Contents

Upload excel file

```
close all
clc
clear all
m = readtable('C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\firstneuralnetwork\toExcel2175.csv');
%m = readtable('C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\secondneuralnetwork\toExcel2175.csv');
%m = readtable('C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\thirdneuralnetwork\toExcel2175.csv');


%m = readtable('toExcel2175.csv');
imnr = table2array(m(:,1));
filename = table2array(m(:,2));
bottles = table2array(m(:,3));
detections = table2array(m(:,4));
truepos = table2array(m(:,5));
falsepos = table2array(m(:,6));
iou = table2array(m(:,7));
mind = table2array(m(:,8));
maxd = table2array(m(:,9));
aved = table2array(m(:,10));
% Precision and Recall
precision = truepos./(falsepos+truepos); nanpre = isnan(precision); precision(nanpre) = 0;
recall = truepos./(truepos+(bottles-truepos)); nanrec = isnan(recall); recall(nanrec) = 0; recall(recall<0) = 0;

f1 = 2*((precision.*recall)./(precision+recall)); f1(isnan(f1)) = 0;
m.('Precision') = precision;
m.('Recall') = recall;
m.('F1') = f1;
```

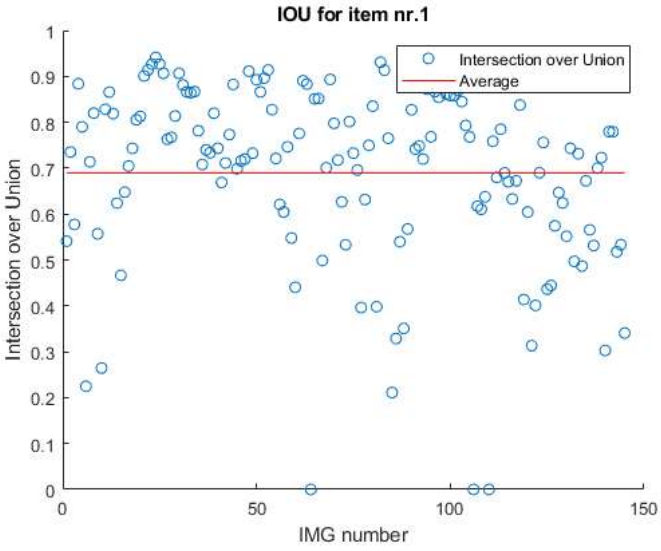
```
Warning: Column headers from the file were modified to make them valid MATLAB
identifiers before creating variable names for the table. The original column
headers are saved in the VariableDescriptions property.
Set 'VariableNamingRule' to 'preserve' to use the original column headers as
table variable names.
```

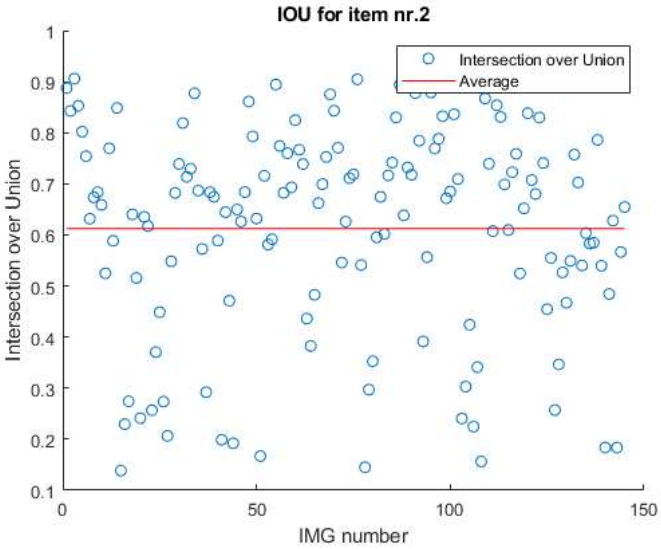
Plot products

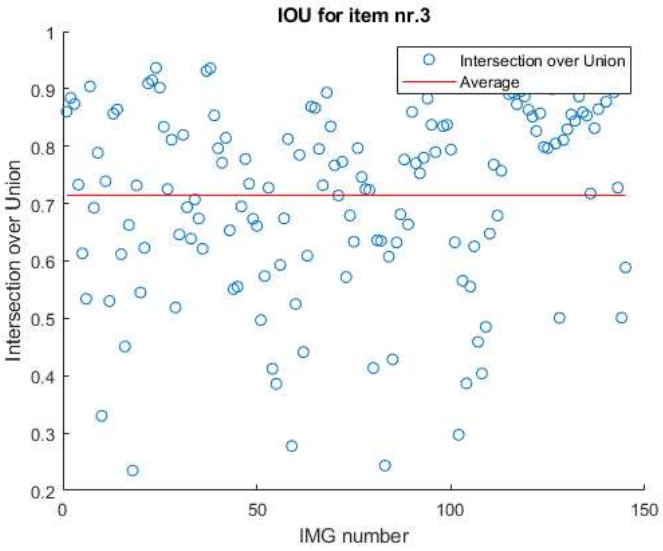
```
close all
clc
a = 1;
maxY = 0;
minY = 1;
prnames = {'1' '2' '3' '4' '5' '6' '7' '8' '9' '10' '11' '12' '13' '14' '15'};
pr  = NaN(145, length(prnames));
prf1 = NaN(145, length(prnames));
counter = 1;
numbersname = zeros(1,2175);
for i = 1:145:length(imnr)
    for j = 1:145
        y(j) = iou(j+(i-1));
        f1curr(j) = f1(j+(i-1));
        numbersname(j+(i-1)) = counter;
    end
    pr(1:145,counter) = y;
    prf1(1:145,counter) = f1curr;
    counter = counter +1;
    x = 1:1:145;
    length(y);
    averageY = mean(y);
    if averageY > maxY
        maxY = averageY;
        maxIndex = a;
    end
    if averageY < minY
        minY = averageY;
        minIndex = a;
    end
    figure(a)
    scatter(x, y)
    hold on


    plot(x,ones(length(x),1)*averageY,"-r")
    title(['IOU for item nr.' num2str(a)])
    xlabel('IMG number')
    ylabel('Intersection over Union')
    legend('Intersection over Union', 'Average')
    name = "C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\item"+ num2str(a) + ".png";
```

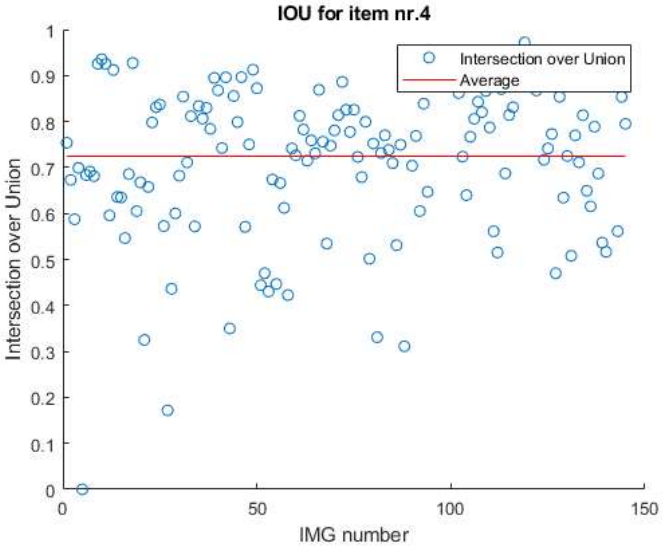
```
    %saveas(gcf,name,'png')

    a = a+1;
end
% Max averages IOU
maxY
maxIndex
```

