SELÇUK ÜNİVERSİTESİ
KONYA - 1975

T.C.
SELÇUK ÜNİVERSİTESİ
FEN BİLİMLERİ ENSTİTÜSÜ

UYGULAMA ÖDEVI

Bilgisayar Mühendisliği Bölümü

Computer Engineering Department

Veri Ön İşleme Teknikleri Dersi

Data Preprocessing Techniques CLASS

100% new algorithms

100% yeni algoritmalar

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DoRequest1.m

```
filename = 'bands.dat';
T = readtable(filename);
```

T = readtable(filename) creates a table by reading column oriented data from a file.

readtable determines the file format from the file extension:

- **.txt, .dat, or .csv for delimited text files**
- **.xls, .xlsb, .xlsm, .xlsx, .xltm, .xltx, or .ods for spreadsheet files**

readtable creates one variable in T for each column in the file and reads variable names from the first row of the file. By default, the variables created are double when the entire column is numeric, or cell arrays of character vectors when any element in a column is not numeric.

```
for i=9:12
```

here for the requested attribute we do the same calculations

```
    % take the attribute and covert to array
    disp(['For Attribute Number ',num2str(i)])
    disp('-----------------------------------------------------');

    att = T(:,i);

    X = table2array(att);
```

A = table2array(T) converts the table, T, to a homogeneous array, A.

```
    % Fisrt we see if we have outliers
    disp('Fisrt we see if we have outliers')
    X = sort(X);
    Q1 = ClacQuartile(X,25);
    Q3 = ClacQuartile(X,75);
    IQR = Q3 - Q1;
    LF = Q1- 1.5* IQR; % LowerFence
    UF = Q3+ 1.5* IQR; % UpperFence
    OutLiers = X(X<LF | X > UF)
```

Calculating outliers to remove them from the data is very important to avoid unreasonable results

```
    % remove outliers if exist
    if size(OutLiers,1) ~= 0
        X = X(X>=LF & X <= UF);
    end
    disp('Outliers are removed')
```

```
For Attribute Number 9
-----------------------------------------------------
Fisrt we see if we have outliers

OutLiers =

     0
   900
Outliers are removed
```

```
%Five Number Summary
    disp('Five Number Summary')
    Min = min(X)
    Q1
    Med = median(X)
    Q3
    Max = max(X)
```

Already defined statistical functions were used because of the simple implementation of them.

```
Five Number Summary

Min =

        1000


Q1 =

        1640


Med =

        1800


Q3 =

        2100


Max =

        2600
```

```
    disp('Other statistical measures')
    Mean = mean(X)
    Mode = mode(X)
    IQR
    Variance = var(X)
    StandardDeviation = std(X)
```

Again, they are easy to calculate.

```
ther statistical measures

Mean =

   1.8589e+03


Mode =

        1800


IQR =
```

```
    460
```

