Analyzing concrete crack image data

The goal of this assessment is to analyze the concrete crack image data from the previous video. You will use the `crackData` table, which is provided in your course files in the file `CrackData.mat`.

In each concrete crack image, a single pixel has the dimensions of **0.5 mm** by **0.5 mm**.

Use the MATLAB script below to perform the following tasks:

1. Convert the `MaxWidth` variable in the `cackData` table from number-of-pixels to millimeters.
2. Convert the `Area` variable in the `cackData` table from number-of-pixels to squared millimeters.
3. Calculate the mean `MaxWidth` in millimeters for all images with a `Risk` of `Mild`. Save this value in the variable `mildMeanWidth`.
4. Calculate the mean `MaxWidth` in millimeters for all images with a `Risk` of `Severe`. Save this value in the variable `severeMeanWidth`.

```
load CrackData.mat
crackData
```

`crackData = 200×4 table`

	NumRegions	Area	MaxWidth	fileName
1	2	2461	17.8885	"00001.jpg"
2	2	2125	17.8885	"00002.jpg"
3	2	2417	16	"00003.jpg"
4	1	2438	14.1421	"00004.jpg"
5	4	1479	18.4391	"00005.jpg"
6	1	2356	14	"00006.jpg"
7	1	2926	18.9737	"00007.jpg"
8	1	2573	15.2315	"00008.jpg"
9	2	1861	14.1421	"00009.jpg"
10	2	2663	17.0880	"00010.jpg"
11	1	3149	23.4094	"00011.jpg"
12	1	2722	18.9737	"00012.jpg"
13	2	1221	14.5602	"00013.jpg"
14	1	3050	25.0599	"00014.jpg"
15	1	2346	14	"00015.jpg"
16	1	2740	14.5602	"00016.jpg"
17	1	2016	14	"00017.jpg"
18	2	2236	13.4164	"00018.jpg"
19	2	1169	10	"00019.jpg"

	NumRegions	Area	MaxWidth	fileName
20	2	1250	8	"00020.jpg"
21	3	1290	10.1980	"00021.jpg"
22	2	1272	10	"00022.jpg"
23	2	2562	16.1245	"00023.jpg"
24	2	2673	22.8035	"00024.jpg"
25	4	1941	16.4924	"00025.jpg"
26	1	2772	21.5407	"00026.jpg"
27	1	2379	20.5913	"00027.jpg"
28	2	2308	14.5602	"00028.jpg"
29	2	1863	13.4164	"00029.jpg"
30	1	2409	12.8062	"00030.jpg"
31	2	1623	12.6491	"00031.jpg"
32	2	1835	10	"00032.jpg"
33	2	1617	10	"00033.jpg"
34	3	608	10	"00034.jpg"
35	2	1388	16.4924	"00035.jpg"
36	3	1867	14.4222	"00036.jpg"
37	2	2126	13.4164	"00037.jpg"
38	2	1652	10.1980	"00038.jpg"
39	3	1303	10	"00039.jpg"
40	2	1427	12	"00040.jpg"
41	6	1745	11.3137	"00041.jpg"
42	3	2433	20.8806	"00042.jpg"
43	3	2445	22	"00043.jpg"
44	4	1871	16.1245	"00044.jpg"
45	2	1436	12	"00045.jpg"
46	4	1281	11.6619	"00046.jpg"
47	4	1340	12.6491	"00047.jpg"
48	2	1723	12	"00048.jpg"
49	2	2393	22.3607	"00049.jpg"
50	1	2633	22	"00050.jpg"
51	6	1571	14.1421	"00051.jpg"
52	1	2760	18.4391	"00052.jpg"

	NumRegions	Area	MaxWidth	fileName
53	2	2677	20	"00053.jpg"
54	1	3137	21.2603	"00054.jpg"
55	5	5441	81.2158	"00055.jpg"
56	2	7842	55.1725	"00056.jpg"
57	1	6524	39.3954	"00057.jpg"
58	3	5419	38.4708	"00058.jpg"
59	2	3968	23.3238	"00059.jpg"
60	2	4107	26	"00060.jpg"
61	2	4240	26.3059	"00061.jpg"
62	3	9089	50.6360	"00062.jpg"
63	2	5887	47.4131	"00063.jpg"
64	1	4673	22	"00064.jpg"
65	1	5700	34.2345	"00065.jpg"
66	1	4049	22.8035	"00066.jpg"
67	1	4589	24	"00067.jpg"
68	1	7381	42.0476	"00068.jpg"
69	1	5008	40.2492	"00069.jpg"
70	1	4638	27.2029	"00070.jpg"
71	1	4121	22	"00071.jpg"
72	2	4258	23.4094	"00072.jpg"
73	1	4179	22.0907	"00073.jpg"
74	1	4850	22	"00074.jpg"
75	1	4387	24	"00075.jpg"
76	1	4175	24	"00076.jpg"
77	1	4776	22	"00077.jpg"
78	3	5174	40	"00078.jpg"
79	3	4645	27.7849	"00079.jpg"
80	1	5504	29.5296	"00080.jpg"
81	1	5912	48.1664	"00081.jpg"
82	1	6657	43.8634	"00082.jpg"
83	2	3189	22.8035	"00083.jpg"
84	2	4079	31.6228	"00084.jpg"
85	1	5775	31.2410	"00085.jpg"