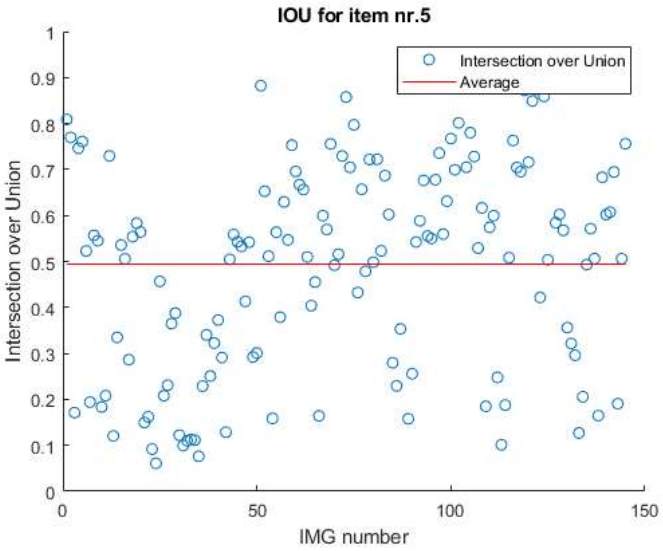
```
maxY =

      0.75476


maxIndex =

    11
```

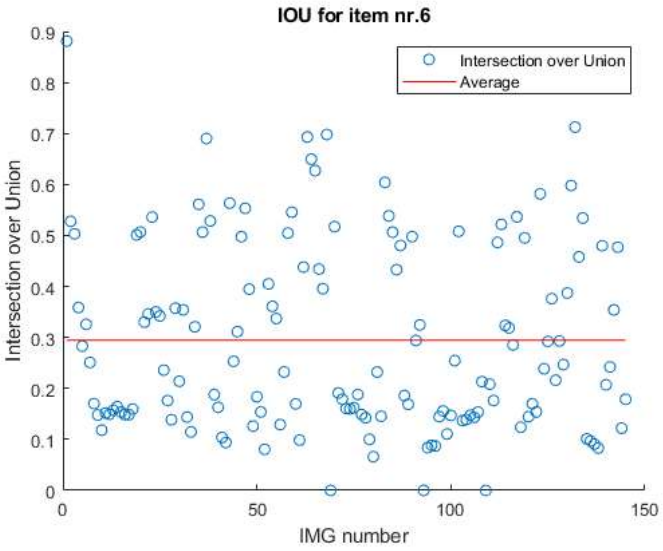


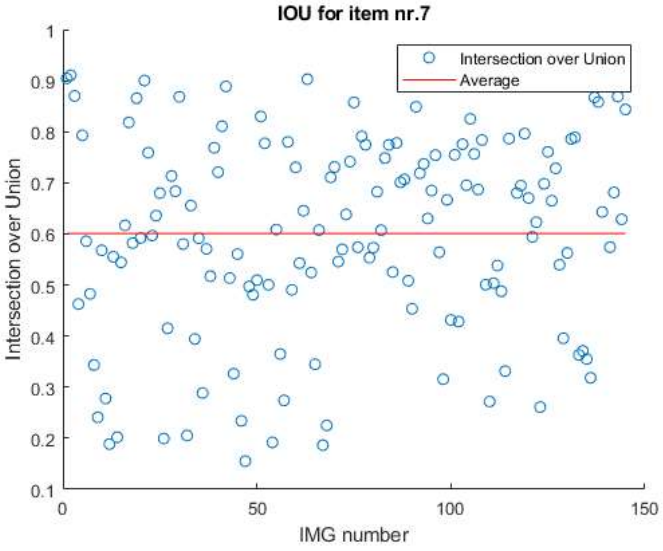


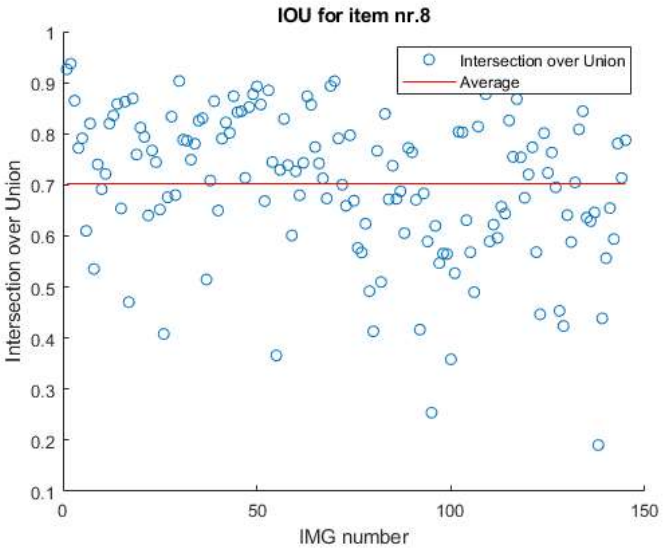

IOU for item nr.3
Intersection over Union
Average
Intersection over Union
IMG number
0
50
100
150
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

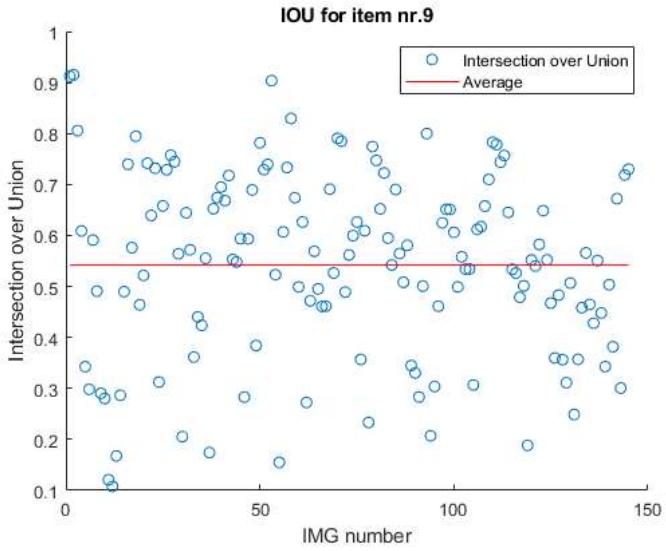

IOU for item nr.4
Intersection over Union
Average
Intersection over Union
IMG number
0
50
100
150
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

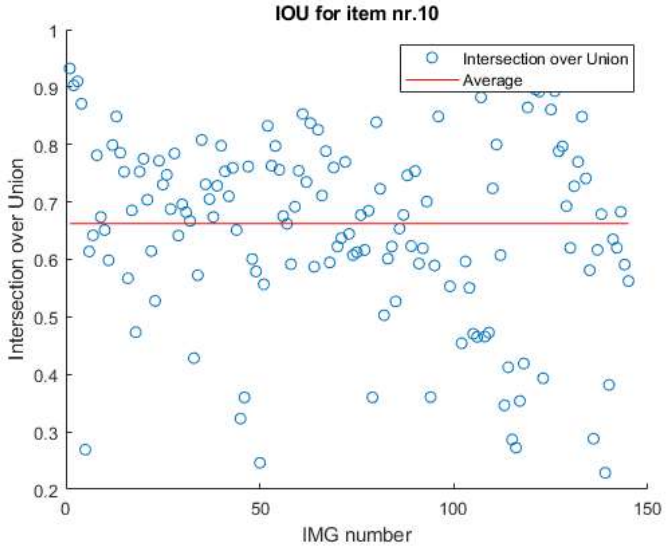

IOU for item nr.5
Intersection over Union
Average
Intersection over Union
IMG number
0
50
100
150
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1

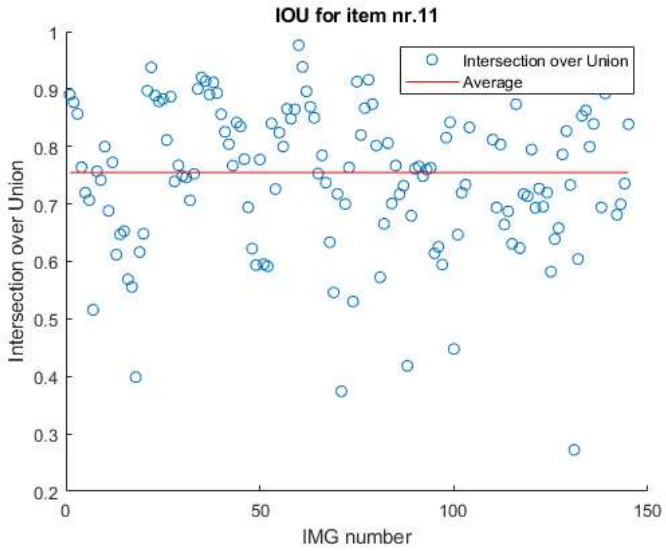

IOU for item nr.6
Intersection over Union
Average
Intersection over Union
IMG number
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
50
100
150

