Data Analysis in Traffic Monitoring

COP315

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Project objectives:

I - Behavioral change in vehicle owners

II - Analysis of speed violation variations w.r.t different parameters

III - Correlation between different parameters involved in analysis

I. Behavioral change in vehicle owners

We observed behavior of vehicle owners which involve analysis among mostly educated group of people and their action after they were informed by our SMS warning service after they violate speed limit in our campus.

- We find out the fraction of violations done by vehicle owners and overall traffic in campus before and after giving them waring via self-generating SMSs and emails to registered user. We have extracted data from server arranged them well and plotted graph which are showing change in behavior of people
- after sending them SMSs Which are given below.

-Constraints/procedure while observing change in behavior.

-We collected those users which were not registered on the portal in April/2018 and May/2018.

-We checked that how many of these gets registered and provide their phone numbers on the portal upto June/2018 and only these users are used for subsequent analysis.

-We start our observation from Sept/2018 and not from June/2018, July/2018 and August/2018 because we want to first warn the violators via SMS in this period (June, July, August).

-Now we start looking for their(violators) % violations in the subsequent months and we don't care if they get SMS in those months (We assumed that they(violators) were warned in June, July, August)

-Observed numbers:

1)-In total we 555 users for analysis.

-We used April/2018 and May/2018 as time span where users were not receiving SMS, lets call this time span as 'Before SMS'.

-First month of observation is September/2018 let's call it (Month1), October as (Month2), and so on upto January/2018 as (Month5)

2)-We distributed users in 5 categories (in each month).

1.Users violating 70% of time or more

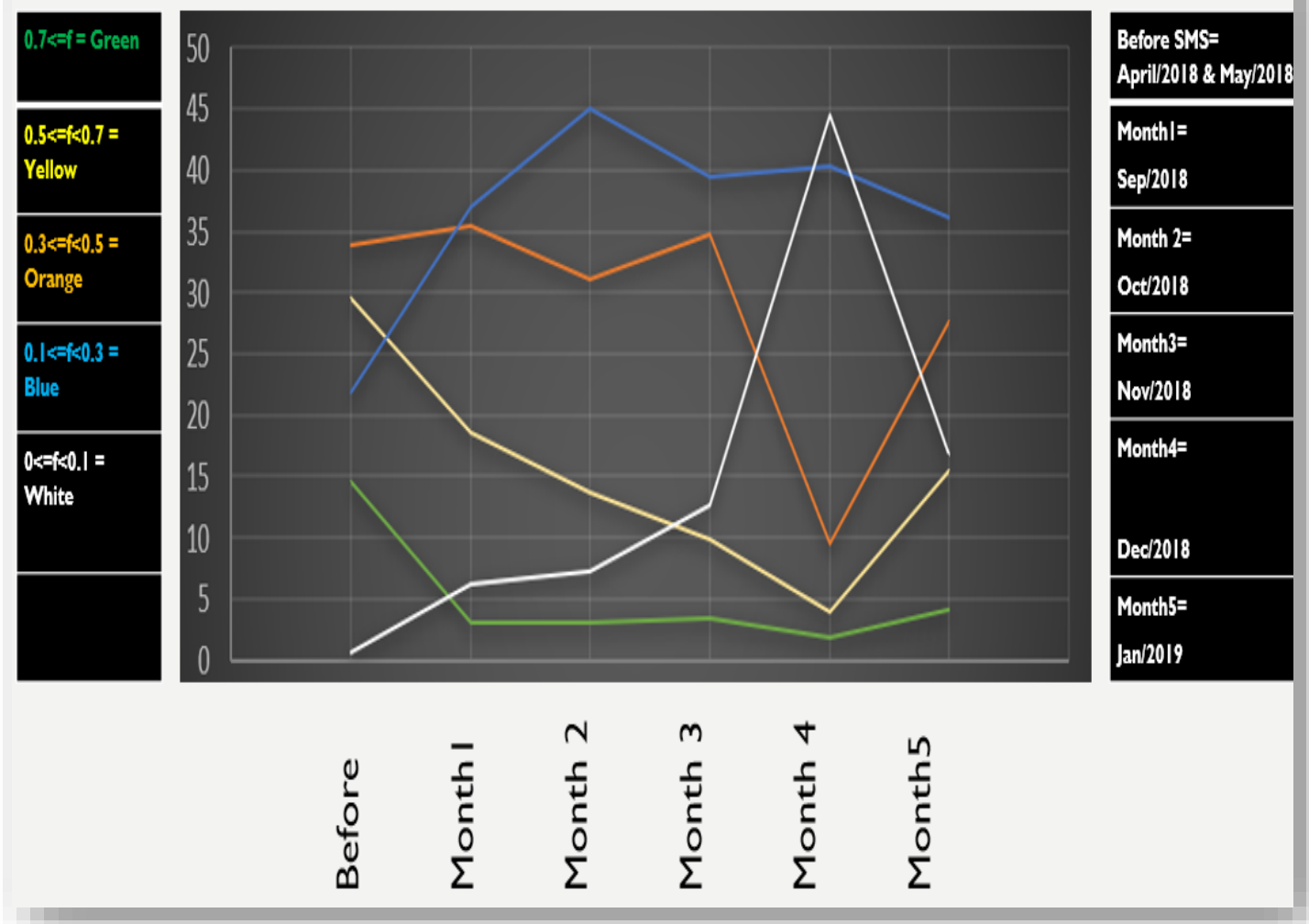
2.Users violating more than 50% but less than 70% .

3.Users violating more than 30% and less than 50%.

4.Users violating more than 10% and less than 30%.

