:10   +    0.237
        3      16:16      13:13   +    0.177
        4      16:16        9:9   +    0.295
        5      16:16      10:10   +    0.336
        6      16:16      10:10   +    0.237
        7      16:16      11:11   +    0.323
        8      11:11      10:10   +    0.229
        9      11:11      11:11        0.323
       10      11:11      10:10   +    0.336
       11      11:11      10:10   +    0.237
       12      11:11      10:10   +    0.237
       13      11:11      10:10   +    0.237
       14      11:11      11:11        0.303
       15      11:11      10:10   +    0.259
       16      11:11      11:11        0.323
       17      11:11      10:10   +    0.221
       18      11:11      10:10   +    0.28
       19      11:11      11:11        0.323
       20      11:11      10:10   +    0.229
       21      11:11      10:10   +    0.237
       22      11:11      13:13   +    0.177
       23      11:11      11:11        0.323
       24      11:11      11:11        0.323
       25      11:11        9:9   +    0.295
       26      11:11      11:11        0.323
       27      11:11      10:10   +    0.229
       28      11:11      10:10   +    0.237
       29      11:11      10:10   +    0.237
       30      11:11      11:11        0.323
       31      11:11      11:11        0.323
       32      11:11      11:11        0.323
       33      11:11      10:10   +    0.309
       34      11:11      10:10   +    0.221
       35      11:11        8:8   +    0.344
```

## Accuracy

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances        1097               26.2629 %
Incorrectly Classified Instances      3080               73.7371 %
Kappa statistic                          0.1582
Mean absolute error                      0.056
Root mean squared error                  0.1688
Relative absolute error                 90.6616 %
Root relative squared error             96.056  %
Total Number of Instances             4177
```

