

## REPORT 4

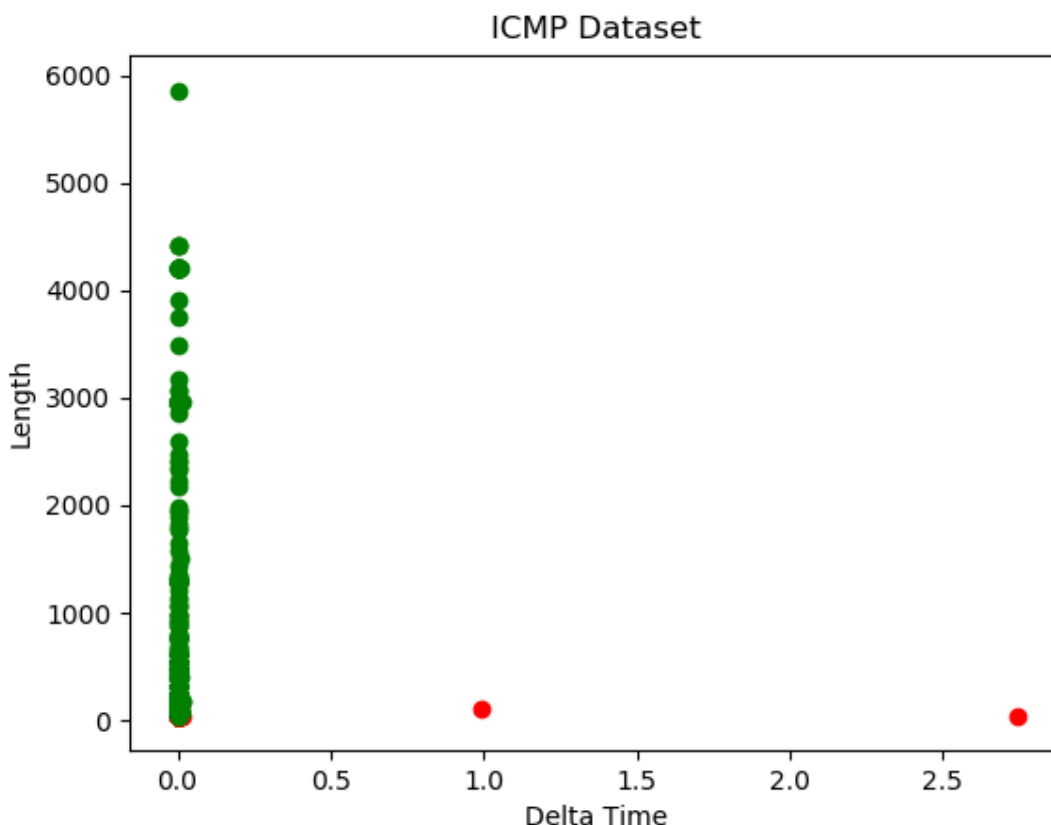
### Algorithms used:

The algorithm used here cycles through different combinations of weights for the weighted average ensemble classifier to find the combination that gives the maximum accuracy.

The combination that gives maximum accuracy can vary based on the algorithms used as well as the dataset. For example, for the ICMP dataset, a combination of [1,2,1] gave the maximum accuracy while for TCPSYN [3,1,1] gave the maximum accuracy. Using algorithms other than the 3 used here for the weighted average classifier will also change the combination that gives the maximum accuracy.

### VISUALIZATION GRAPHS OF THE DATASETS: (red – flood, green – normal)

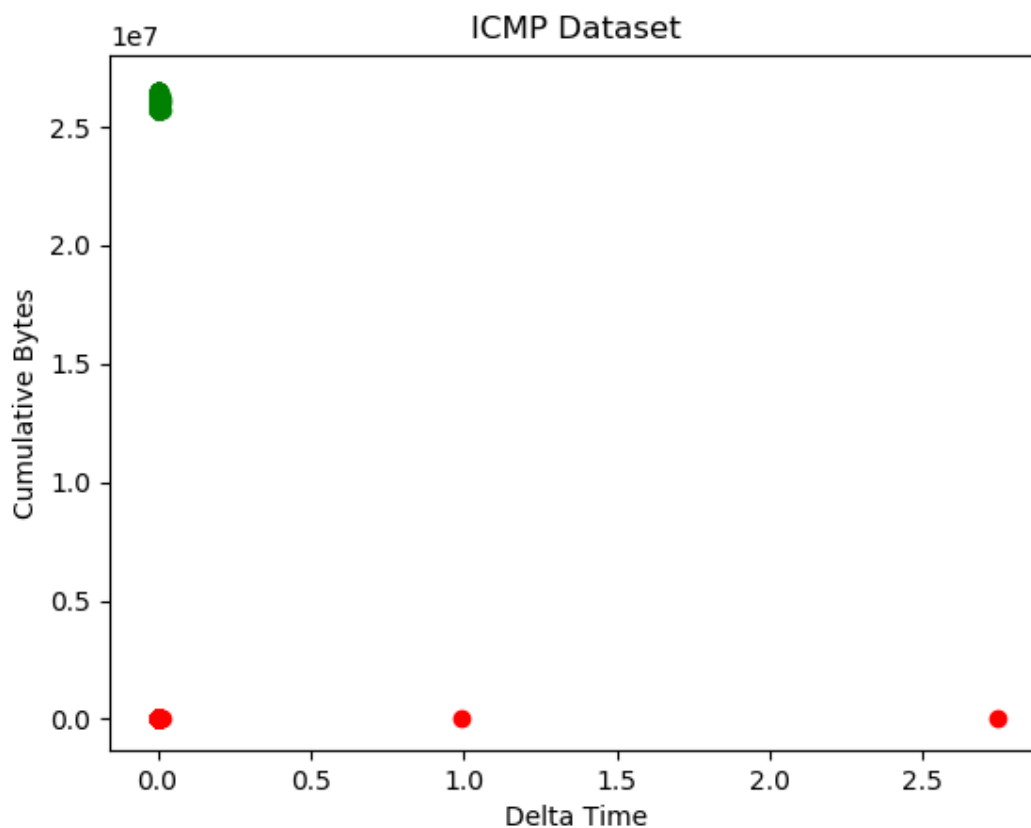
#### ICMP



We can see from this graph that when the length of the sent packets is 0, then irrespective of delta time values, it is a flood condition