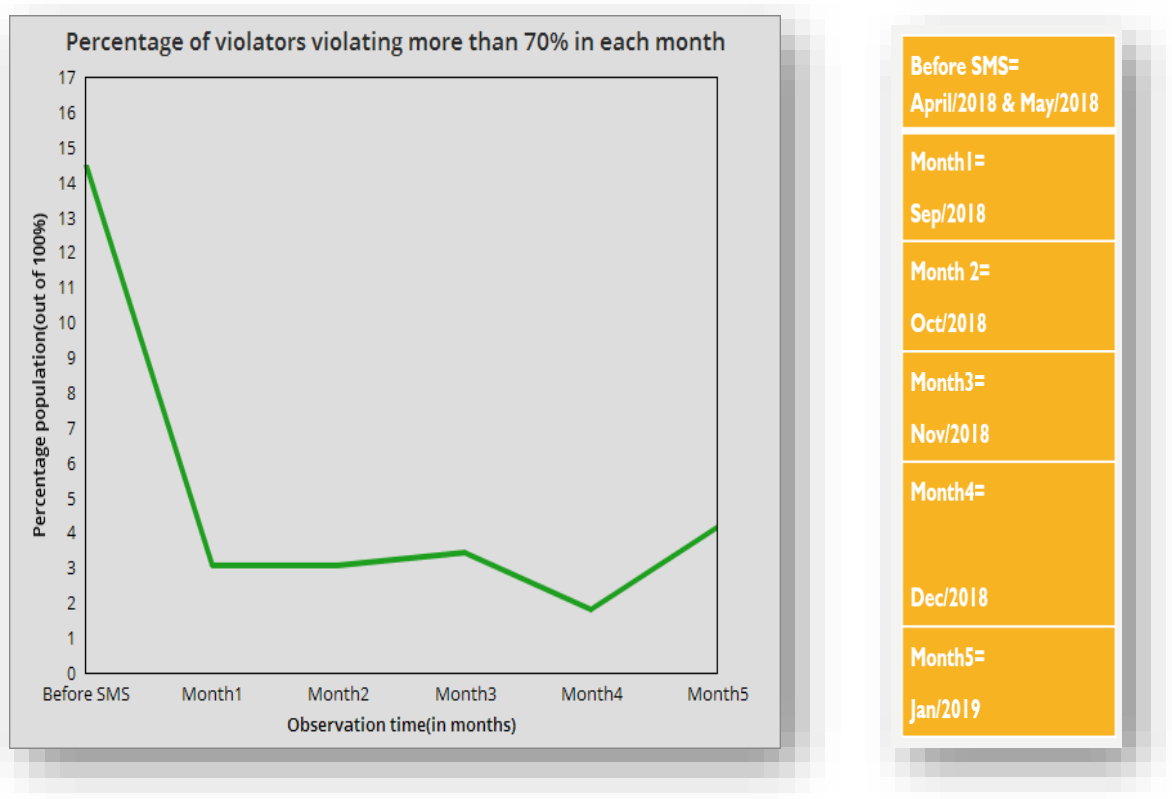
5.Users violating less than or equal to 10% of time.

Categories f=Fraction	Before SMS		Month 1		Month 2		Month 3		Month 4		Month 5	
	Users out of 555	% of Users (100)	Users out of 555	% of Users (100)	Users out of 555	% of Users (100)	Users out of 555	% of Users (100)	Users out of 555	% of Users (100)	Users out of 555	% of Users (100)
0.7<=f	79	14.50	17	3.06	17	3.06	19	3.423	10	1.801	23	4.14
0.5<=f<0.7	164	29.55	103	18.55	76	13.69	55	9.9	22	3.963	86	15.49
0.3<=f<0.5	188	33.87	197	35.49	173	31.17	193	34.77	53	9.549	153	27.567
0.1<=f<0.3	121	21.80	205	36.93	250	45.04	219	39.45	224	40.36	201	36.21
0<=f<0.1	4	0.72	34	6.126	40	7.207	70	12.61	247	44.50	93	16.756


0.7<=f = Green
0.5<=f<0.7 = Yellow
0.3<=f<0.5 = Orange
0.1<=f<0.3 = Blue
0<=f<0.1 = White
50
45
40
35
30
25
20
15
10
5
0
Before
Month I
Month 2
Month 3
Month 4
Month5
Before SMS= April/2018 & May/2018
Month1= Sep/2018
Month 2= Oct/2018
Month3= Nov/2018
Month4= Dec/2018
Month5= Jan/2019

Representation of above table: -

Figure 1.



Observation and conclusion: -

For Fig 1. (f>=0.7)