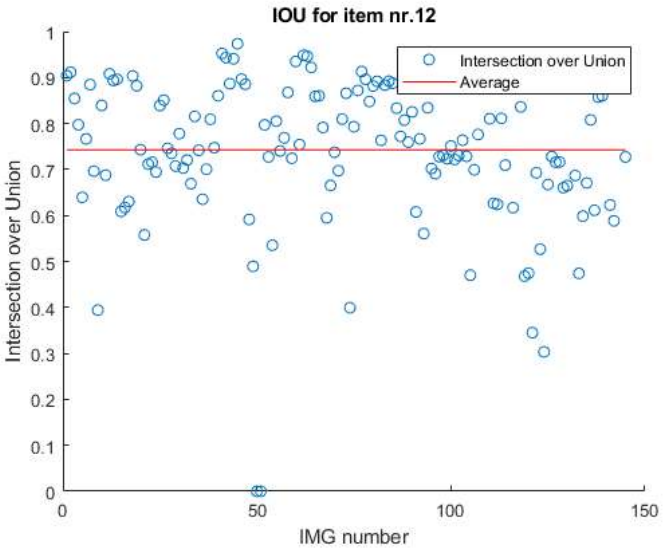

IOU for item nr.7
Intersection over Union
Average
Intersection over Union
IMG number
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150

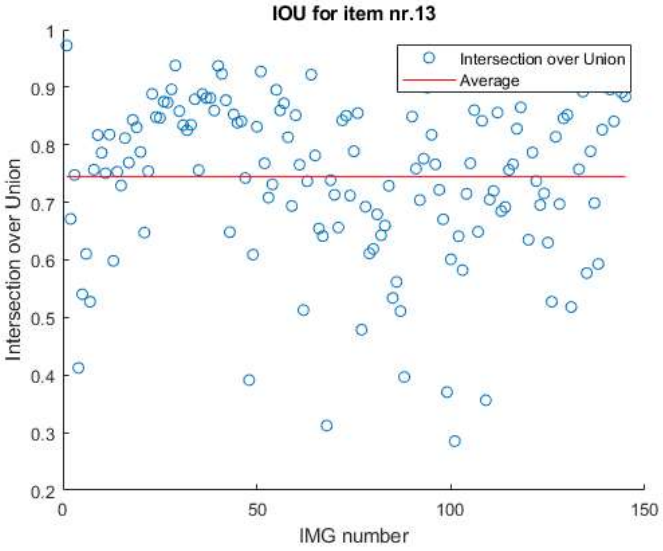

IOU for item nr.8
Intersection over Union
Average
Intersection over Union
IMG number
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150

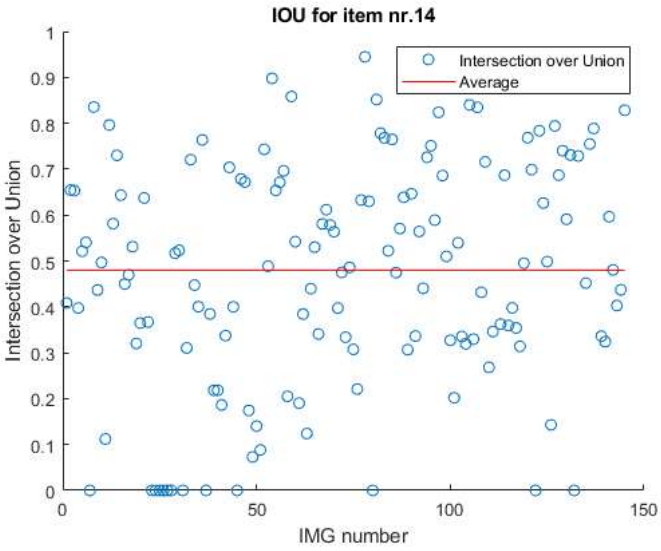

IOU for item nr.9
Intersection over Union
Average
Intersection over Union
IMG number
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
50
100
150

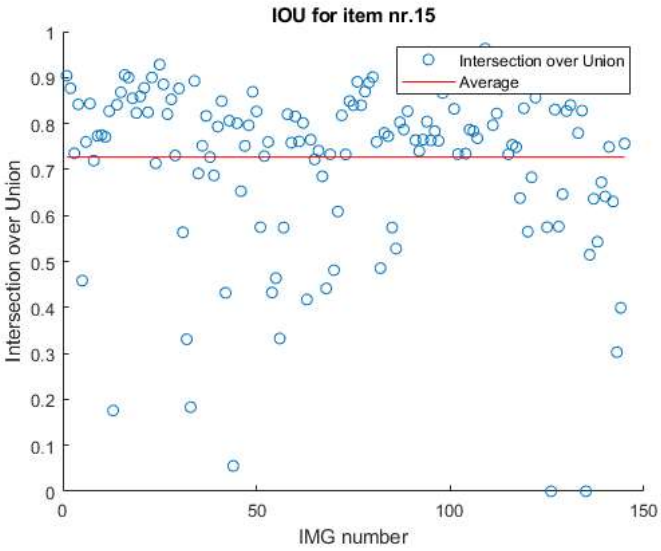

IOU for item nr.10
Intersection over Union
Average
Intersection over Union
IMG number
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
50
100
150


IOU for item nr.11
Intersection over Union
Average
Intersection over Union
IMG number
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
50
100
150


IOU for item nr.12
Intersection over Union
Average
Intersection over Union
IMG number
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150


IOU for item nr.13
Intersection over Union
Average
Intersection over Union
IMG number
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150