Similarly, when delta time is 0, then irrespective of length values, it is a normal condition.

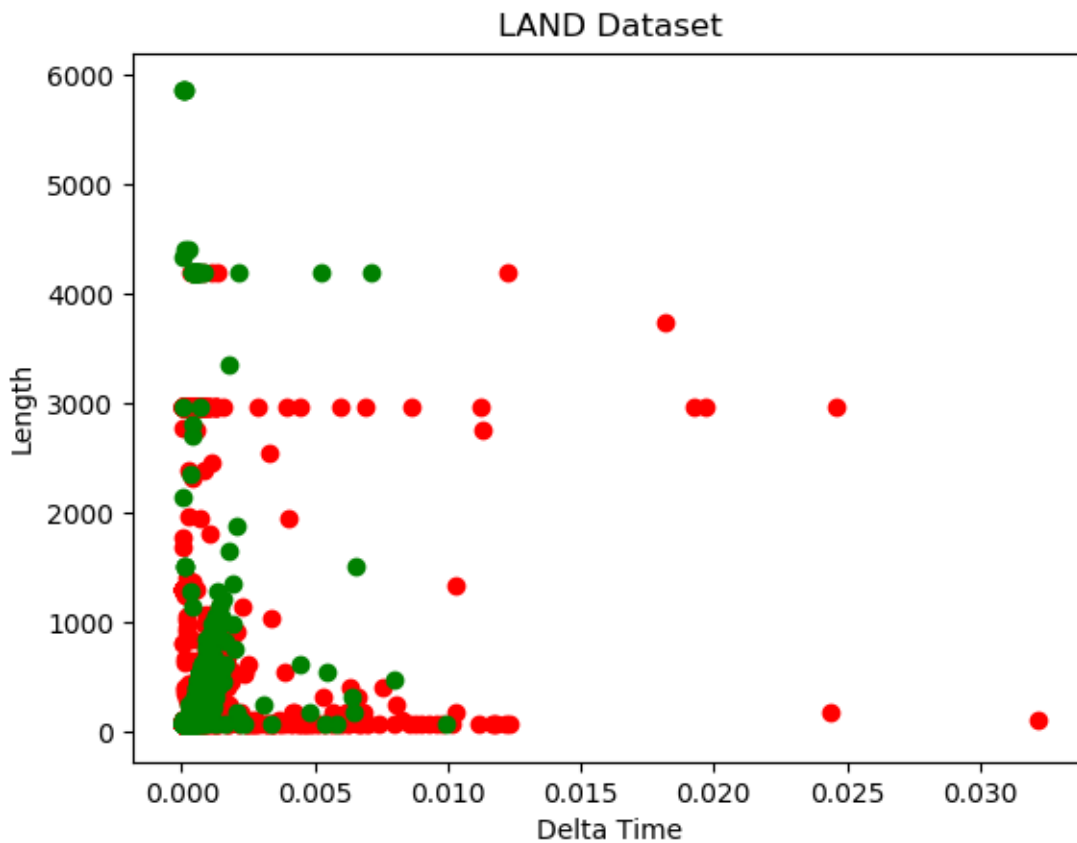
This shows that packets that take lesser time and are larger in size are of normal condition and packets that take more time and are smaller in size are of flood condition.



From this graph, we can see that when cumulative bytes is 0, for all Delta times values, it is a flood condition.