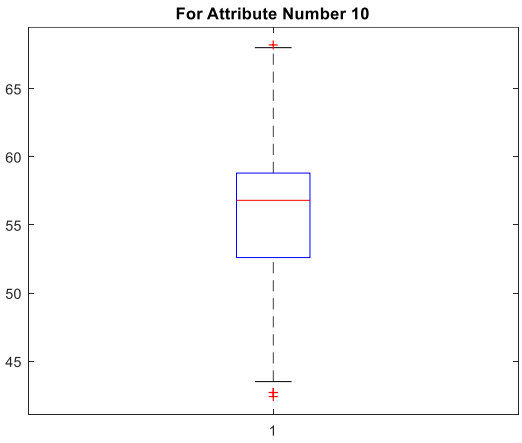
```
Variance =

    9.6142e+04
```

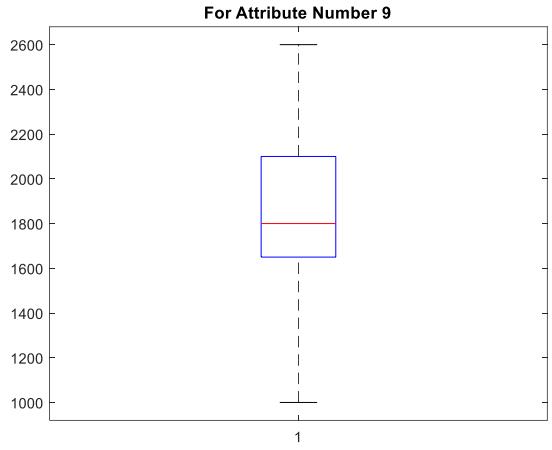
```
StandardDeviation =

   310.0670
```

```
    figure
    boxplot(X);
```

As an example we show the result of the first two attributes for boxplot

```
    title(['For Attribute Number ',num2str(i)])


end
```





DoRequest2.m

```
filename = 'bands.dat';
T = readtable(filename);

for i=9:12
    figure


    % take the attribute and covert to array
    disp(['For Attribute Number ',num2str(i)])
    disp('-------------------------------------------------------');

    att = T(:,i);
    X = table2array(att);

     % Fisrt we see if we have outliers
    disp('Fisrt we see if we have outliers')
```

```
    X = sort(X);
    Q1 = ClacQuartile(X,25);
    Q3 = ClacQuartile(X,75);
    IQR = Q3 - Q1;
    LF = Q1- 1.5* IQR; % LowerFence
    UF = Q3+ 1.5* IQR; % UpperFence
    OutLiers = X(X<LF | X > UF)

    % remove outliers if exist
    if size(OutLiers,1) ~= 0
        X = X(X>=LF & X <= UF);
    end
    disp('Outliers are removed')



    % min-max normalizasyon

    Min = min(X);
    Max = max(X);
    New_Min = 0;
    New_Max = 1;

    X_MinMax = ((X - Min )/ (Max - Min) ) * (New_Max- New_Min) +
New_Min;
Here we use the rule
    disp('min-max normalization is Done ');
    disp(X_MinMax');


For Attribute Number 9
-------------------------------------------------------
Fisrt we see if we have outliers

OutLiers =

     0
   900

Outliers are removed
min-max normalization is Done
  Columns 1 through 6

         0    0.0625    0.1250    0.1563    0.1563    0.1563


    Mean = mean(X);
    SD = std(X);

    X_ZScore = (X-Mean)/SD;
    disp('Z-Score normalization is Done ');
    disp(X_ZScore')
disp(X_ZScore')
  Columns 1 through 6

   -0.6059   -0.6059   -0.6059   -0.6059   -0.6059   -
0.6059
```

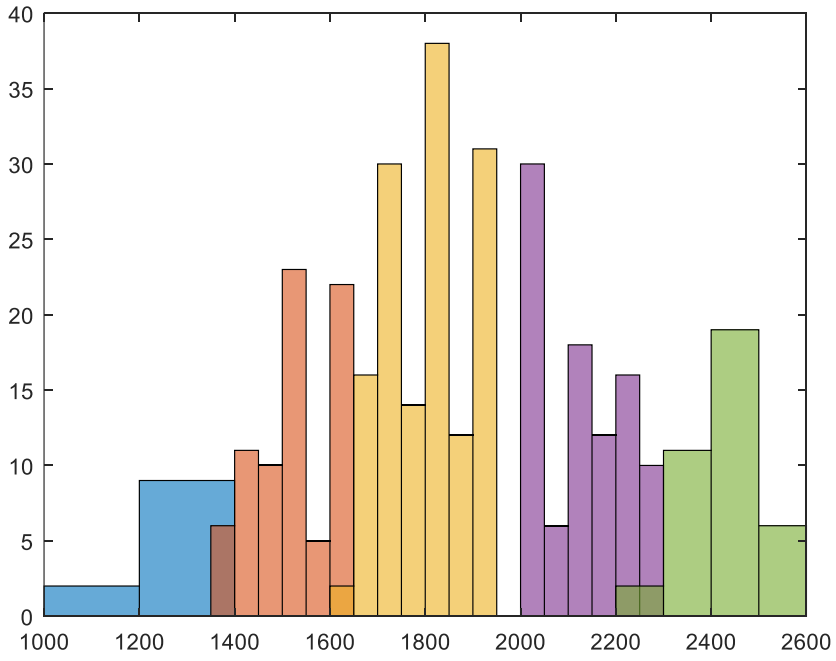
```
  Columns 7 through 12

   -0.6059   -0.6059   -0.6059   -0.6059   -0.6059   -
0.6059
```

```
    disp('Applaying n equal-width ...');
    disp('Number of Bins and width ')
    n = 5
    Width = (Max-Min)/n
```

```
Applaying n equal-width ...
Number of Bins and width

n =

     5


Width =

   320
```

```
    X = sort(X);
    for j = 1 : n
        Bin = X (X >= Min+ (j-1)*Width & X< Min+ j * Width);
        histogram(Bin)
        hold on
    end

end
```