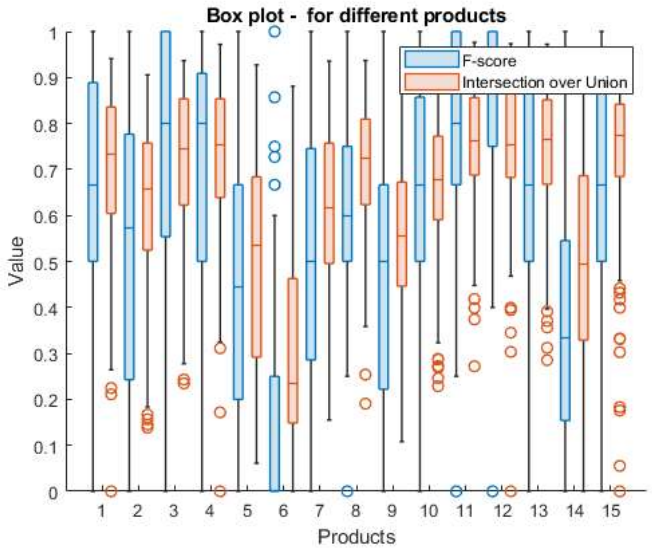




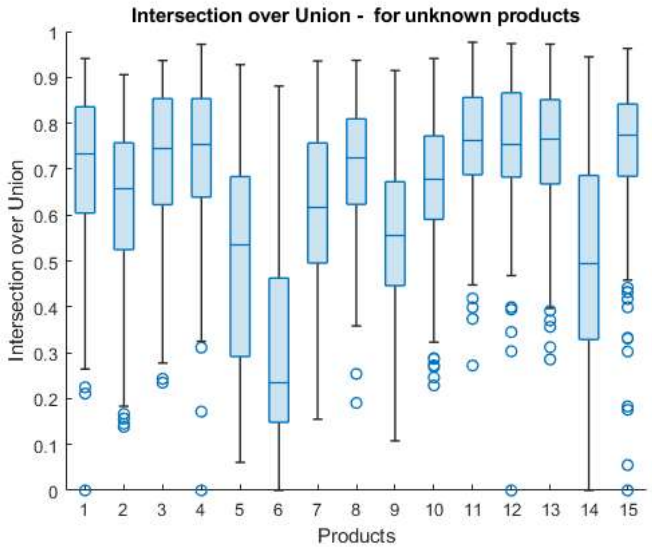
Boxplot for different products

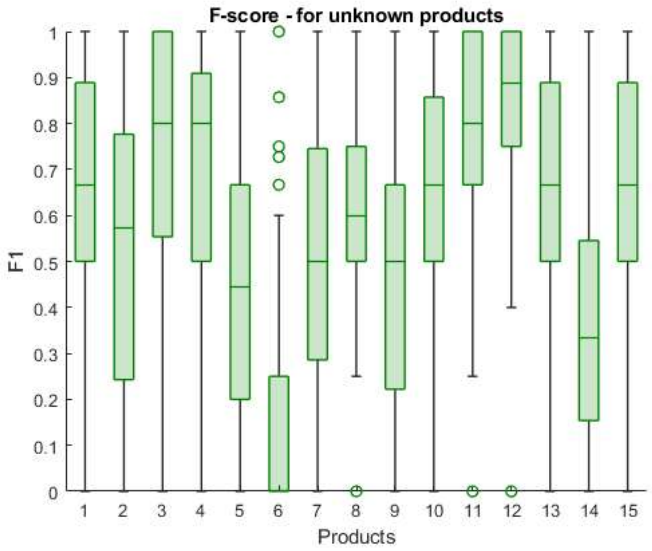
```
iouname = strings(1,2175); iouname(:) = 'IoU';
f1name = strings(1,2175); f1name(:) = 'F1';
name = [iouname,f1name]';
blend = [iou; f1];
blendnum = [numbersname';numbersname'];
```

```
figure()
boxchart(blendnum, blend, 'GroupByColor', name)
title(['Box plot -  for different products'])
xlabel('Products')
ylabel('Value')
xticks([1 2 3 4 5 6 7 8 9 10 11 12 13 14 15])
axis([0 16 0 1])
legend('F-score','Intersection over Union')
```




```
figure()
%subplot(1,2,1)
boxchart(pr)
title(['Intersection over Union -  for unknown products'])
xlabel('Products')
ylabel('Intersection over Union')
name = "C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\iouboxplotForProducts.png";

saveas(gcf,name,'png')
%subplot(1,2,2)
figure()
boxchart(prf1,'BoxFaceColor',[0 0.5 0],'MarkerColor',[0 0.5 0])
title(['F-score - for unknown products'])
xlabel('Products')
ylabel('F1')
name = "C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\f1boxplotForProducts.png";
saveas(gcf,name,'png')
```



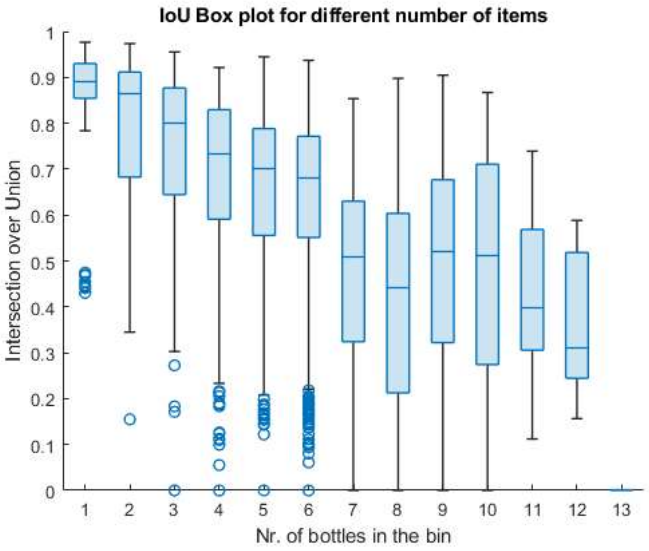


Getting values to box plot for different values of bottles in the bin.

```
names = {'one' 'two' 'three' 'four' 'five' 'six' 'seven' 'eight' 'nine' 'ten' 'eleven' 'twelve' 'thirteen'};
M  = NaN(787, length(names));
for i=1:1:length(names)
    M(1:length(iou(find(bottles == i))),i) = iou(find(bottles == i));
end
```

Boxplot

```
figure()
boxchart(M)
title(['IoU Box plot for different number of items'])
xlabel('Nr. of bottles in the bin')
ylabel('Intersection over Union')
name = "C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\boxplotBottles.png";
saveas(gcf,name,'png')
```



Splitting items

```
format short g
i1 = m(m.ImageNr <= 145, :); i2 = m((m.ImageNr <= 145*2 & m.ImageNr > 145), :);
i3 = m((m.ImageNr <= 145*3 & m.ImageNr > 145*2), :); i4 = m((m.ImageNr <= 145*4 & m.ImageNr > 145*3), :);
i5 = m(m.ImageNr <= 145*5 & m.ImageNr > 145*4, :); i6 = m(m.ImageNr <= 145*6 & m.ImageNr > 145*5, :);
i7 = m(m.ImageNr <= 145*7 & m.ImageNr > 145*6, :); i8 = m(m.ImageNr <= 145*8 & m.ImageNr > 145*7, :);
i9 = m(m.ImageNr <= 145*9 & m.ImageNr > 145*8, :); i10 = m(m.ImageNr <= 145*10 & m.ImageNr > 145*9, :);
i11 = m(m.ImageNr <= 145*11 & m.ImageNr > 145*10, :); i12 = m(m.ImageNr <= 145*12 & m.ImageNr > 145*11, :);
i13 = m(m.ImageNr <= 145*13 & m.ImageNr > 145*12, :); i14 = m(m.ImageNr <= 145*14 & m.ImageNr > 145*13, :); i15 = m(m.ImageNr <= 145*15 & m.ImageNr > 145*14,
for i=1:15
    itemprod(i) = sum(eval(['i' num2str(i) '.Bottles']));
    itemdet(i) = sum(eval(['i' num2str(i) '.Detections']));
    itemTP(i) = sum(eval(['i' num2str(i) '.TruePositive']));
    itemFP(i) = sum(eval(['i' num2str(i) '.FalsePositive']));
    itemIoU(i) = round(mean(eval(['i' num2str(i) '.IOU'])),4);
    itemPr(i) = round(mean(eval(['i' num2str(i) '.Precision'])),4);
    itemRe(i) = round(mean(eval(['i' num2str(i) '.Recall'])),4);
    itemF1(i) = round(mean(eval(['i' num2str(i) '.F1'])),4);

end
itemnr = 1:15;

avgtable = table(itemnr', itemprod',itemdet',itemTP', itemFP',itemIoU', itemPr', itemRe', itemF1');
avgtable.Properties.VariableNames = {'Item' 'All-Products' 'All-Detections' 'All-True Positive' 'All-False Positive' 'Avg-IoU' 'Avg-Precision' 'Avg-Recall' 'A
writetable(avgtable,'table.csv', 'Delimiter',',')
avrageIoU = mean(avgtable.("Avg-IoU"))
avragePrecision = mean(avgtable.("Avg-Precision"))
avrageRecall = mean(avgtable.("Avg-Recall"))
avrageF1 = mean(avgtable.("Avg-F1"))
```

```
avgtable =

  15×9 table

    Item    All-Products    All-Detections    All-True Positive    All-False Positive    Avg-IoU    Avg-Precision    Avg-Recall    Avg-F1
    ____    ____________    ______________    _________________    __________________    _______    _____________    __________    ______

      1          684              361                334                   24              0.6899        0.854          0.5479      0.6373
      2         1029              443                385                   58              0.6123       0.7729           0.434      0.5231
      3          667              412                382                   30              0.7145        0.877          0.6299      0.7087
      4          683              412                387                   24              0.7246       0.8992           0.626      0.7068
      5          892              381                291                   90               0.494       0.6533          0.3397      0.4317
      6          918              225                 93                  129              0.2944       0.2862           0.115      0.1588
      7          851              415                344                   71              0.6008       0.7613          0.4117      0.5207
      8          788              362                339                   23              0.7023       0.9182          0.4631      0.5893
      9          887              360                294                   66              0.5417       0.7176          0.3551       0.46
     10          665              370                332                   38              0.6625       0.8184          0.5293      0.6229
     11          627              407                386                   21              0.7548       0.9264          0.6628       0.75
     12          574              453                431                   20              0.7428        0.938          0.7891      0.8349
     13          618              329                320                    9               0.745       0.9552          0.5786      0.6891
     14         1031              312                230                   70              0.4798       0.6666          0.2746      0.3609
     15          616              330                310                   18              0.7272        0.904          0.5607      0.6602


avrageIoU =

      0.63244


avragePrecision =

      0.79655


avrageRecall =

      0.48783
```