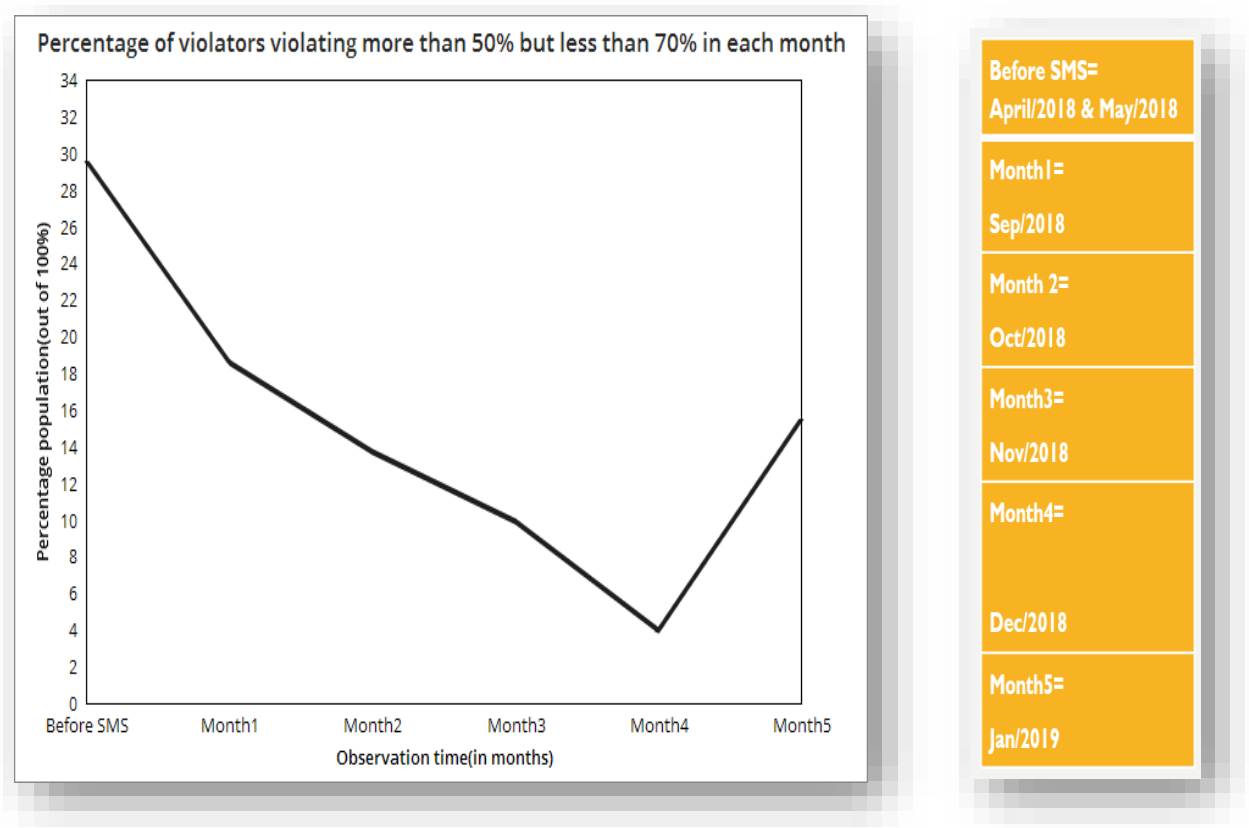
-We observed that Number of users violating more than 70% times gets reduced over the observation time and this may be happened because they are getting SMS at least 70% of times (i.e. whenever they violate the speed limit) which may have helped them remembering more about speed limit.

-If we do not consider Month 4(December) then mean of percentage violators is 3.42%. That means there are like 18 users in each month who tends to violate more than 70%. We can put them in the category of Hitlist Violators.

Some of this user are Owners of vehicles corresponding to following vehicle id: -

DL1CP7151, DL3SCD5590, DL3SDX0434, DL3SBT5895, DL12CJ6212, DL3SDV2337

Figure 2



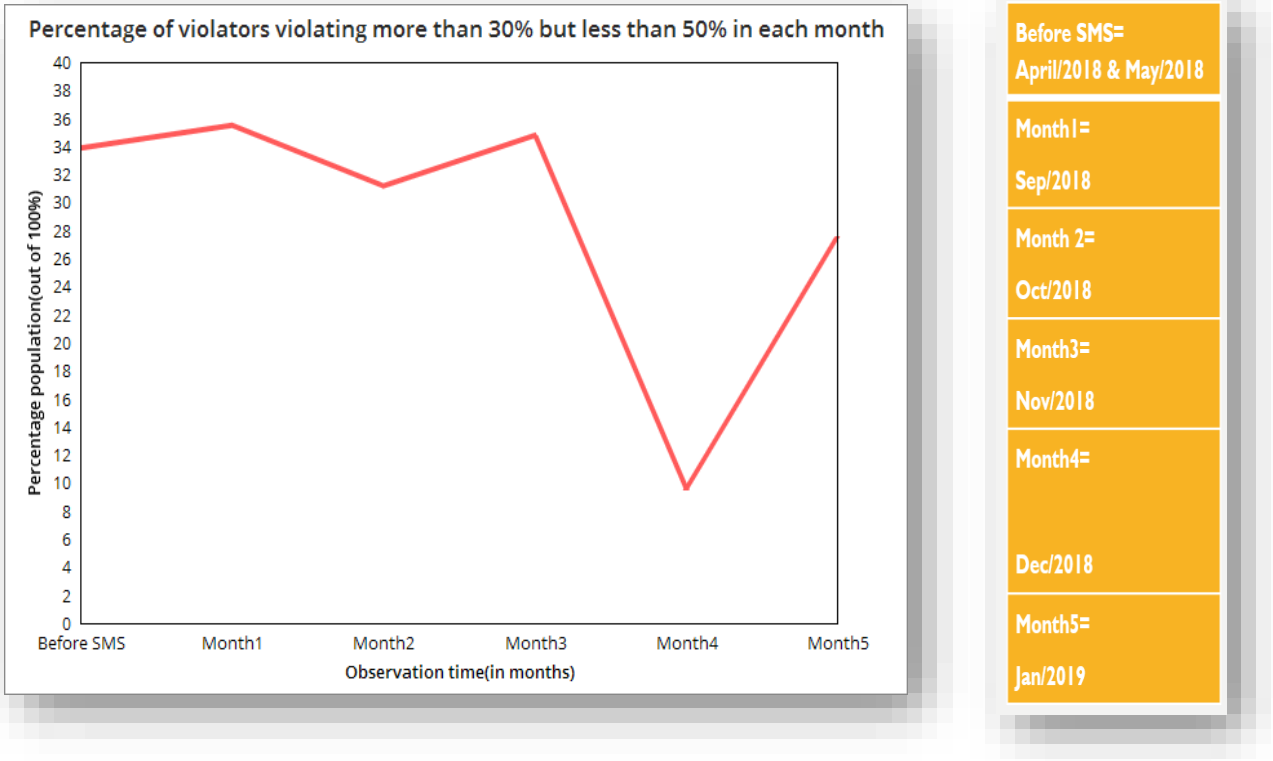
Observation and conclusion: -

For Fig 2 (0.5<f<=0.7)

-In this case also we saw decrease in total number of violators over the observation time we can guess the same reason which followed for in case of Fig.1

-Percentage of violators decreased from 29.55% to 14.40% again excluding December month.