	NumRegions	Area	MaxWidth	fileName
86	7	4485	28.6356	"00086.jpg"
87	2	4707	29.7321	"00087.jpg"
88	5	3374	29.1204	"00088.jpg"
89	4	6974	32.5576	"00089.jpg"
90	3	2150	34.4093	"00090.jpg"
91	1	2182	15.6205	"00091.jpg"
92	3	4379	29.7321	"00092.jpg"
93	3	4591	24.0832	"00093.jpg"
94	1	5922	25.0599	"00094.jpg"
95	1	5005	28.2843	"00095.jpg"
96	1	7444	53.8516	"00096.jpg"
97	2	7257	52.4976	"00097.jpg"
98	1	5516	28.2843	"00098.jpg"
99	1	5143	26	"00099.jpg"
100	4	4800	26.6833	"00100.jpg"

⋮

```
cutoffArea = 4000;
crackData.Risk = discretize(crackData.Area,[0,cutoffArea,inf], ...
    "categorical",["Mild","Severe"]);
```

```
%As a single pixel has height of 0.5 mm and width of 0.5 mm
crackData.MaxWidth = crackData.MaxWidth * 0.5;
%Area of pixel is 0.5*0.5
crackData.Area = crackData.Area * 0.25;
```

```
mean = groupsummary(crackData,"Risk","median","MaxWidth")
```

mean = 2×3 table

	Risk	GroupCount	median_MaxWidth
1	Mild	69	8.0623
2	Severe	131	17.4642

```
mildMeanWidth = mean(1,"median_MaxWidth");
severeMeanWidth = mean(2,"median_MaxWidth");
```

```

```

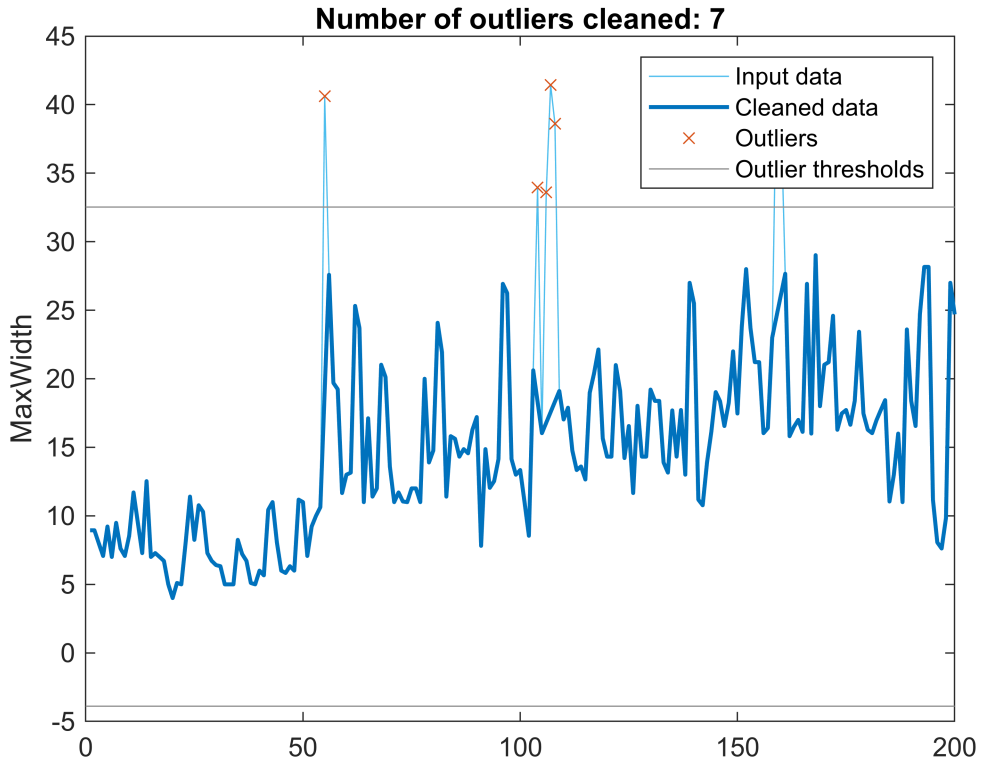
```
% Remove outliers
[newTable3,outlierIndices2,~,thresholdLow,thresholdHigh] = rmoutliers(crackData,...
    "DataVariables","MaxWidth");

% Display results
figure
plot(crackData.MaxWidth,"Color",[77 190 238]/255,"DisplayName","Input data")
hold on
plot(find(~outlierIndices2),newTable3.MaxWidth,"Color",[0 114 189]/255,...
    "LineWidth",1.5,"DisplayName","Cleaned data")

% Plot outliers
plot(find(outlierIndices2),crackData.MaxWidth(outlierIndices2),"x",...
    "Color",[217 83 25]/255,"DisplayName","Outliers")

% Plot outlier thresholds
plot([xlim missing xlim],...
    [thresholdLow.MaxWidth*[1 1] NaN thresholdHigh.MaxWidth*[1 1]],...
    "Color",[145 145 145]/255,"DisplayName","Outlier thresholds")

hold off
title("Number of outliers cleaned: " + nnz(outlierIndices2))
legend
ylabel("MaxWidth")
```



```
clear thresholdLow thresholdHigh
```

```
outlierImages = crackData.fileName(outlierIndices);
montage(outlierImages,"BorderSize",1);
```