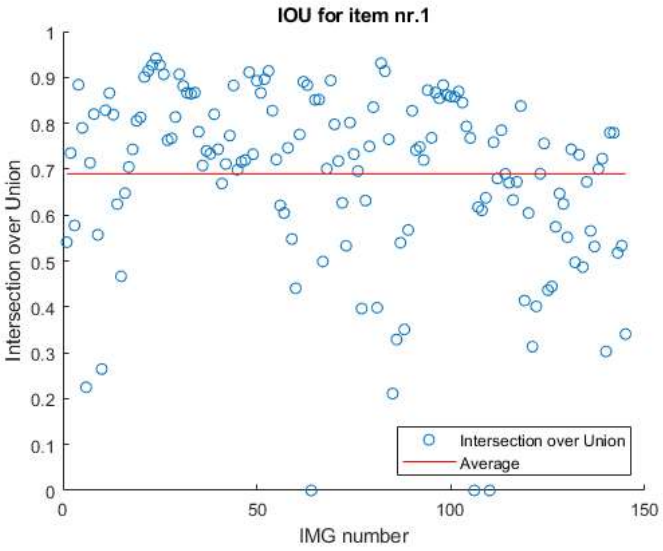
```
avrageF1 =

      0.57696
```

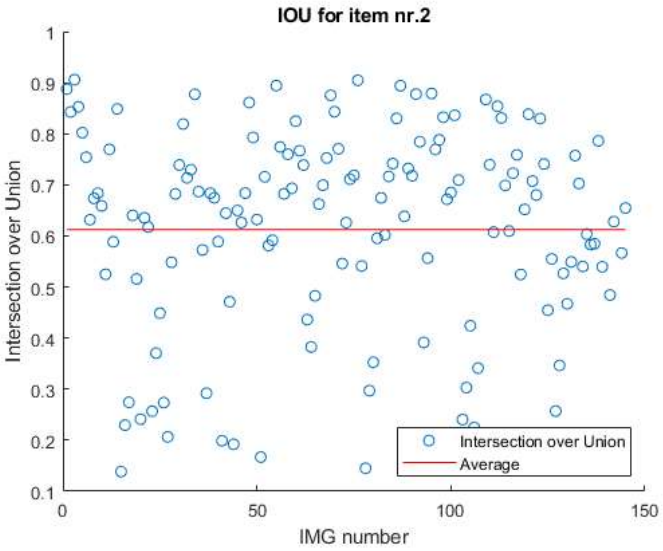
no zero detections

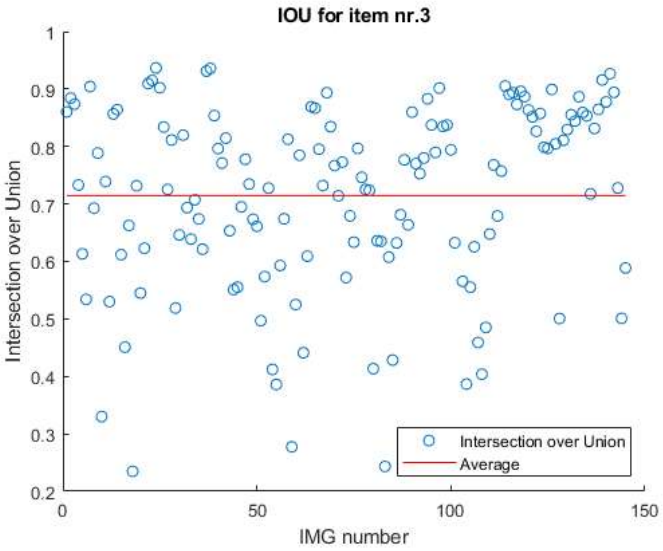
```
close all
zerodetect = find(m.("Detections")>0);
newtable = m(zerodetect,:);
```

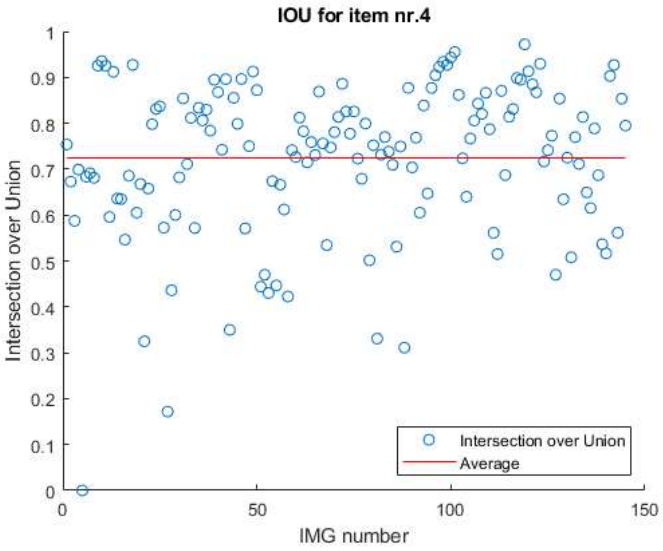
```
format short g
i1 = newtable(newtable.ImageNr <= 145, :); i2 = newtable((newtable.ImageNr <= 145*2 & newtable.ImageNr > 145), :);
i3 = newtable((newtable.ImageNr <= 145*3 & newtable.ImageNr > 145*2), :); i4 = newtable((newtable.ImageNr <= 145*4 & newtable.ImageNr > 145*3), :);
i5 = newtable(newtable.ImageNr <= 145*5 & newtable.ImageNr > 145*4, :); i6 = newtable(newtable.ImageNr <= 145*6 & newtable.ImageNr > 145*5, :);
i7 = newtable(newtable.ImageNr <= 145*7 & newtable.ImageNr > 145*6, :); i8 = newtable(newtable.ImageNr <= 145*8 & newtable.ImageNr > 145*7, :);
i9 = newtable(newtable.ImageNr <= 145*9 & newtable.ImageNr > 145*8, :); i10 = newtable(newtable.ImageNr <= 145*10 & newtable.ImageNr > 145*9, :);
i11 = newtable(newtable.ImageNr <= 145*11 & newtable.ImageNr > 145*10, :); i12 = newtable(newtable.ImageNr <= 145*12 & newtable.ImageNr > 145*11, :);
i13 = newtable(newtable.ImageNr <= 145*13 & newtable.ImageNr > 145*12, :); i14 = newtable(newtable.ImageNr <= 145*14 & newtable.ImageNr > 145*13, :); i15 = new
numbersname1 = []
for i=1:15
    itemprod(i) = sum(eval(['i' num2str(i) '.Bottles']));
    itemdet(i) = sum(eval(['i' num2str(i) '.Detections']));
    itemTP(i) = sum(eval(['i' num2str(i) '.TruePositive']));
    itemFP(i) = sum(eval(['i' num2str(i) '.FalsePositive']));
    itemIoU(i) = sum(mean(eval(['i' num2str(i) '.IOU'])),4);
    itemPr(i) = round(mean(eval(['i' num2str(i) '.Precision'])),4);
    itemRe(i) = round(mean(eval(['i' num2str(i) '.Recall'])),4);
    itemF1(i) = round(mean(eval(['i' num2str(i) '.F1'])),4);
    value = ones(length(eval(['i' num2str(i) '.ImageNr'])),1).*i';
    test = [numbersname1 ; value];
    numbersname1 = test;
    figure(i)
    scatter(1:1:length((eval(['i' num2str(i) '.IOU']))), (eval(['i' num2str(i) '.IOU'])))
    hold on
    plot(1:1:length((eval(['i' num2str(i) '.IOU']))),ones(length(1:1:length((eval(['i' num2str(i) '.IOU'])))),1)*(mean(eval(['i' num2str(i) '.IOU']))),"-r")
    title(['IOU for item nr.' num2str(i)])
    xlabel('IMG number')
    ylabel('Intersection over Union')
    legend('Intersection over Union', 'Average', 'Location','southeast')
    name = "C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\item"+ num2str(i) + ".png";
    saveas(gcf,name,'png')
end
itemnr = 1:15;
```