Figure 3



Observation and conclusion: -

For Fig 3 (0.3<f<=0.5)

-Unlike of above two cases in this case % of violators increased in month 1 decreased a little in month 2 and again increased in month 3 so we can think it as % drop in above two cases may have shifted in this category, in case of December it can be seen that % of violators are less.

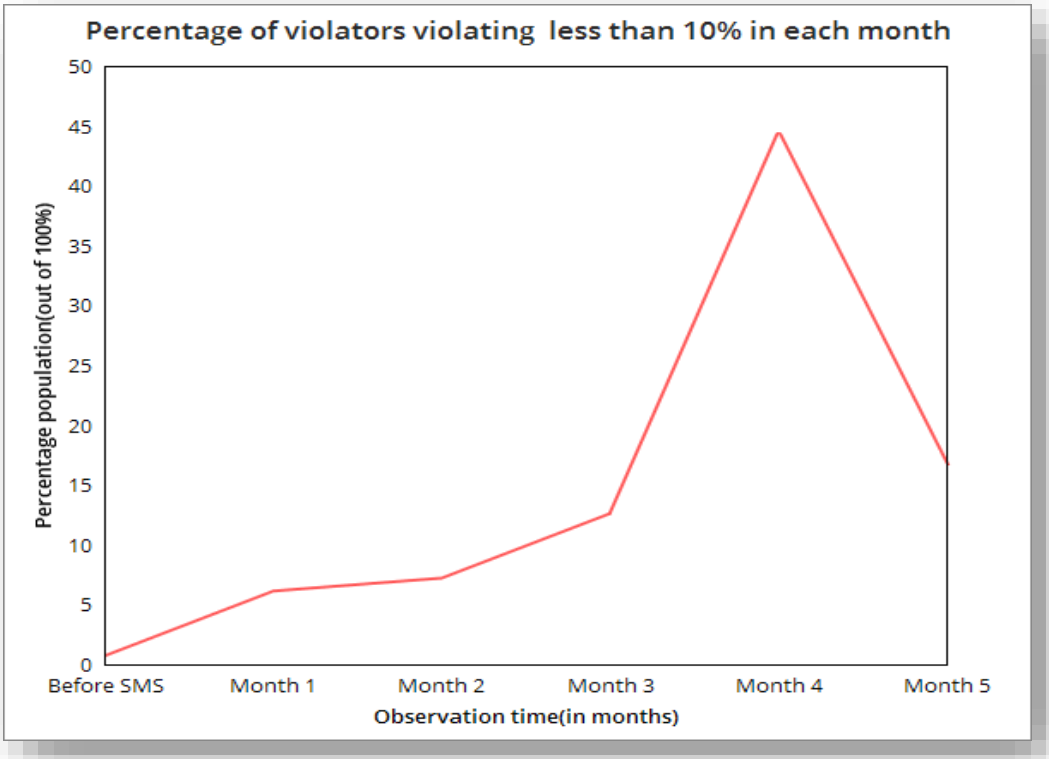
Figure 4

Observation and conclusion: -

For Fig 4(0.1<f<=0.3)

-We can clearly visualize that % of violators in this category are increased over our observation time so decreasing trend in case 1, case 2(Fig 1 and Fig 2) is the result of increasing trend in this category. So we are expecting that a user violating more than 5 times before sending SMS is violating 1-3 times (out of 10) after sending SMS***. But shifting in this category does not mean total violations in the Month 1 Month 2...Month 5 have decreased It just means a greater number of violators are violating 1-3 times but still they are violating***. It means a greater number of violators with frequency of 1-3 violations in a month.