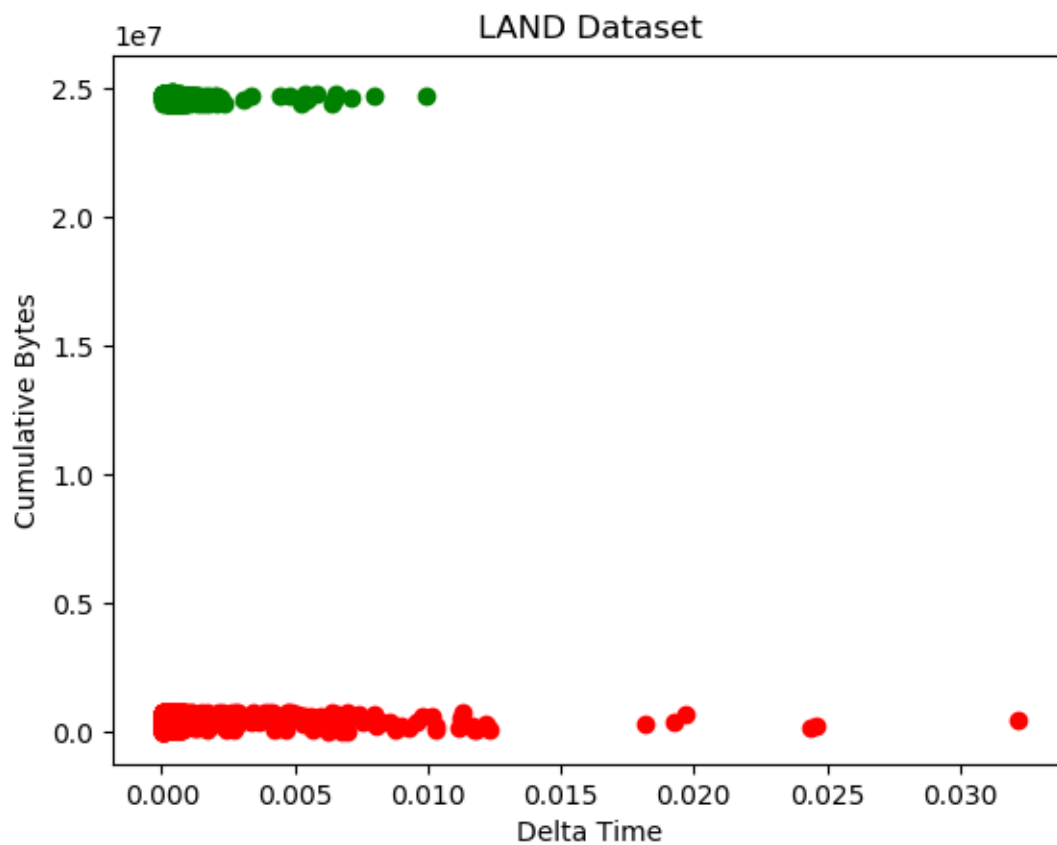
Similarly, when Delta time is 0, for all values of Cumulative bytes, it is a normal condition.

This shows that packets that take lesser time and have cumulative bytes are of normal condition and packets that take more time and do not have cumulative bytes are of flood condition.



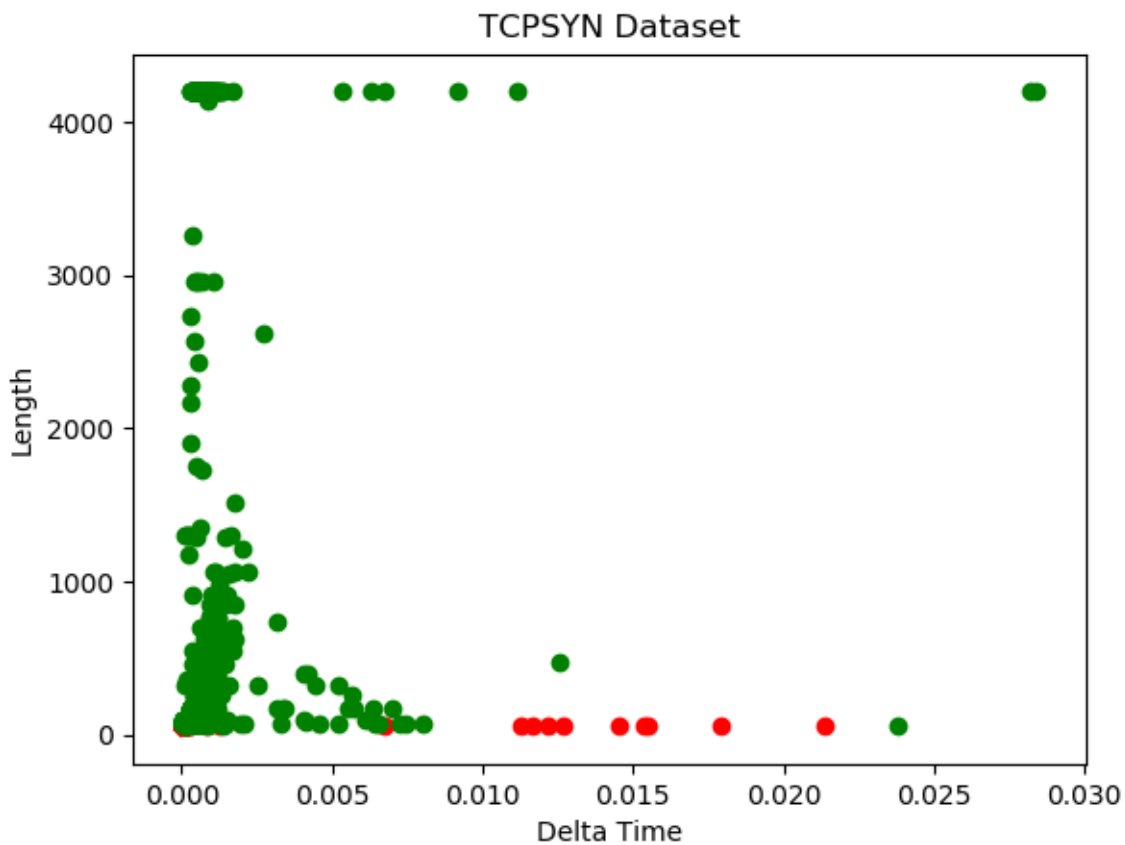
From the graph it is visible that when Delta time is closer to 0 (0 to 0.01), for all value of length, it can be either normal or flood condition thus showing that the following parameters are not enough to differentiate.

Similarly, when delta time is greater than 0.01, for all values of length, it definitely is a flood condition.