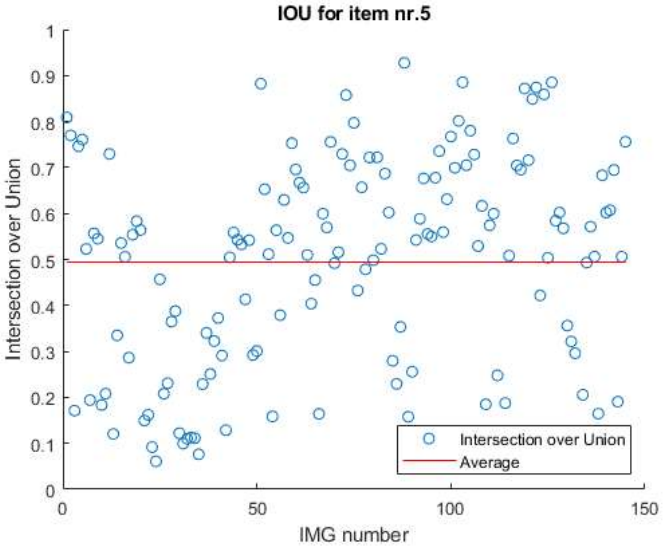
```
numbersname1 =

     []
```

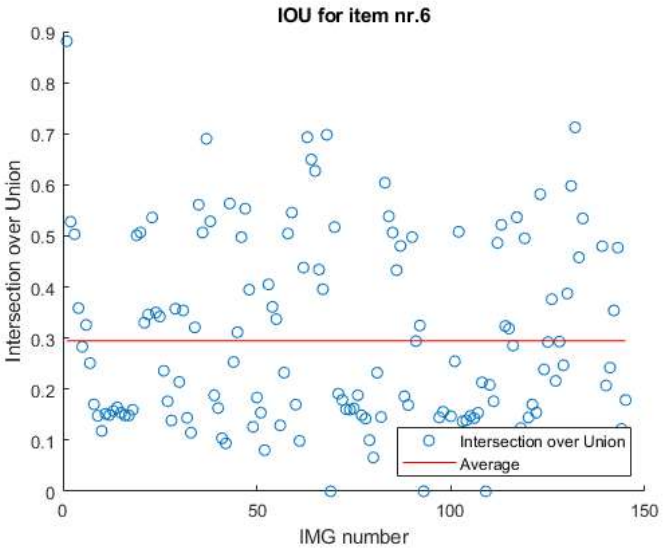

IOU for item nr.1
Intersection over Union
IMG number
Intersection over Union
Average

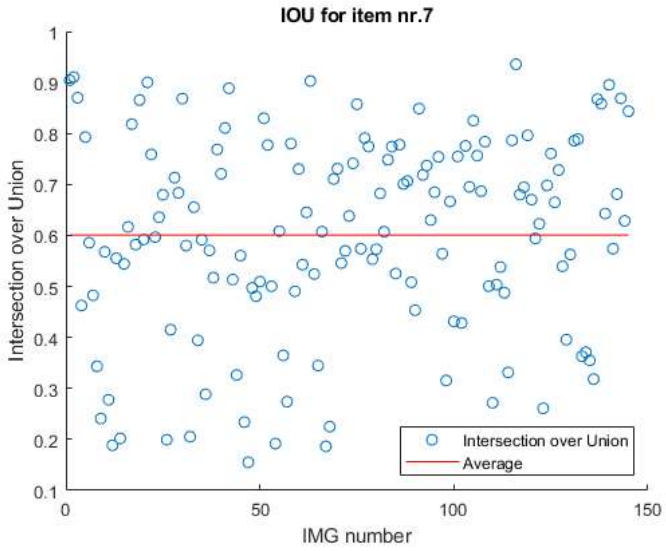

IOU for item nr.2
Intersection over Union
IMG number
Intersection over Union
Average

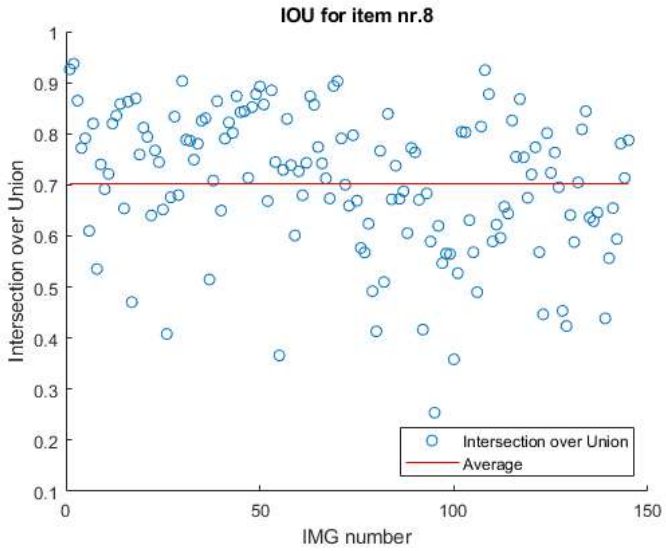

IOU for item nr.3
Intersection over Union
IMG number
Intersection over Union
Average

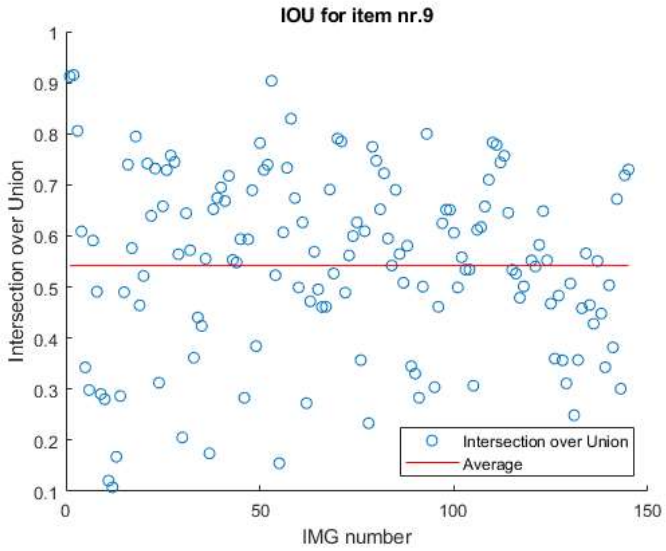

IOU for item nr.4
Intersection over Union
IMG number
Intersection over Union
Average
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150

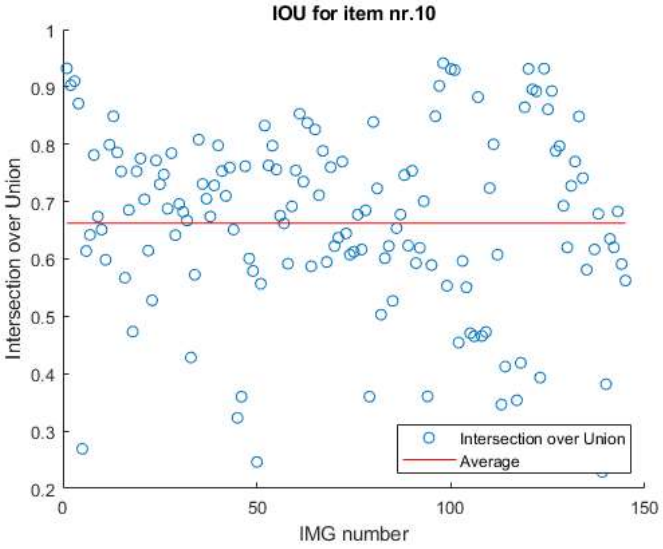

IOU for item nr.5
Intersection over Union
IMG number
Intersection over Union
Average
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
50
100
150