Figure 5



Before SMS= April/2018 & May/2018

Month1= Sep/2018

Month 2= Oct/2018

Month3= Nov/2018

Month4= Dec/2018

Month5= Jan/2019

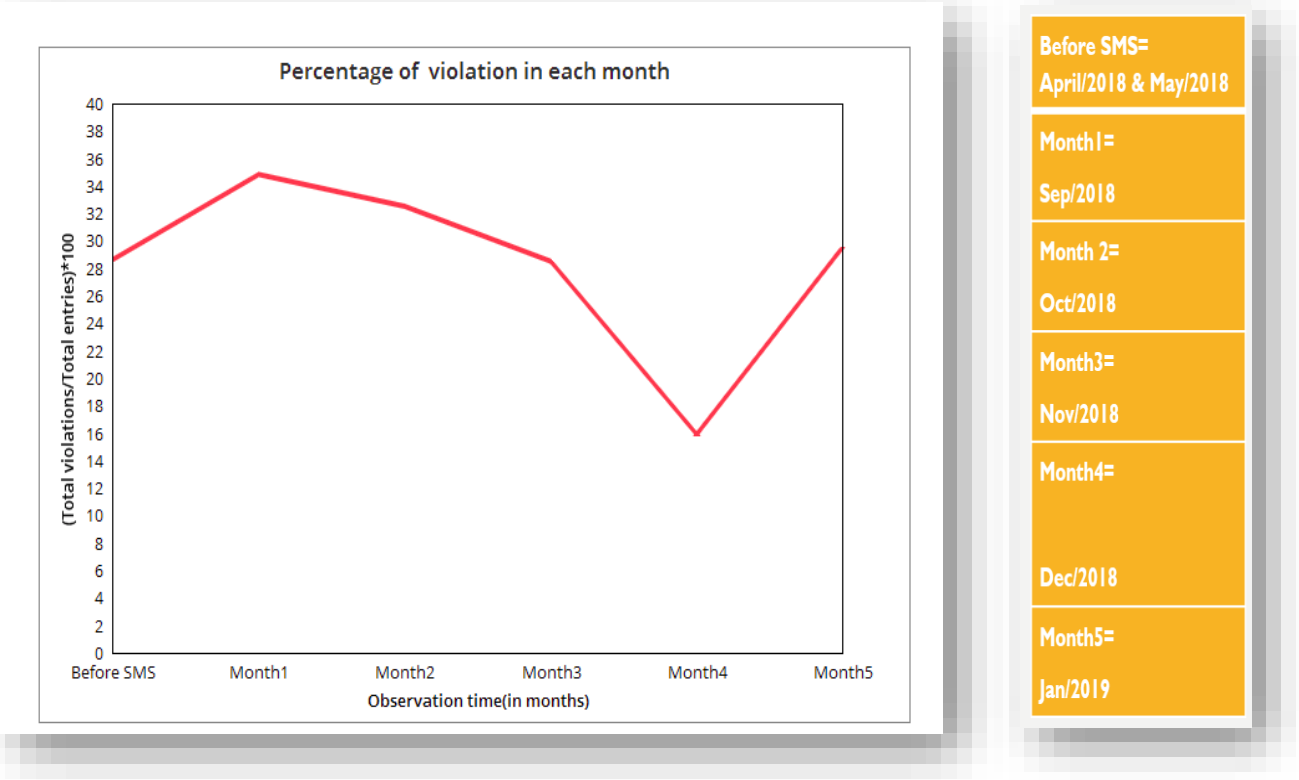
Observation and conclusion: -

For fig 5(f<=0.1)

-This can be explained as same as in case of Fig 4. Peak appears at month 4 i.e. in December 84% of users violated less than 0.3% of time.

-Analysis on percentage violations in each month: -

Figure 6



-We were expecting that number of violations will decrease over the observation time, but we Observed that Month1 (September) most number of violations i.e. 34.83%.

-Reason for this can be as stated as large number of users (72.42% of users) lies in category of fig 3 and fig 4 i.e. $0.1<f<0.5$. Which increases the overall number of violations in the month of September

-Again, total number of violations are not less for month 2 and month 3 as compared to months when SMS were not sent. This leads to intuition that **There is no change in the behavior of violators which belong to category of fig 3 and fig 4 i.e. users violating 10% to 50% of time before SMS.**

-As observed in all the categories December is the month with lesser risk.

Overall conclusion: -

-We were able to change the behavior of Hitlist violators and violators with violation % greater than 50%.

-It seems that we are not able to change behavior of violators with % between 10% to 50%, because total number of violations in the month1(Sept), month 2(Oct.) ...month 3(Jan) is not changed significantly.

-December is the month with lowest number of violations.

II. Analysis of speed violation variations w.r.t different parameters

We analyzed speed of vehicles in our campus concerning the different parameters which were helpful in observe behaviors of our vehicle owners.

Parameters were as follows:

1)Time-Wise Analysis

2)Day/Week-Wise Analysis

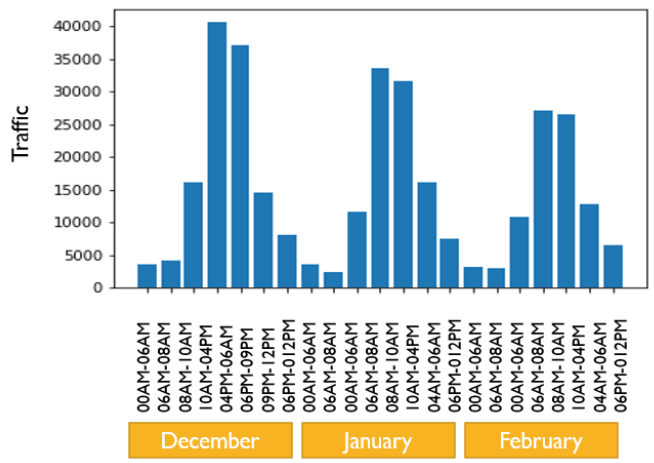
3)Holiday- Working Day Wise Analysis

-Time-Wise Analysis

We analyzed speed violations w.r. t time using labeling different intervals of time in a day such that

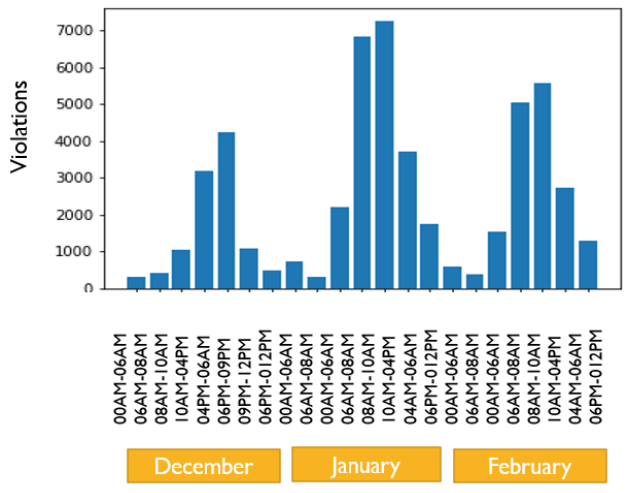
0 AM to 6 AM; 6 AM to 8 AM; 8 AM to 10 AM; 10 AM to 4 PM; 4 PM to 6 PM; 9PM to 12PM of a day.

Graphs given below shows the variation of traffic, where X-axis shows the intervals of time in a day w.r.t three months.



Traffic variations vs Time duration(1st bar shows Number of vehicles in campus between 1st of Dec till 31st Dec that happen between 00:00-06:00).