the histogram for the first bin here



DoRequest3.m

```
filename = 'bands.dat';
T = readtable(filename);

disp('Claculating Antropy for the classification attribute ...');

att = T(:,20);
XT = table2array(att);
XT = string(XT);
 We convert to string so we can compare the class values
N = size(XT,1);
count1 = size( find(XT == 'band'),1);
prop1 = (count1)/N;

count2 = size( find(XT == 'noband'),1);
prop2 = (count2)/N;

HT = - prop1 * log2(prop1) - prop2 * log2(prop2);
Since we have two clases

disp(' Antropy for the classification attribute H(T)');
HT
```

```
Claculating Antropy for the classification attribute ...
 Antropy for the classification attribute H(T)

HT =

    0.9506
```

```
for i=9:12
    HNew_X = 0; %the antropy for the current attribute ...  All Bin
Mean Values


    % take the attribute and covert to array
    disp(['For Attribute Number ',num2str(i)])
    disp('-----------------------------------------------------');

    att = T(:,i);
    X = table2array(att);

    % Fisrt we see if we have outliers
    disp('Fisrt we see if we have outliers')
    X = sort(X);
    Q1 = ClacQuartile(X,25);
    Q3 = ClacQuartile(X,75);
    IQR = Q3 - Q1;
    LF = Q1- 1.5* IQR; % LowerFence
    UF = Q3+ 1.5* IQR; % UpperFence
    OutLiers = X(X<LF | X > UF)

    % remove outliers if exist
    if size(OutLiers,1) ~= 0
        X = X(X>=LF & X <= UF);
    end
```

```
    disp('Outliers are removed')
    For Attribute Number 9
-------------------------------------------------------
Fisrt we see if we have outliers

OutLiers =

     0
   900

Outliers are removed


    New_X = table2array(att);
    if size(OutLiers,1) ~= 0
        New_X = New_X(New_X>=LF & New_X <= UF);
    end

    disp('Applaying n equal-width ...');
    disp('Number of Bins and width ')
    n = 3

    Min = min(X);
    Max = max(X);
    Width = (Max-Min)/n

    for j = 1 : n
        Bin = X (X >= Min+ (j-1)*Width & X< Min+ j * Width);
        disp('Smoothing By Mean')
        Mean = mean (Bin);
        indexs = find(ismember( New_X,Bin));
        New_X(indexs) = Mean;


Applaying n equal-width ...
Number of Bins and width

n =

     3


Width =

  533.3333

Smoothing By Mean

        disp('Calculating the antropy for the generated categorical
value ... Bin Mean Value');

        count1 = size( find(XT(indexs) == 'band'),1);
        BinN = size(Bin,1);
        prop1 = (count1)/BinN;

        count2 = size( find(XT(indexs) == 'noband'),1);
        prop2 = (count2)/BinN;

        HBin  = - prop1 * log2(prop1) - prop2 * log2(prop2)
```

```
HBin =

    0.9885

        %Calculating the antropy for the current attribute ...  All
Bin Mean Values
        prop = BinN/N;
        HNew_X = HNew_X + prop * HBin;
    end
    disp('Calculating the antropy for the current attribute ...  All
Bin Mean Values');
    HNew_X

HNew_X =

    0.9172
    disp('Calculating the GAIN for the current attribute ...');
    Gain = HT - HNew_X

Gain =

    0.0334
end
```