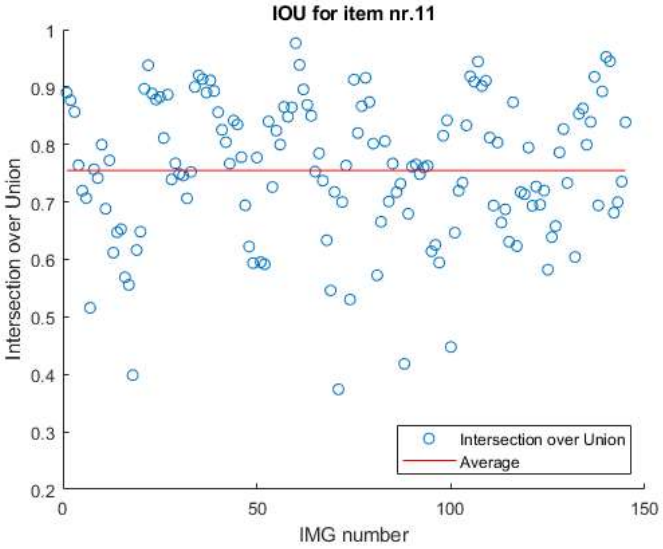

IOU for item nr.6
Intersection over Union
IMG number
Intersection over Union
Average
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
50
100
150

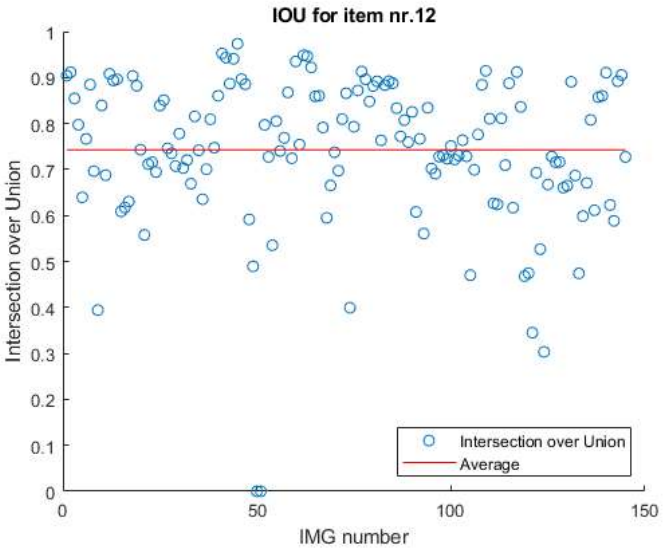

IOU for item nr.7
Intersection over Union
IMG number
Intersection over Union
Average

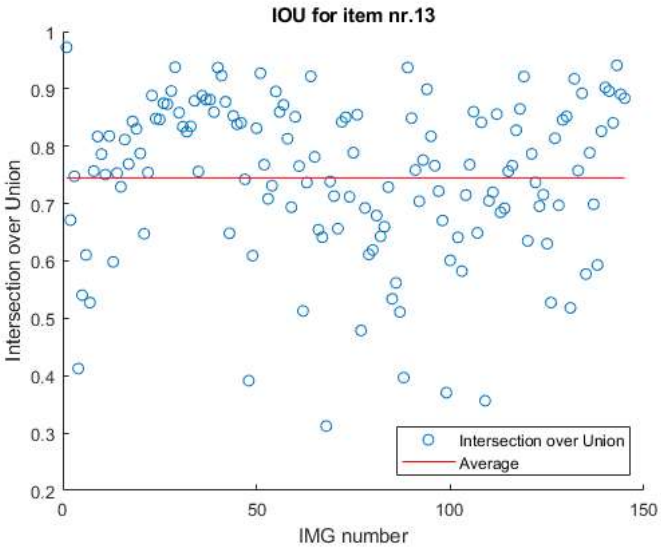

IOU for item nr.8
Intersection over Union
IMG number
Intersection over Union
Average

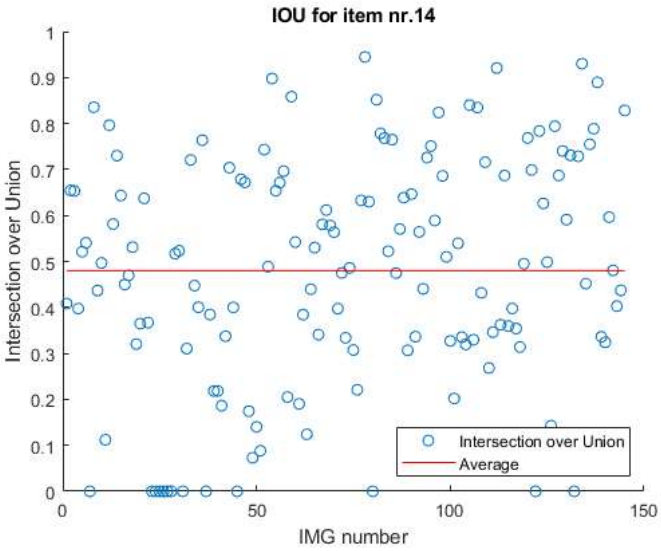

IOU for item nr.9
Intersection over Union
IMG number
Intersection over Union
Average

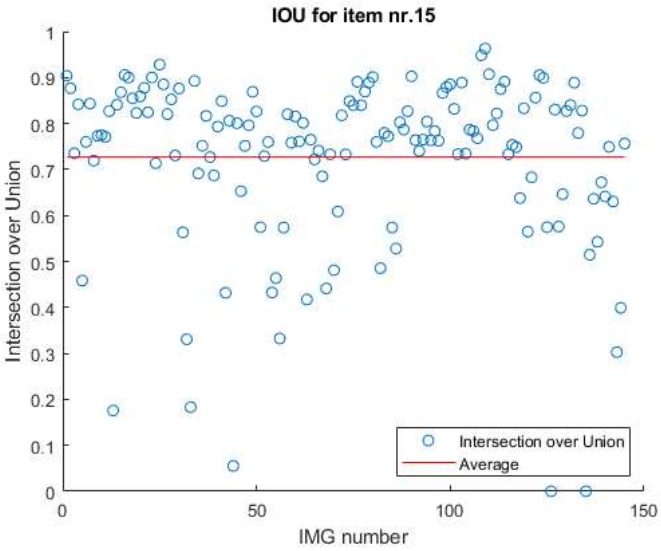

IOU for item nr.10
Intersection over Union
IMG number
Intersection over Union
Average
0
50
100
150
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


IOU for item nr.11
Intersection over Union
IMG number
Intersection over Union
Average
0
50
100
150
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


IOU for item nr.12
Intersection over Union
IMG number
Intersection over Union
Average
0
50
100
150
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1








```
avgtablev2 = table(itemnr', itemprod',itemdet',itemTP', itemFP',itemIoU', itemPr', itemRe', itemF1');
avgtablev2.Properties.VariableNames = {'Item' 'All-Products' 'All-Detections' 'All-True Positive' 'All-False Positive' 'Avg-IoU' 'Avg-Precision' 'Avg-Recall'
writetable(avgtablev2,'table.csv', 'Delimiter',',')
avrageIoU = mean(avgtablev2.("Avg-IoU"))
avragePrecision = mean(avgtablev2.("Avg-Precision"))
avrageRecall = mean(avgtablev2.("Avg-Recall"))
avrageF1 = mean(avgtablev2.("Avg-F1"))
allp = sum(avgtablev2.("All-Products"))
alld = sum(avgtablev2.("All-Detections"))
alltp = sum(avgtablev2.("All-True Positive"))
allfp = sum(avgtablev2.("All-False Positive"))
```