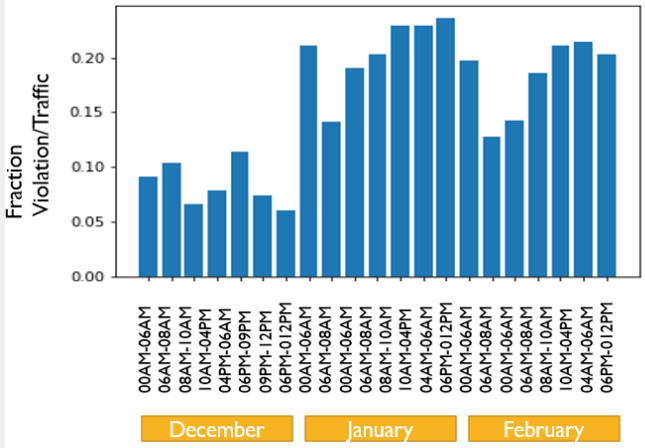
Conclusion: Highest number of traffic is between 08AM to 10AM.



Violations in campus vs Day of the week(1st bar shows the Violations in a day(say Monday))

Conclusion: Maximum number of violations happens between 10AM to 04PM and Minimum number of violations

Happens in 06 to 08



The fraction: Violations / Time duration vs Day of the week(1st bar shows the fraction of violations in a day(say Monday) and Traffic in campus on that particular day)

Conclusion: Highest number of violation/traffic happens overall between 10AM to 04PM.

We can see that overall

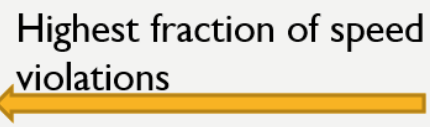
December

January

February

Time intervals	violation	fraction	traffic
0AM - 6AM	327	0.091264	3583
6AM - 8AM	435	0.103252	4213
8AM-10AM	1063	0.065922	16125
10AM-4PM	3199	0.078735	40630
4PM-6PM	4223	0.114086	37016
6PM-9PM	1079	0.074036	14574
9PM-12PM	481	0.060215	7988
0AM - 6AM	601	0.197502	3043
6AM - 8AM	369	0.127285	2899
8AM-10AM	1552	0.142989	10854
10AM-4PM	5041	0.185795	27132
4PM-6PM	5582	0.210459	26523
6PM-9PM	2736	0.214504	12755
9PM-12PM	1294	0.202631	6386
0AM - 6AM	728	0.210587	3457
6AM - 8AM	324	0.140931	2299
8AM-10AM	2218	0.190468	11645
10AM-4PM	6832	0.203497	33573
4PM-6PM	7255	0.229756	31577
6PM-9PM	3709	0.229546	16158
9PM-12PM	1750	0.236135	7411

Time intervals	Mean of fractions
0AM - 6AM	0.358962507
6AM - 8AM	0.277514057
8AM-10AM	0.272400578
10AM-4PM	0.344163573
4PM-6PM	0.401129926
6PM-9PM	0.365055315
9PM-12PM	0.341557903



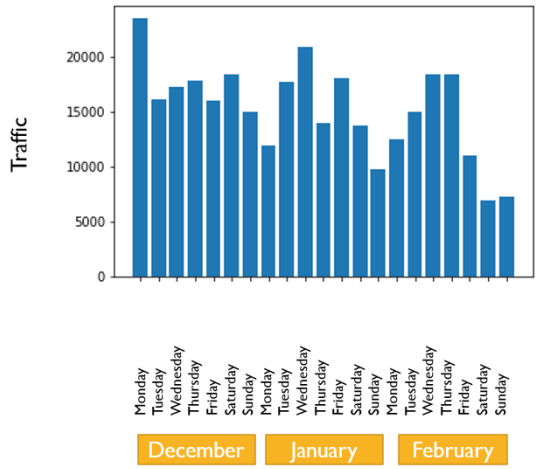
Conclusion:

We found out that fraction speed violation was **minimum** in the morning interval of **8AM to 10AM** and at day interval of **4PM to 6PM** fraction of spped violations are **maximum**.

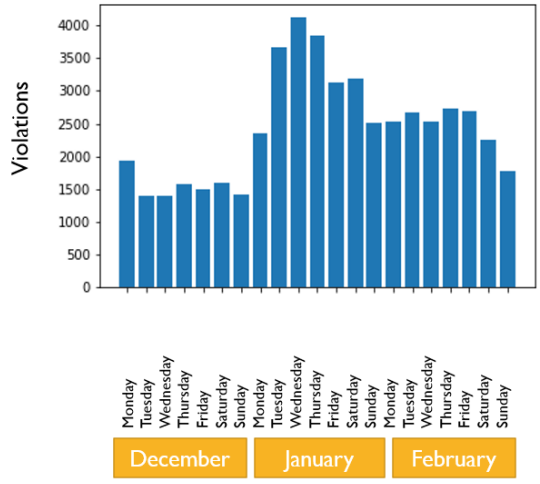
-Day-Wise Analysis

We used weekly data to find several violations on each weekday (Mon, Tue, Wed, Thu, Fri, Sat, Sun). We analyzed the data for 3 months (December, January, February) by finding number of violations on each day of week and further finding fraction of violations by dividing it by traffic on each day of the week.

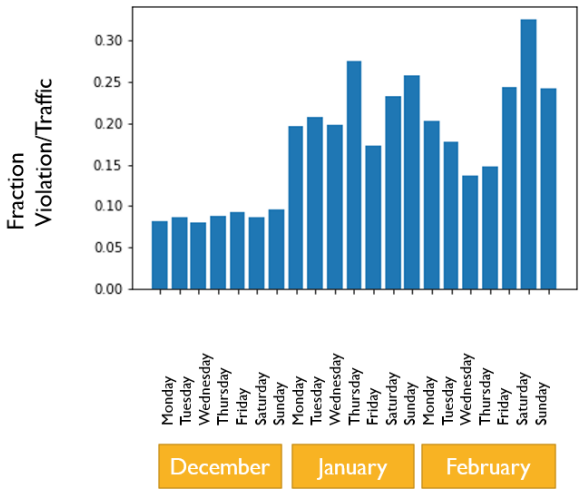
Graphs given below shows the variation of traffic, where X-axis shows the days of the week w.r.t three months.