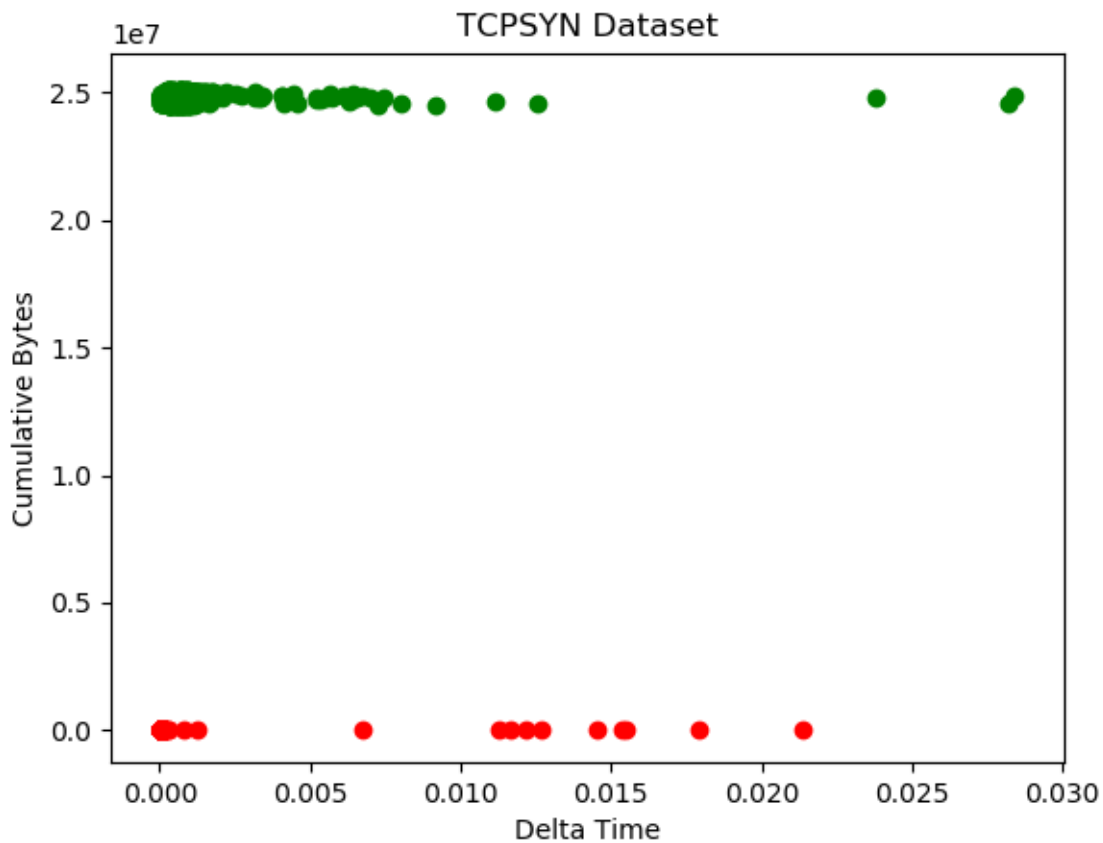
From the graph, it is visible that cumulative bytes alone determines flood or normal conditions. For higher values of cumulative bytes, for all value of delta time, it is a normal condition. Similarly, for lower values of cumulative bytes, for all values of delta time, it is a flood condition.

## TCPSYN



From the graph it is visible that flood conditions only arise when length is almost 0 and delta time is in the range [0.070 to 0.022]. Hence flood conditions depend on both parameters.

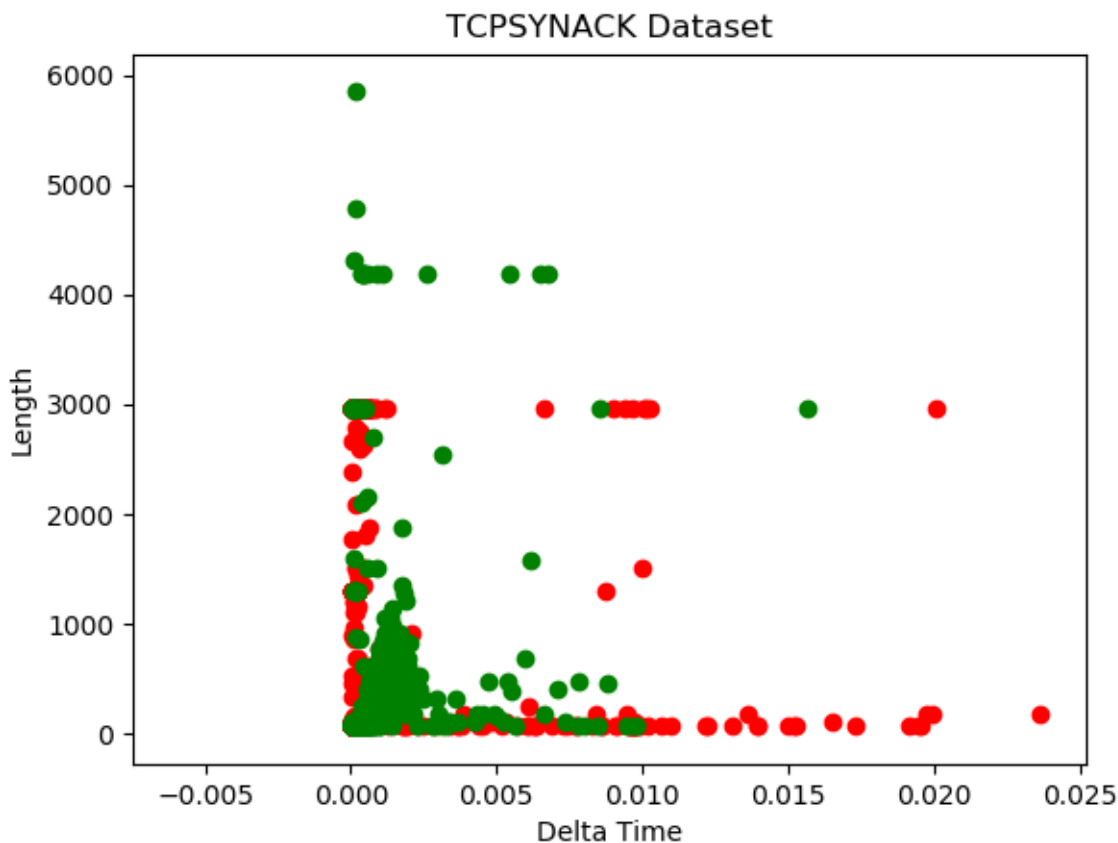
For all other values of Length and Delta Time, there exist normal conditions