## Confusion Matrix

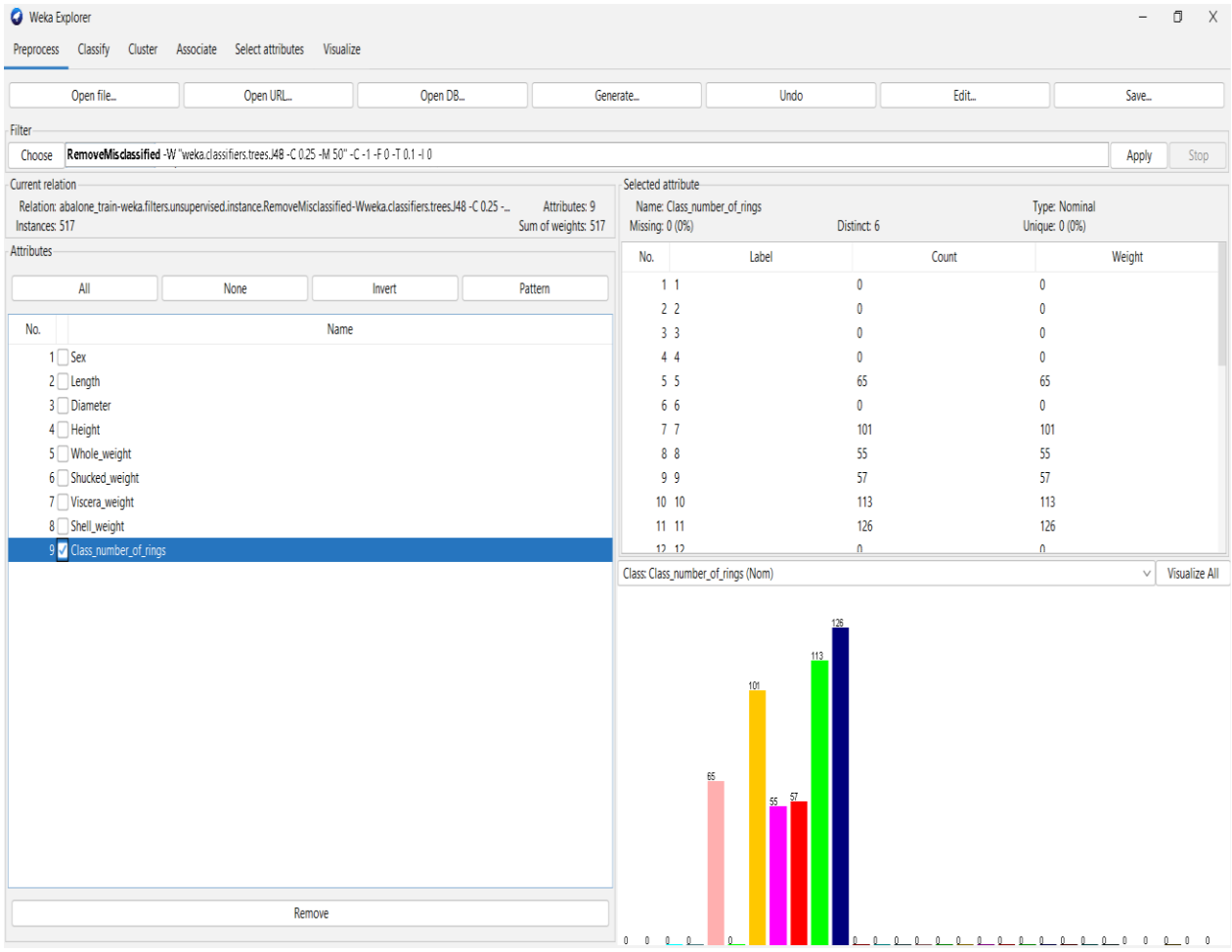
```
=== Confusion Matrix ===

   a   b   c   d   e   f   g   h   i   j   k   l   m   n   o   p   q   r   s   t   u   v   w   x   y   z  aa  ab  ac   <-- classified as
   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   a = 1
   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   b = 2
   0   0   0  13   2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   c = 3
   0   0   0  34  17   5   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   d = 4
   0   0   0  21  52  21  17   0   1   3   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   e = 5
   0   0   0   4  42  46 122  22  14   7   0   0   2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   f = 6
   0   0   0   3  13  47 159 100  50  16   3   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   g = 7
   0   0   0   0   5  13 105 181 168  71  12   3   8   1   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0 |   h = 8
   0   0   0   0   1   6  34 151 243 183  52   4  15   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   i = 9
   0   0   0   0   0   1  19  73 197 220 105   3  15   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0 |   j = 10
   0   0   0   0   0   1   9  45 103 177 125  10  15   2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   k = 11
   0   0   0   0   0   1   4  28  46  93  62   8  20   1   0   4   0   0   0   0   0   0   0   0   0   0   0   0   0 |   l = 12
   0   0   0   0   0   1   3  16  30  68  43   7  25   1   0   9   0   0   0   0   0   0   0   0   0   0   0   0   0 |   m = 13
   0   0   0   0   0   0   3   6  23  35  28   3  22   2   0   4   0   0   0   0   0   0   0   0   0   0   0   0   0 |   n = 14