The traffic vs day of the week(1st bar shows the traffic in a day(say Monday)).



Violations in campus vs day of the week(1st bar shows the violations in a Day(say Monday))



The fraction: Violations / Time duration vs Day of the week(1st bar shows the fraction of Violations in a Day(Say Monday) and Traffic in Campus on that particular day)

		Violation/traffic vs days in a week	traffic vs days in a week	violation vs days in week	
December	Monday	0.081885013	15967	1491	
	Tuesday	0.086592698	11046	2691	
	Wednesday	0.080873433	18115	3123	
	Thursday	0.088301336	23533	1927	
	Friday	0.093380096	12453	2535	
	Saturday	0.086600065	11969	2345	
	Sunday	0.095238095	18418	1595	
January	Monday	0.203565406	6893	2245	
	Tuesday	0.178174313	13724	3190	
	Wednesday	0.136873476	14952	1424	
	Thursday	0.148089778	7324	1777	
	Friday	0.243617599	9742	2511	
	Saturday	0.325692732	17814	1573	
	Sunday	0.24262698	18401	2725	
February	Monday	0.195922801	14000	3849	
	Tuesday	0.207504521	16133	1397	
	Wednesday	0.197671633	15019	2676	
	Thursday	0.274928571	17696	3672	
	Friday	0.172398565	17311	1400	
	Saturday	0.232439522	18455	2526	
	Sunday	0.257749949	20873	4126	

Days	Mean of Fraction
Monday	0.16045774
Tuesday	0.157423844
Wednesday	0.138472847
Thursday	0.170439895
Friday	0.169798753
Saturday	0.214910773
Sunday	0.198538341

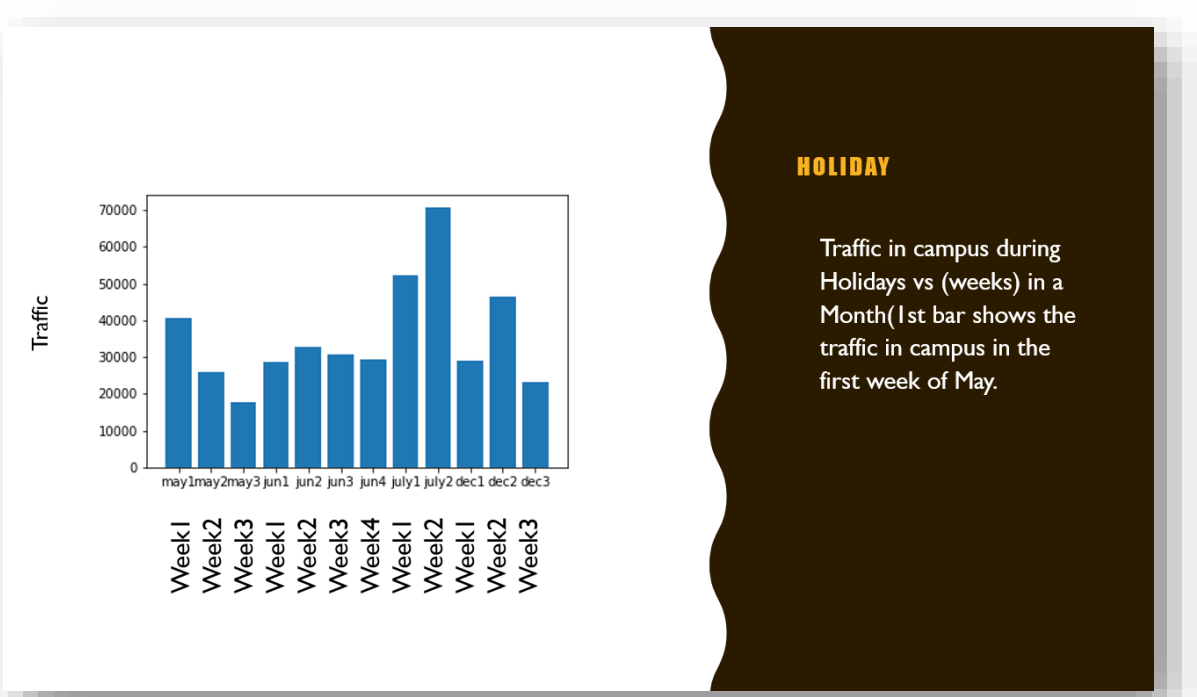
Highest fraction of violation and traffic

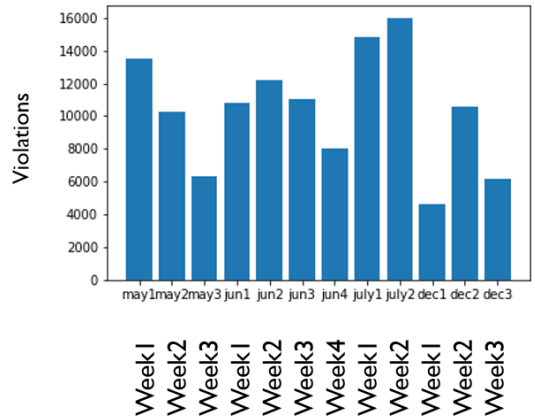
Conclusion:

We found out that overall speed violation fraction was **minimum** on the **Wednesday** and on **Saturday** it is **maximum**.