---

the same operation is repeated here but for n = 4 number of bins as it is requested in the homework

```
for i=9:12
    HNew_X = 0; %the antropy for the current attribute ...  All Bin
Mean Values


    % take the attribute and covert to array
    disp(['For Attribute Number ',num2str(i)])
    disp('-----------------------------------------------------');

    att = T(:,i);
    X = table2array(att);


    % Fisrt we see if we have outliers
    disp('Fisrt we see if we have outliers')
    X = sort(X);
    Q1 = ClacQuartile(X,25);
    Q3 = ClacQuartile(X,75);
    IQR = Q3 - Q1;
    LF = Q1- 1.5* IQR; % LowerFence
    UF = Q3+ 1.5* IQR; % UpperFence
    OutLiers = X(X<LF | X > UF)

    % remove outliers if exist
    if size(OutLiers,1) ~= 0
        X = X(X>=LF & X <= UF);
```

```
    end
    disp('Outliers are removed')



    New_X = table2array(att);
    if size(OutLiers,1) ~= 0
        New_X = New_X(New_X>=LF & New_X <= UF);
    end

    disp('Applaying n equal-width ...');
    disp('Number of Bins and width ')
    n = 4

    Min = min(X);
    Max = max(X);
    Width = (Max-Min)/n

    for j = 1 : n
        Bin = X (X >= Min+ (j-1)*Width & X< Min+ j * Width);
        disp('Smoothing By Mean')
        Mean = mean (Bin);
        indexs = find(ismember( New_X,Bin));
        New_X(indexs) = Mean;

        disp('Calculating the antropy for the generated categorical
value ... Bin Mean Value');

        count1 = size( find(XT(indexs) == 'band'),1);
        BinN = size(Bin,1);
        prop1 = (count1)/BinN;

        count2 = size( find(XT(indexs) == 'noband'),1);
        prop2 = (count2)/BinN;

        HBin  = - prop1 * log2(prop1) - prop2 * log2(prop2)

        %Calculating the antropy for the current attribute ...  All
Bin Mean Values
        prop = BinN/N;
        HNew_X = HNew_X + prop * HBin;
    end
    disp('Calculating the antropy for the current attribute ...  All
Bin Mean Values');
    HNew_X
    disp('Calculating the GAIN for the current attribute ...');
    Gain = HT - HNew_X
end
```

as an example we show the results of the 12th attribute …

```
For Attribute Number 12
-------------------------------------------------------
Fisrt we see if we have outliers

OutLiers =

     6
     6
     6
     6
     6
     8
     8
     8
     8
     8
     8
     8
    10
    10
    10
    10
    10
    10
    10
    12
    12
    12
    12
    16

Outliers are removed
Applaying n equal-width ...
Number of Bins and width

n =

     4


Width =

    1.2500

Smoothing By Mean
Calculating the antropy for the generated categorical
value ... Bin Mean Value

HBin =
```

```
    0.9248

Smoothing By Mean
Calculating the antropy for the generated categorical
value ... Bin Mean Value

HBin =

    0.7793

Smoothing By Mean
Calculating the antropy for the generated categorical
value ... Bin Mean Value

HBin =

    0.9852

Smoothing By Mean
Calculating the antropy for the generated categorical
value ... Bin Mean Value

HBin =

    0.8256

Calculating the antropy for the current attribute ...
All Bin Mean Values

HNew_X =

    0.8067

Calculating the GAIN for the current attribute ...

Gain =

    0.1439
```