   0   0   0   0   0   0   1  10  15  33  16   1  25   0   0   2   0   0   0   0   0   0   0   0   0   0   0   0   0 |   o = 15
   0   0   0   0   0   0   1   6   7  14  13   4  20   0   0   2   0   0   0   0   0   0   0   0   0   0   0   0   0 |   p = 16
   0   0   0   0   0   0   0   0   8  14  19   1  13   0   0   3   0   0   0   0   0   0   0   0   0   0   0   0   0 |   q = 17
   0   0   0   0   0   0   0   1   6  13   9   4   7   0   0   2   0   0   0   0   0   0   0   0   0   0   0   0   0 |   r = 18
   0   0   0   0   0   0   0   0   5   9   8   1   8   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0 |   s = 19
   0   0   0   0   0   0   0   1   0   6   5   3   8   1   0   2   0   0   0   0   0   0   0   0   0   0   0   0   0 |   t = 20
   0   0   0   0   0   0   0   1   1   5   3   1   3   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   u = 21
   0   0   0   0   0   0   0   0   2   0   2   0   1   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0 |   v = 22
   0   0   0   0   0   0   0   0   1   1   0   1   4   0   0   2   0   0   0   0   0   0   0   0   0   0   0   0   0 |   w = 23
   0   0   0   0   0   0   0   0   0   0   2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   x = 24
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0 |   y = 25
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0 |   z = 26
   0   0   0   0   0   0   0   0   0   0   0   1   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0 |  aa = 27
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |  ab = 28
   0   0   0   0   0   0   0   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |  ac = 29
```