-Holiday-Wise and Working day-wise analysis

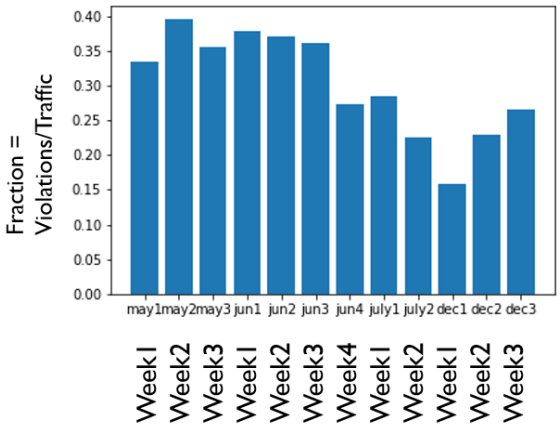
We used weekly data to find several violations on each weekday (Mon, Tue, Wed, Thu, Fri, Sat, Sun). We analyzed the data for 3 months (December, January, February) by finding number of violations on each day of week and further finding fraction of violations by dividing it by traffic on each day of the week. We divided summer and winter holidays of 2018 in weeks and for 3 months (December, January and February) we analyzed according to days of the week.





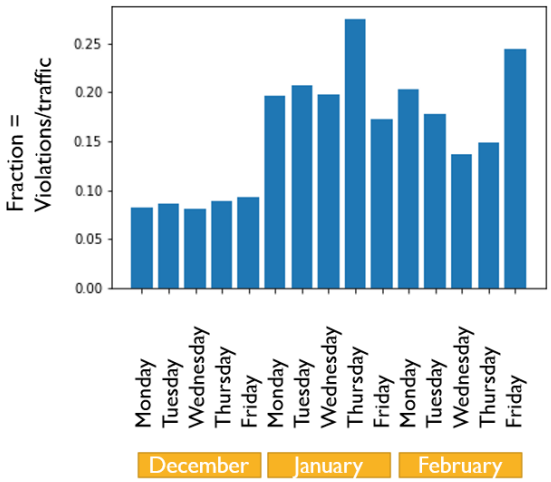
HOLIDAY

Violation in campus during holidays vs (weeks) in a Month(1st bar shows the traffic on campus in the first week of May.



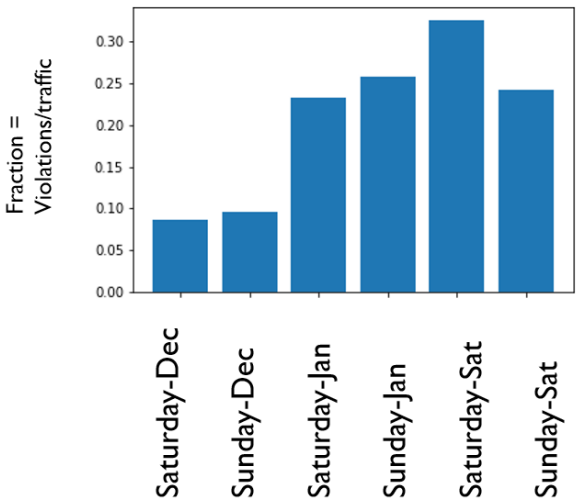
HOLIDAY

The fraction of violations in campus and traffic in campus on holiday days vs (weeks) in a Month(1st bar shows the fraction of violation and traffic in campus in first week of May.



WORKING DAY

The fraction of violation in campus and traffic in the campus on working days vs days(week) in a Month(1st bar shows Violations/Traffic campus on Monday.

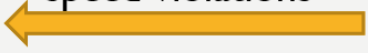


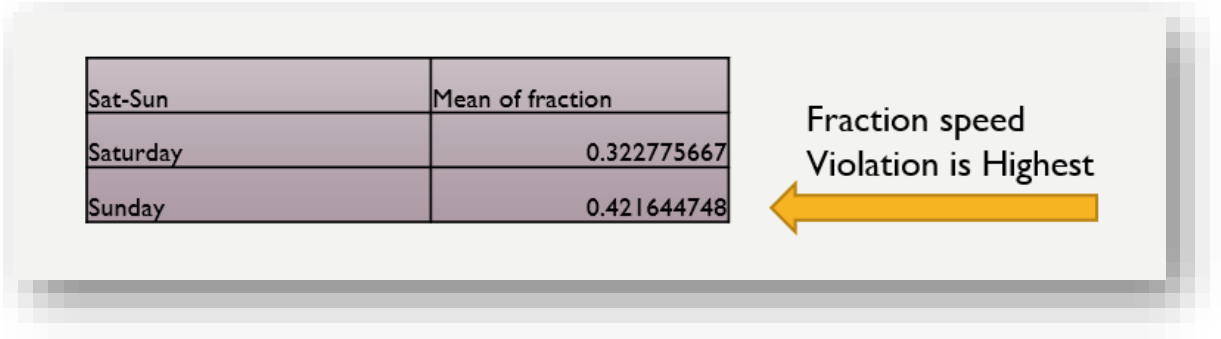
SAT-SUN

The fraction: violations in campus on weekends/ Traffic in campus on weekends vs week in a Month(1st bar shows the fraction of violations in campus on weekends and traffic in campus on weekends(say in 1st week of Dec).

Weeks of Holidays	fraction_of_holidays
May Week1	0.159481428
May Week2	0.228515245
May Week3	0.266124497
June Week1	0.284540831
June week2	0.22619755
June Week3	0.377879221
June Week4	0.371330037
July Week1	0.360630589
July Week2	0.272755019
December Week1	0.333382603
December Week2	0.395594646
December Week3	0.354891001

Working Days	Mean of Fraction
Monday	0.350758019
Tuesday	0.333935185
Wednesday	0.283637453
Thursday	0.328033971
Friday	0.447142863





Conclusion:

We found out that overall speed violation fraction was

- **minimum** on the **first Week of Summer holiday (May)** and it is **maximum** in **second week of winter holiday in December.**

- **minimum** on the **Wednesdays** of December, January, February and it is **maximum** on the **Fridays** of December, January, February**.**

- **minimum** on the **Saturdays** of December, January, February and it is **maximum** on the **Sundays** of December, January, February**.**

GitHub link: https://github.com/Girrajgg/analysis

Blog Link: https://godiyagirraj2.wixsite.com/trafficmonitoring/analysis