From the graph it is visible that for all Cumulative bytes alone determines the conditions. I.e. when cumulative bytes are high, for all values of Delta time, there is normal conditions.

Similarly when cumulative bytes are 0, for all values of Delta Time, there is flood conditions

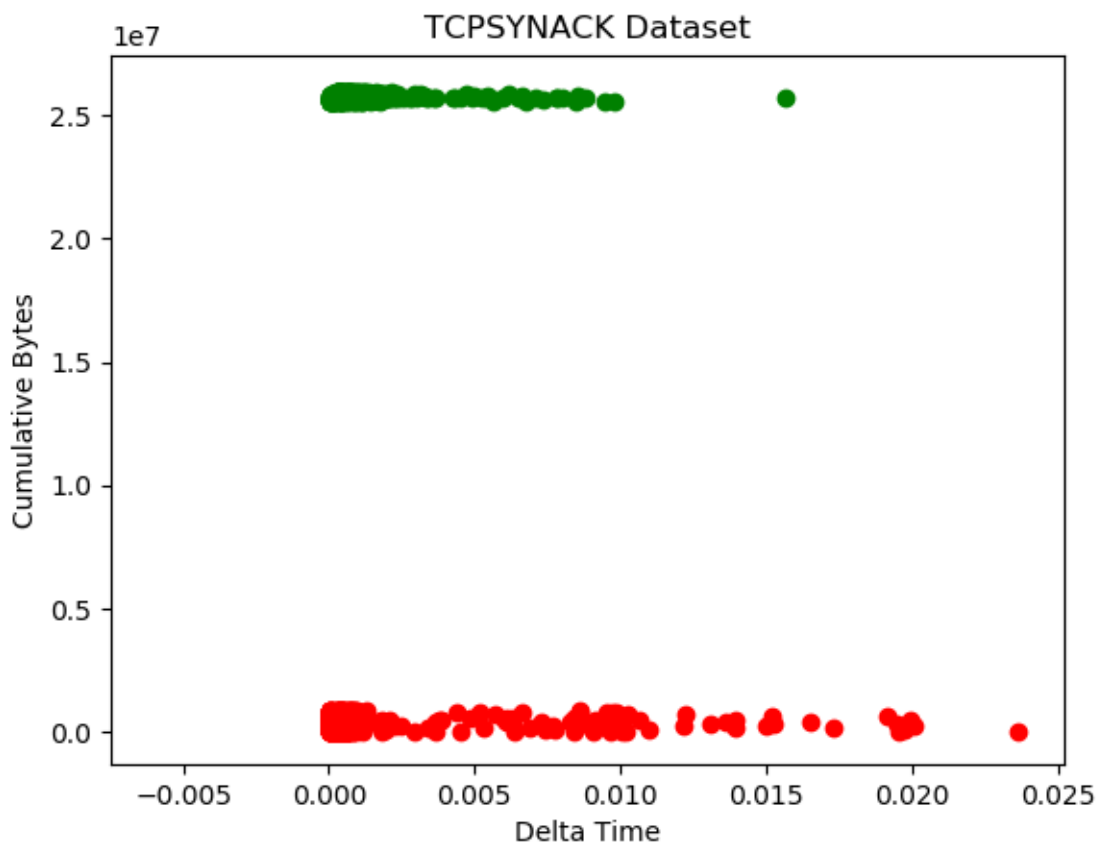
## TCPSYNACK



From the graph we can see that when delta time lies between 0 and 0.01 and length lies between 0 and 3000, it cannot be determined whether there is flood or normal conditions as both conditions occur, hence these two parameters are not enough.

For the same range of delta time (0 to 0.01) and length  $> 3000$ , only normal conditions exist.

When delta time is greater than 0.01, for all values of length, flood conditions exist.