avgtablev2 =

15×9 table

Item	All-Products	All-Detections	All-True Positive	All-False Positive	Avg-IoU	Avg-Precision	Avg-Recall	Avg-F1
1	684	361	334	24	0.68992	0.854	0.5479	0.6373
2	1029	443	385	58	0.61233	0.7729	0.434	0.5231
3	667	412	382	30	0.71451	0.877	0.6299	0.7087
4	683	412	387	24	0.72463	0.8992	0.626	0.7068
5	892	381	291	90	0.49399	0.6533	0.3397	0.4317
6	918	225	93	129	0.29444	0.2862	0.115	0.1588
7	851	415	344	71	0.60083	0.7613	0.4117	0.5207
8	788	362	339	23	0.7023	0.9182	0.4631	0.5893
9	887	360	294	66	0.5417	0.7176	0.3551	0.46
10	665	370	332	38	0.66249	0.8184	0.5293	0.6229
11	627	407	386	21	0.75476	0.9264	0.6628	0.75
12	574	453	431	20	0.74284	0.938	0.7891	0.8349
13	618	329	320	9	0.74502	0.9552	0.5786	0.6891
14	1031	312	230	70	0.4798	0.6666	0.2746	0.3609
15	616	330	310	18	0.72721	0.904	0.5607	0.6602

avrageIoU =

0.63245

avragePrecision =

0.79655

avrageRecall =

0.48783

avrageF1 =

0.57696

allp =

11530

alld =

5572

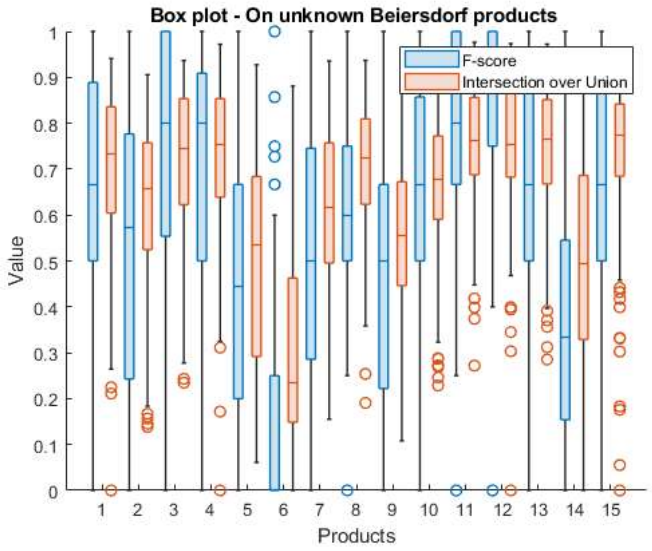
alltp =

4858

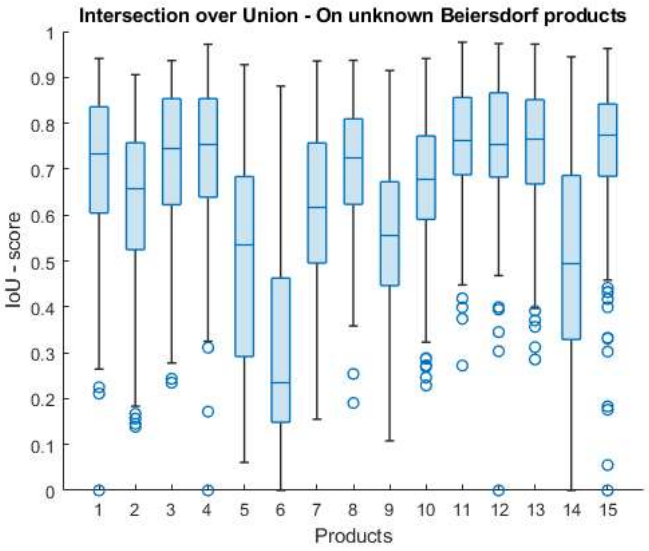
allfp =

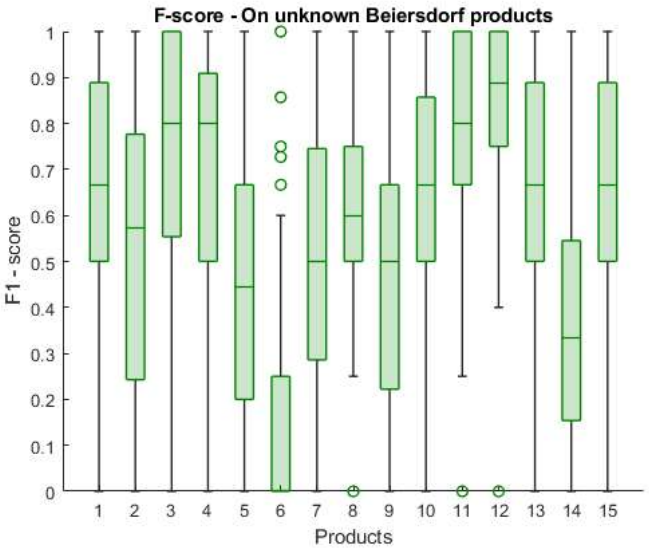
691

```
iouname = strings(1,length(newtable.("IOU"))); iouname(:) = 'IoU';
f1name = strings(1,length(newtable.("F1"))); f1name(:) = 'F1';
name = [iouname,f1name]';
blend = [newtable.IOU; newtable.F1];

blendnum = [numbersname1;numbersname1];
figure()
boxchart(blendnum, blend, 'GroupByColor', name)
title(['Box plot - On unknown Beiersdorf products '])
xlabel('Products')
ylabel('Value')
xticks([1 2 3 4 5 6 7 8 9 10 11 12 13 14 15])
axis([0 16 0 1])
legend('F-score','Intersection over Union')
```



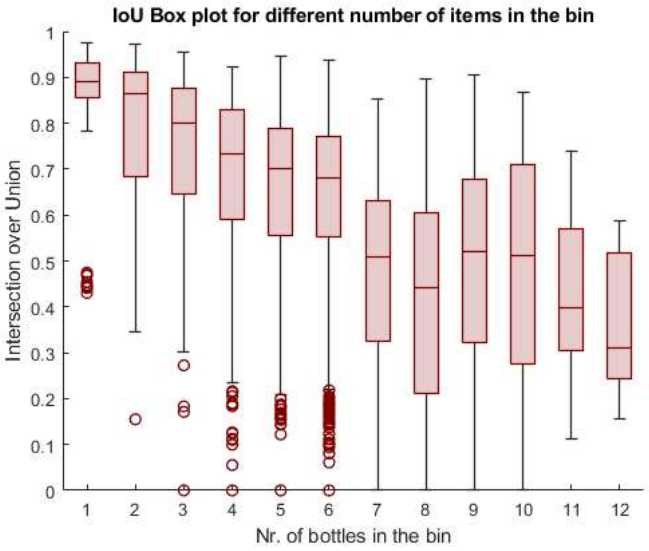

```
figure()
boxchart(numbersname1, newtable.IOU)
title(['Intersection over Union - On unknown Beiersdorf products'])
xlabel('Products')
ylabel('IoU - score')
xticks([1 2 3 4 5 6 7 8 9 10 11 12 13 14 15])
axis([0 16 0 1])
%legend('F-score','Intersection over Union')

figure()
boxchart(numbersname1, newtable.F1, 'BoxFaceColor',[0 0.5 0],'MarkerColor',[0 0.5 0])
title(['F-score - On unknown Beiersdorf products'])
xlabel('Products')
ylabel('F1 - score')
xticks([1 2 3 4 5 6 7 8 9 10 11 12 13 14 15])
axis([0 16 0 1])

%legend('F-score','Intersection over Union')
```





Boxplot

```
names = {'one' 'two' 'three' 'four' 'five' 'six' 'seven' 'eight' 'nine' 'ten' 'eleven' 'twelve'};
MM  = NaN(787, length(names));
for i=1:1:length(names)
    MM(1:length(newtable.IOU(find(newtable.Bottles == i))),i) = newtable.IOU(find(newtable.Bottles == i));
end

figure()
boxchart(MM, 'BoxFaceColor',[0.5 0 0],'MarkerColor',[0.5 0 0])
title(['IoU Box plot for different number of items in the bin'])
xlabel('Nr. of bottles in the bin')
ylabel('Intersection over Union')
name = "C:\Users\Aron Gauti\Dropbox\HR\Meistaraverkefni\Results\boxplotBottles.png";
saveas(gcf,name,'png')
```



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