# Case 2:

## Data Pre-processing

### Filter: RemoveMisclassified

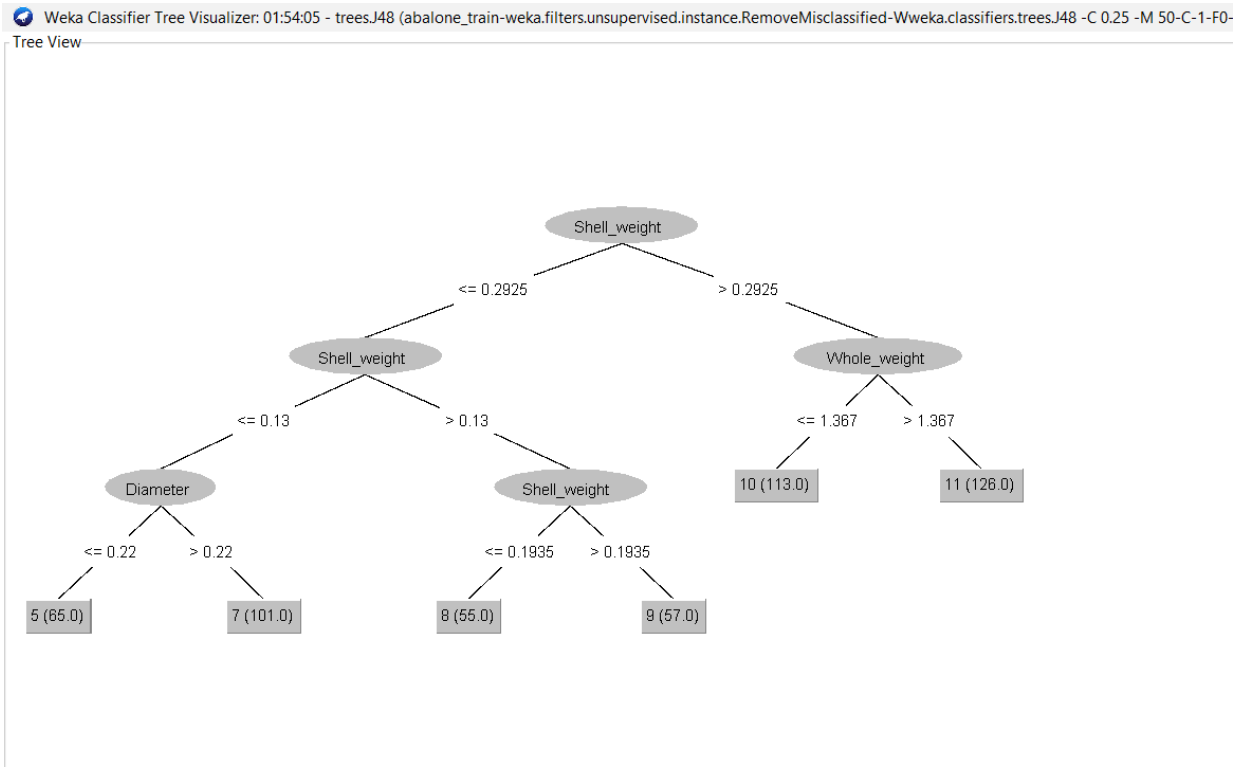


# Building the classification model

## Training:

### Algorithm: J48 Decision Tree

### Decision tree generated



## Testing:

Using the model built above

Prediction of number of rings

(taken 35 instances for screenshot)

Classifier output

| inst# | actual | predicted | error | prediction |
|---|---|---|---|---|
| 1 | 15:15 | 8:8 | + | 1 |
| 2 | 7:7 | 7:7 | | 1 |
| 3 | 9:9 | 9:9 | | 1 |
| 4 | 10:10 | 8:8 | + | 1 |
| 5 | 7:7 | 7:7 | | 1 |
| 6 | 8:8 | 7:7 | + | 1 |
| 7 | 20:20 | 10:10 | + | 1 |
| 8 | 16:16 | 9:9 | + | 1 |
| 9 | 9:9 | 8:8 | + | 1 |
| 10 | 19:19 | 10:10 | + | 1 |
| 11 | 14:14 | 9:9 | + | 1 |
| 12 | 10:10 | 8:8 | + | 1 |
| 13 | 11:11 | 8:8 | + | 1 |
| 14 | 10:10 | 9:9 | + | 1 |
| 15 | 10:10 | 8:8 | + | 1 |
| 16 | 12:12 | 9:9 | + | 1 |
| 17 | 7:7 | 7:7 | | 1 |
| 18 | 10:10 | 7:7 | + | 1 |
| 19 | 7:7 | 7:7 | | 1 |
| 20 | 9:9 | 7:7 | + | 1 |
| 21 | 11:11 | 7:7 | + | 1 |
| 22 | 10:10 | 7:7 | + | 1 |
| 23 | 12:12 | 9:9 | + | 1 |
| 24 | 9:9 | 9:9 | | 1 |
| 25 | 10:10 | 10:10 | | 1 |
| 26 | 11:11 | 10:10 | + | 1 |
| 27 | 11:11 | 9:9 | + | 1 |
| 28 | 12:12 | 9:9 | + | 1 |
| 29 | 15:15 | 10:10 | + | 1 |
| 30 | 11:11 | 9:9 | + | 1 |
| 31 | 10:10 | 10:10 | | 1 |
| 32 | 15:15 | 11:11 | + | 1 |
| 33 | 18:18 | 10:10 | + | 1 |
| 34 | 19:19 | 11:11 | + | 1 |
| 35 | 13:13 | 11:11 | + | 1 |