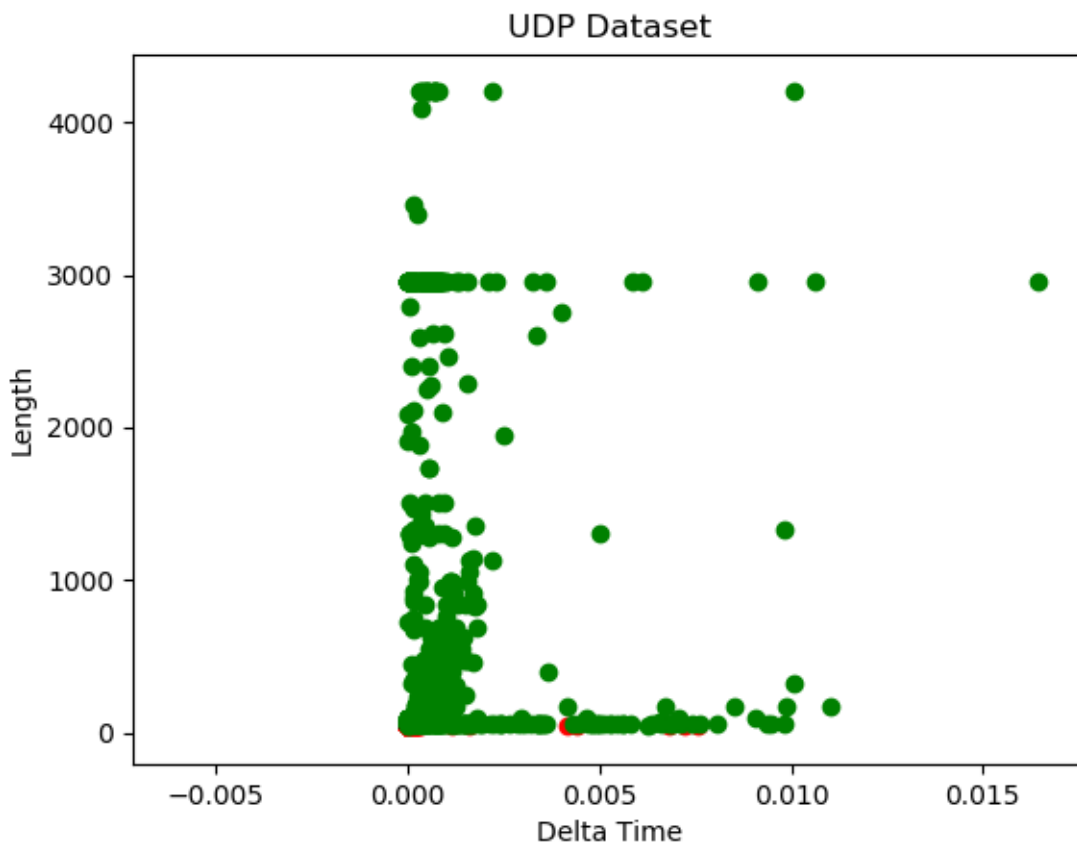


From the graph, we can see that cumulative bytes solely determine flood or normal conditions. When cumulative bytes is 0 then for all values of Delta time it is flood conditions.

Similarly, when cumulative bytes are greater than 0, then for all values of Delta time, normal conditions exist.

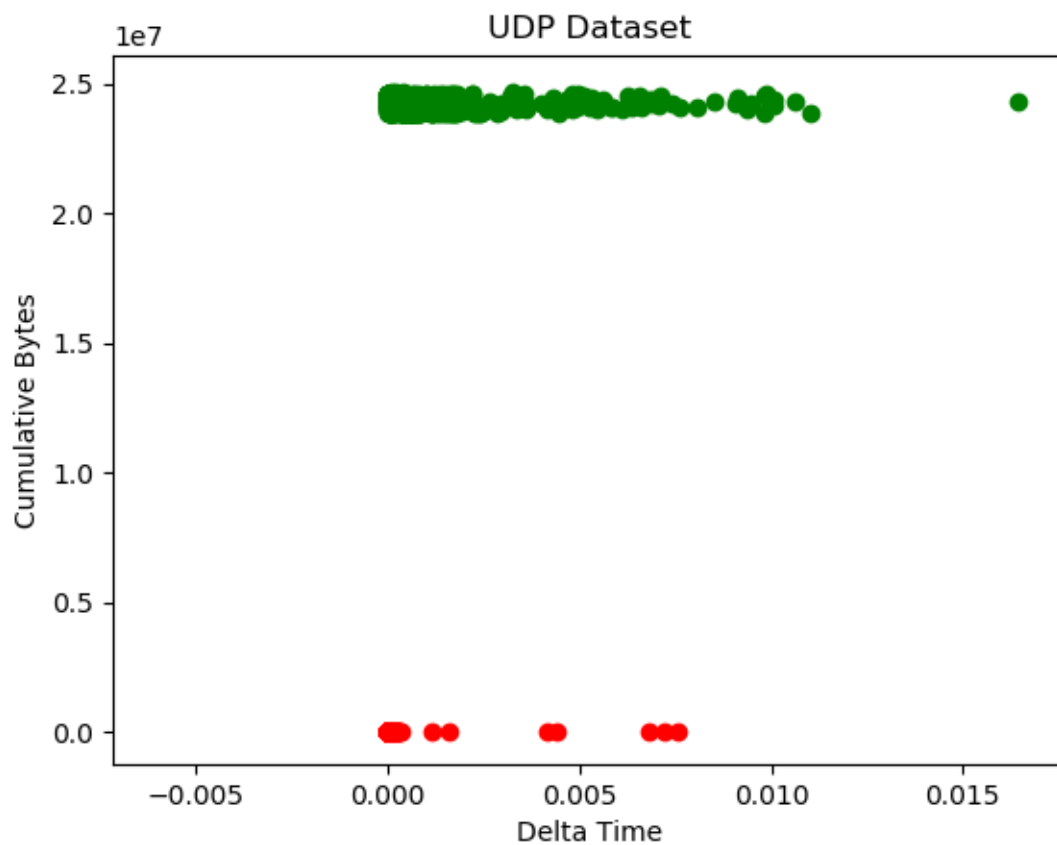


## UDP



From the graph it is visible that for length 0 we cannot determine whether flood conditions or normal conditions exist as for all values of delta time, many have both conditions.

When length is not 0 then it solely determines that there is normal conditions as for all values of delta time, there is normal conditions.



From the graph it is visible that cumulative bytes solely determine the condition. For Cumulative bytes equal to 0, for all values of Delta time flood conditions exist.

Similarly for higher values of cumulative bytes, for all values of delta time normal conditions exist.

### Table1:

1. OneVsRestClassifier(LogisticRegression())
2. BaggingClassifier()
3. MultinomialNB()

### Table2:

1. OneVsRestClassifier(GaussianNB())
2. BaggingClassifier(max\_samples=200)
3. MultinomialNB(alpha=2)

### Table3:

1. OneVsRestClassifier(RandomForestClassifier())
2. BaggingClassifier(n\_estimators=5,max\_samples=200)
3. MultinomialNB(alpha=2,fit\_prior=False)

## OUTPUT

### ICMP

#### [TABLE1]

```
C:\Users\Joels PC\Desktop>python PBL3.py
sys:1: DtypeWarning: Columns (20) have mixed types. Specify dtype option on import or set low_memory=False.
OneVsRestClassifier  BaggingClassifier  MultinomialNB  mean  std  Precision  Recall  F-measure  True Postives  True Negatives  False Positives
0 1.0 2.0 1.0 0.986982 0.015785 0.999916 0.999210 0.999563 279868.0 29685.0 47.0
1 3.0 1.0 2.0 0.942943 0.113041 0.977104 0.994857 0.985773 278467.0 29575.0 157.0
2 3.0 1.0 1.0 0.942946 0.113036 0.979038 0.995080 0.986891 278592.0 29575.0 157.0
```

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.986982	0.015785
2	3	1	2	0.942943	0.113041
3	3	1	1	0.942946	0.113036

[TABLE2]

C:\Users\Joels PC\Desktop>python PBL3.py  
sys:1: DtypeWarning: Columns (20) have mixed types. Specify dtype option on import or set low\_memory=False.

	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.954096	0.090737	0.960947	0.992918	0.976243	277382.0	29575.0	157.0
1	3.0	1.0	2.0	0.964090	0.070747	0.877067	0.980187	0.920251	270256.0	29575.0	157.0
2	3.0	1.0	1.0	0.964527	0.069873	0.883811	0.981417	0.925213	270944.0	29575.0	157.0

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.954096	0.090737
2	3	1	2	0.964090	0.070747
3	3	1	1	0.964527	0.069873

[TABLE3]

C:\Users\Joels PC\Desktop>python PBL3.py  
sys:1: DtypeWarning: Columns (20) have mixed types. Specify dtype option on import or set low\_memory=False.

	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.995276	0.008375	0.999568	0.997344	0.998452	279859.0	29575.0	157.0
1	3.0	1.0	2.0	0.932460	0.135041	0.999882	0.999987	0.999935	279861.0	29732.0	0.0
2	3.0	1.0	1.0	0.932434	0.135028	0.999849	0.999984	0.999916	279859.0	29732.0	0.0

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.995276	0.008375
2	3	1	2	0.932460	0.135041
3	3	1	1	0.932434	0.135028

LAND

[TABLE1]

C:\Users\Joels PC\Desktop>python PBL3.py

	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.923097	0.099098	1.000000	1.000000	1.000000	23052.0	34548.0	0.0
1	3.0	1.0	2.0	0.612764	0.022318	0.591301	0.583128	0.583200	9737.0	25699.0	8849.0
2	3.0	1.0	1.0	0.734139	0.076496	0.717319	0.660954	0.662316	9782.0	31009.0	3539.0

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.923097	0.099098
2	3	1	2	0.612764	0.022318
3	3	1	1	0.734139	0.076496

[TABLE2]

```
C:\Users\Joels PC\Desktop>python PBL3.py
OneVsRestClassifier  BaggingClassifier  MultinomialNB      mean      std  Precision  Recall  F-measure  True Postives  True Negatives  False Positives
0                   1.0              2.0              1.0  0.923097  0.099098  1.000000  1.000000  1.000000      23052.0        34548.0         0.0
1                   3.0              1.0              2.0  0.669583  0.085150  0.670316  0.635961  0.636385      9716.0         29381.0        5167.0
2                   3.0              1.0              1.0  0.698944  0.051144  0.728275  0.665181  0.666590      9726.0         31385.0        3163.0
```

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.923097	0.099098
2	3	1	2	0.669583	0.085150
3	3	1	1	0.698944	0.051144

[TABLE3]

```
C:\Users\Joels PC\Desktop>python PBL3.py
OneVsRestClassifier  BaggingClassifier  MultinomialNB      mean      std  Precision  Recall  F-measure  True Postives  True Negatives  False Positives
0                   1.0              2.0              1.0  0.923097  0.099098  1.0      1.0      1.0      23052.0        34548.0         0.0
1                   3.0              1.0              2.0  0.984444  0.031111  1.0      1.0      1.0      23052.0        34548.0         0.0
2                   3.0              1.0              1.0  0.949097  0.092261  1.0      1.0      1.0      23052.0        34548.0         0.0
```

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.923097	0.099098
2	3	1	2	0.984444	0.031111
3	3	1	1	0.949097	0.092261

TCPSYN

[TABLE1]

```
C:\Users\Joels PC\Desktop>python PBL3.py
OneVsRestClassifier  BaggingClassifier  MultinomialNB      mean      std  Precision  Recall  F-measure  True Postives  True Negatives  False Positives
0                   1.0              2.0              1.0  0.864254  0.257685  1.000000  1.000000  1.000000      231852.0        29748.0         0.0
1                   3.0              1.0              2.0  0.873569  0.122941  0.987956  0.904655  0.941221      231847.0        24076.0        5672.0
2                   3.0              1.0              1.0  0.917431  0.112888  0.992157  0.937895  0.962939      231852.0        26053.0        3695.0
```