## Accuracy

```
=== Summary ===

Correctly Classified Instances        1150               27.5317 %
Incorrectly Classified Instances      3027               72.4683 %
Kappa statistic                          0.1673
Mean absolute error                      0.05
Root mean squared error                  0.2236
Relative absolute error                 81.5773 %
Root relative squared error            123.7933 %
Total Number of Instances             4177
```

## Confusion Matrix

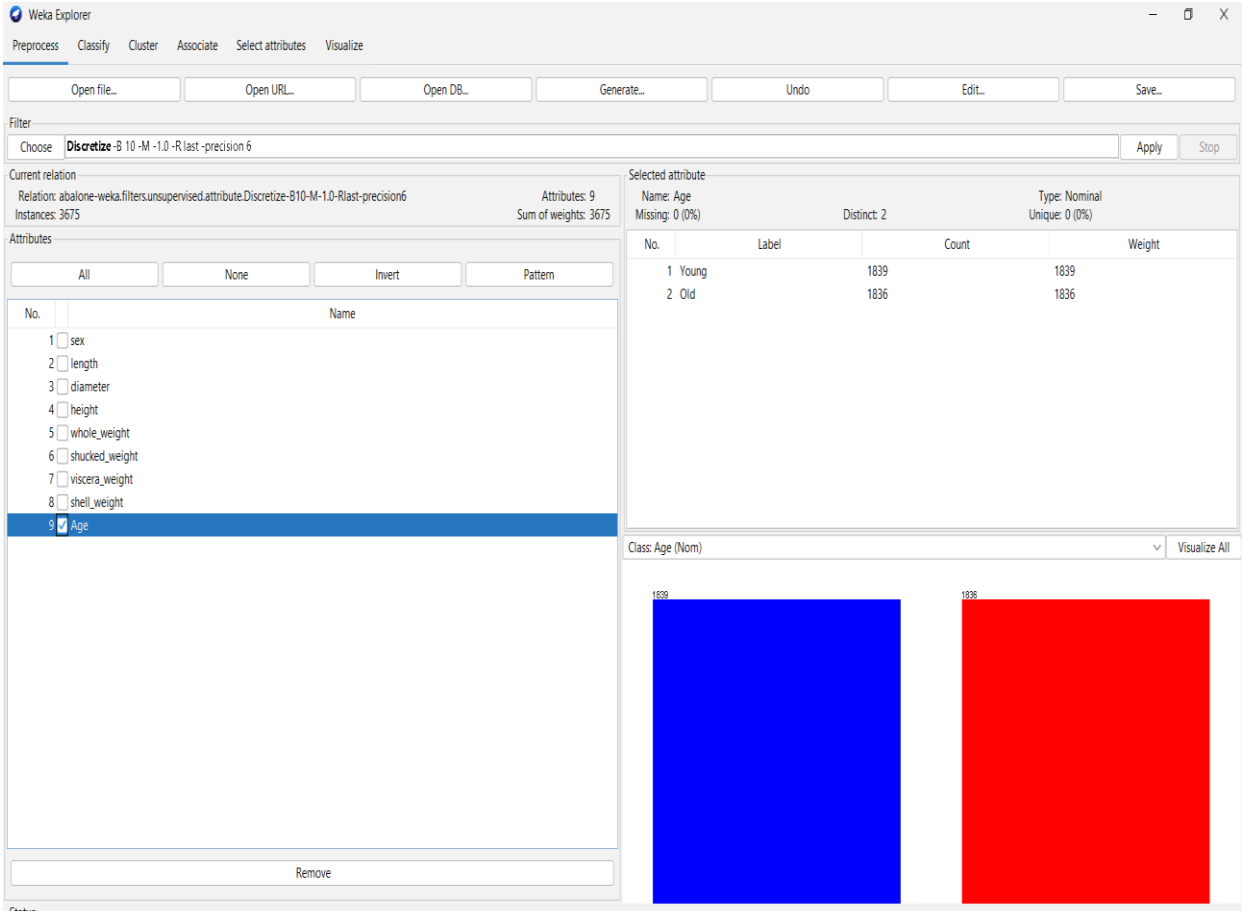
```
=== Confusion Matrix ===

   a   b   c   d   e   f   g   h   i   j   k   l   m   n   o   p   q   r   s   t   u   v   w   x   y   z  aa  ab  ac   <-- classified as
   0   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   a = 1
   0   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   b = 2
   0   0   0   0  15   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   c = 3
   0   0   0   0  53   0   4   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   d = 4
   0   0   0   0  78   0  37   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   e = 5
   0   0   0   0  47   0 186  18   5   2   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   f = 6
   0   0   0   0  17   0 260  89  21   3   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   g = 7
   0   0   0   0   6   0 144 202 179  30   7   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   h = 8
   0   0   0   0   1   0  87 143 275 131  52   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   i = 9
   0   0   0   0   0   0  57  74 207 185 111   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   j = 10
   0   0   0   0   0   0  28  49 124 136 150   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   k = 11
   0   0   0   0   0   0  16  29  73  79  70   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   l = 12
   0   0   0   0   0   0  10  18  58  69  48   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   m = 13
   0   0   0   0   0   0   3  12  40  46  25   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   n = 14
   0   0   0   0   0   0   2  12  29  37  23   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   o = 15
   0   0   0   0   0   0   2   5  14  27  19   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   p = 16
   0   0   0   0   0   0   0   1  16  22  19   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   q = 17
   0   0   0   0   0   0   1   2   7  19  13   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   r = 18
   0   0   0   0   0   0   0   1   8  13  10   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   s = 19
   0   0   0   0   0   0   0   0   3  16   7   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   t = 20
   0   0   0   0   0   0   0   1   2   5   6   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   u = 21
   0   0   0   0   0   0   0   0   3   0   3   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   v = 22
   0   0   0   0   0   0   0   0   3   5   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   w = 23
   0   0   0   0   0   0   0   0   0   0   2   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   x = 24
   0   0   0   0   0   0   0   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   y = 25
   0   0   0   0   0   0   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |   z = 26
   0   0   0   0   0   0   0   0   0   1   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |  aa = 27
   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |  ab = 28
   0   0   0   0   0   0   0   0   0   0   1   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0   0 |  ac = 29
```

# Approach 2: Predicting the age

## Data Pre-processing

### Filter: Discretize

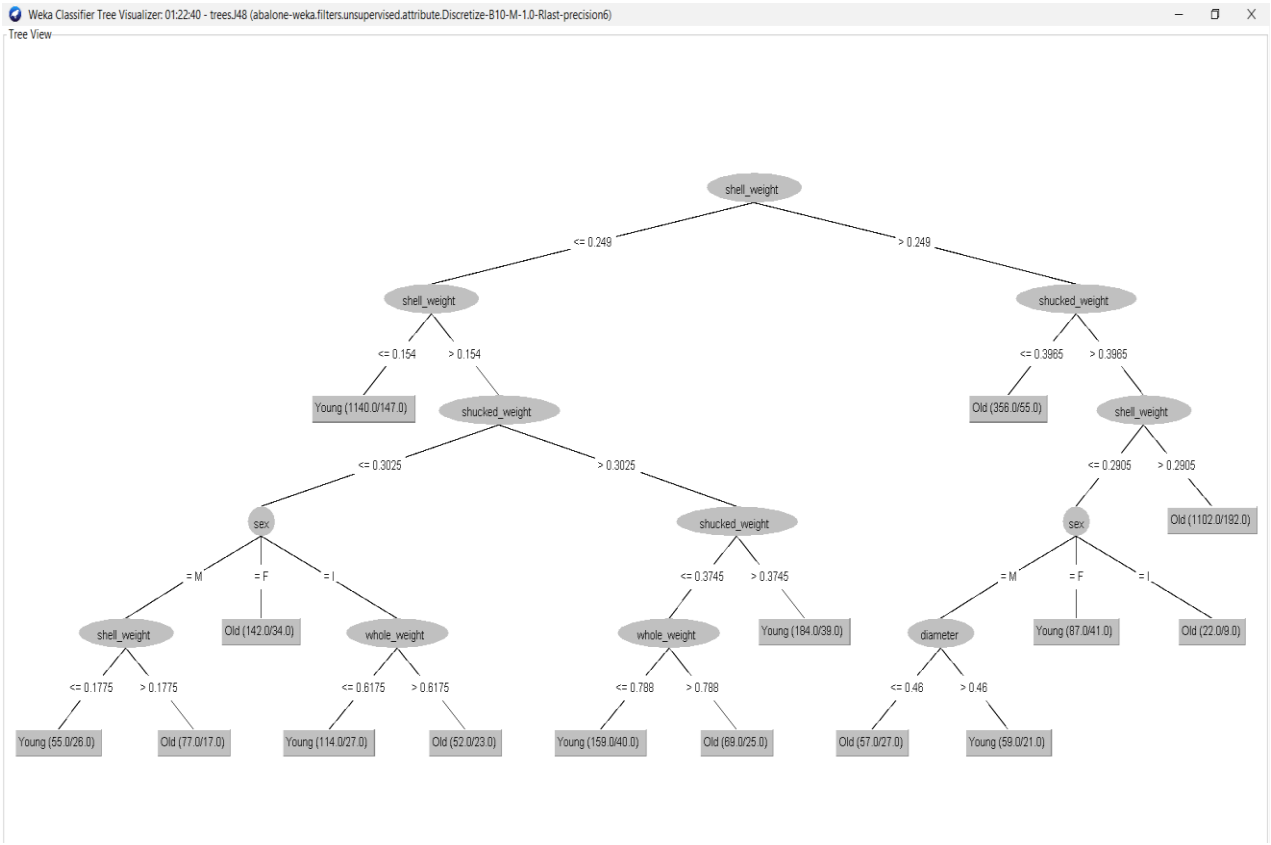


# Building the classification model

## Training:

### J48 Decision Tree

### Decision tree generated



# Testing:

Using the model built above

Prediction of age

(taken 35 instances for screenshot)

Classifier output

```
=== Predictions on user test set ===

     inst#      actual  predicted error prediction
         1    1:Young     1:Young         0.871
         2      2:Old       2:Old         0.761
         3    1:Young     1:Young         0.871
         4    1:Young       2:Old   +     0.826
         5    1:Young     1:Young         0.871
         6    1:Young       2:Old   +     0.761
         7      2:Old     1:Young   +     0.529
         8      2:Old       2:Old         0.826
         9    1:Young     1:Young         0.871
        10    1:Young     1:Young         0.644
        11      2:Old     1:Young   +     0.788
        12    1:Young     1:Young         0.763
        13      2:Old     1:Young   +     0.748
        14    1:Young     1:Young         0.644
        15    1:Young     1:Young         0.871
        16    1:Young     1:Young         0.871
        17      2:Old     1:Young   +     0.871
        18      2:Old       2:Old         0.846
        19      2:Old       2:Old         0.826
        20      2:Old       2:Old         0.761
        21    1:Young     1:Young         0.871
        22      2:Old     1:Young   +     0.529
        23      2:Old       2:Old         0.826
        24      2:Old       2:Old         0.826
        25      2:Old     1:Young   +     0.871
        26      2:Old       2:Old         0.826
        27    1:Young     1:Young         0.763
        28      2:Old     1:Young   +     0.871
        29      2:Old       2:Old         0.779
        30      2:Old       2:Old         0.826
        31    1:Young     1:Young         0.871
        32      2:Old       2:Old         0.826
        33      2:Old     1:Young   +     0.871
        34    1:Young     1:Young         0.763
        35    1:Young     1:Young         0.871
```

Accuracy + Confusion matrix

```
=== Summary ===

Correctly Classified Instances         390               78      %
Incorrectly Classified Instances       110               22      %
Kappa statistic                          0.5593
Mean absolute error                      0.3132
Root mean squared error                  0.402
Total Number of Instances              500

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure  MCC      ROC Area  PRC Area  Class
               0.805     0.246     0.774      0.805     0.789      0.560     0.832     0.808     Young
               0.754     0.195     0.786      0.754     0.770      0.560     0.832     0.783     Old
Weighted Avg.  0.780     0.221     0.780      0.780     0.780      0.560     0.832     0.796

=== Confusion Matrix ===

   a   b   <-- classified as
 206  50 |   a = Young
  60 184 |   b = Old
```