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.864254	0.257685
2	3	1	2	0.873569	0.122941
3	3	1	1	0.917431	0.112888

[TABLE2]

C:\Users\Joels PC\Desktop>python PBL3.py												
	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives	
0	1.0	2.0	1.0	0.976208	0.047531	0.999681	0.997645	0.998660	231851.0	29608.0	140.0	
1	3.0	1.0	2.0	0.834483	0.119639	0.711241	0.791523	0.740595	208513.0	20339.0	9409.0	
2	3.0	1.0	1.0	0.857385	0.099347	0.742825	0.802376	0.767452	213678.0	20322.0	9426.0	

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.976208	0.047531
2	3	1	2	0.834483	0.119639
3	3	1	1	0.857385	0.099347

[TABLE3]

C:\Users\Joels PC\Desktop>python PBL3.py												
	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives	
0	1.0	2.0	1.0	0.864312	0.257525	0.999707	0.997714	0.998708	231852.0	29612.0	136.0	
1	3.0	1.0	2.0	0.869890	0.260075	0.999916	0.999989	0.999953	231847.0	29748.0	0.0	
2	3.0	1.0	1.0	0.868076	0.259201	1.000000	1.000000	1.000000	231852.0	29748.0	0.0	

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.864312	0.257525
2	3	1	2	0.869890	0.260075
3	3	1	1	0.868076	0.259201

TCPSYNACK

[TABLE1]

C:\Users\Joels PC\Desktop>python PBL3.py											
	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.919971	0.100721	1.000000	1.000000	1.000000	27112.0	28088.0	0.0
1	3.0	1.0	2.0	0.940942	0.078533	0.977694	0.977464	0.977065	27112.0	26822.0	1266.0
2	3.0	1.0	1.0	0.959841	0.058649	0.999484	0.999502	0.999493	27112.0	28060.0	28.0

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.919971	0.100721
2	3	1	2	0.940942	0.078533
3	3	1	1	0.959841	0.058649

[TABLE2]

C:\Users\Joels PC\Desktop>python PBL3.py											
	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.910145	0.110315	1.000000	1.000000	1.000000	27112.0	28088.0	0.0
1	3.0	1.0	2.0	0.862406	0.157390	0.795039	0.790259	0.790184	19823.0	23857.0	4231.0
2	3.0	1.0	1.0	0.860899	0.172779	0.937854	0.928293	0.928983	23356.0	27951.0	137.0

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.910145	0.110315
2	3	1	2	0.862406	0.157390
3	3	1	1	0.860899	0.172779

[TABLE3]

C:\Users\Joels PC\Desktop>python PBL3.py											
	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.919971	0.100721	1.0	1.0	1.0	27112.0	28088.0	0.0
1	3.0	1.0	2.0	0.966145	0.047286	1.0	1.0	1.0	27112.0	28088.0	0.0
2	3.0	1.0	1.0	0.927420	0.095522	1.0	1.0	1.0	27112.0	28088.0	0.0

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.919971	0.100721
2	3	1	2	0.966145	0.047286
3	3	1	1	0.927420	0.095522

UDP

[TABLE1]

```
C:\Users\Joels PC\Desktop>python PBL3.py
sys:1: DtypeWarning: Columns (20) have mixed types. Specify dtype option on import or set low_memory=False.
```

	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.897483	0.183537	1.000000	1.000000	1.000000	271914.0	28086.0	0.0
1	3.0	1.0	2.0	0.905829	0.044766	0.731890	0.856748	0.774441	248100.0	22499.0	5587.0
2	3.0	1.0	1.0	0.959251	0.008277	0.974216	0.840809	0.894125	271526.0	19184.0	8902.0

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.897483	0.183537
2	3	1	2	0.905829	0.044766
3	3	1	1	0.959251	0.008277

[TABLE2]

```
C:\Users\Joels PC\Desktop>python PBL3.py
sys:1: DtypeWarning: Columns (20) have mixed types. Specify dtype option on import or set low_memory=False.
```

	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.999928	0.000083	0.999994	0.999947	0.999971	271914.0	28083.0	3.0
1	3.0	1.0	2.0	0.972277	0.015933	0.989896	0.900164	0.939442	271914.0	22478.0	5608.0
2	3.0	1.0	1.0	0.964861	0.019422	0.980520	0.803763	0.867993	271914.0	17063.0	11023.0

Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.999928	0.000083
2	3	1	2	0.972277	0.015933
3	3	1	1	0.964861	0.019422

[TABLE3]

```
C:\Users\Joels PC\Desktop>python PBL3.py
sys:1: DtypeWarning: Columns (20) have mixed types. Specify dtype option on import or set low_memory=False.
```

	OneVsRestClassifier	BaggingClassifier	MultinomialNB	mean	std	Precision	Recall	F-measure	True Postives	True Negatives	False Positives
0	1.0	2.0	1.0	0.948997	0.101872	1.0	1.0	1.0	271914.0	28086.0	0.0
1	3.0	1.0	2.0	0.990403	0.014077	1.0	1.0	1.0	271914.0	28086.0	0.0
2	3.0	1.0	1.0	0.899189	0.184106	1.0	1.0	1.0	271914.0	28086.0	0.0



Sr No	OneVsRest Classifier	Bagging Classifier	MultinomialNB	Mean	Std dev
1	1	2	1	0.948997	0.101872
2	3	1	2	0.990403	0.014077
3	3	1	1	0.899189	0.184106