UNITED STATES TRAFFIC ACCIDENTS

VS

SAUDI ARABIA CASES

Presented by Champions

Champions Team

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Introduction

Traffic accidents issues

Related 2030 vision goals

01

Dataset description

US Accidents Dataset

This is a countrywide traffic accident dataset, which covers 49 states

Collected from February 2016 to Dec 2021

There are about 1.5 million accident records and has 47 features

1	ID
2	Severity
3	Start_Time
4	End_Time
5	Start_Lat
6	Start_Lng
7	End_Lat
8	End_Lng
9	Distance(mi)
10	Description
11	Number
12	Street
13	Side
14	City
15	County
16	State
17	Zipcode
18	Country
19	Timezone
20	Airport_Code
21	Weather_Timestamp
22	Temperature(F)

23	Wind_Chill(F)
24	Humidity(%)
25	Pressure(in)
26	Visibility(mi)
27	Wind_Direction
28	Wind_Speed(mph)
29	Precipitation(in)
30	Weather_Condition
31	Amenity
32	Bump
33	Crossing
34	Give_Way
35	Junction
36	No_Exit
37	Railway
38	Roundabout
39	Station
40	Stop
41	Traffic_Calming
42	Traffic_Signal
43	Turning_Loop
44	Sunrise_Sunset
45	Civil_Twilight
46	Nautical_Twilight
47	Astronomical_Twilight

02

Dashboard

US Accidents

Severity Distribution

Civil Twilight and Side

9.19
Average of Visibility(mi)

1.05M
Count of Accidents

Total Accidents per Year

US Accidents

Accidents by Traffic Signals

81669

Accidents by Junction

101085

03

Exploratory Data Analysis EDA

US Accidents Locations

The Distribution of Severity Values

Accidents in each Year & month

04

Pig Latin Exploratory Data Analysis

Q 1

Find the total number of accidents by month of 2019, 2020, and 2021. For the highest populated US states, which are California CA, Texas TX, Florida FL, New York NY, and Pennsylvania PA. Then compare the results with the rate of accidents in the highest populated KSA regions

```
Accidents_Count:
(2020,8,PA,1)
(2020,10,CA,1)
(2020,10,FL,1)
(2020,11,FL,1)
(2021,2,CA,367)
(2021,2,FL,198)
(2021,2,NY,15)
(2021,2,PA,88)
(2021,2,TX,85)
(2021,3,CA,11392)
(2021,3,FL,7641)
(2021,3,NY,1433)
(2021,3,PA,2031)
(2021,3,TX,2242)
(2021,4,CA,12140)
(2021,4,FL,7680)
(2021,4,NY,1925)
(2021,4,PA,2093)
(2021,4,TX,2627)
(2021,5,CA,12343)
(2021,5,FL,8183)
(2021,5,NY,2430)
(2021,5,PA,2471)
(2021,5,TX,3239)
(2021,6,CA,18773)
(2021,6,FL,12772)
(2021,6,NY,3167)
(2021,6,PA,3480)
(2021,6,TX,4848)
(2021,7,CA,17841)
(2021,7,FL,11520)
(2021,7,NY,2886)
(2021,7,PA,2982)
(2021,7,TX,4519)
(2021,8,CA,18872)
(2021,8,FL,12673)
(2021,8,NY,2927)
(2021,8,PA,3491)
(2021,8,TX,5247)
(2021,9,CA,21230)
(2021,9,FL,16220)
(2021,9,NY,2931)
(2021,9,PA,3818)
(2021,9,TX,4957)
(2021,10,CA,23397)
(2021,10,FL,18424)
(2021,10,NY,3238)
(2021,10,PA,3837)
(2021,10,TX,4679)
(2021,11,CA,27481)
(2021,11,FL,24470)
(2021,11,NY,4482)
(2021,11,PA,5178)
(2021,11,TX,5849)
(2021,12,CA,44850)
(2021,12,FL,32838)
(2021,12,NY,5468)
(2021,12,PA,5869)
(2021,12,TX,6333)
```

Q 2

Find the number of accidents in each state where the accident side is “R”, and the Amenity is labeled as “FALSE”. Group By the Weather_Condition.

```
(Fair,315139)
(Mostly Cloudy,113455)
(Cloudy,85749)
(Partly Cloudy,78035)
(Clear,72156)
(Light Rain,37884)
(Overcast,31221)
(Scattered Clouds,20139)
(,19485)
(Haze,11263)
(Fog,10318)
(Light Snow,10253)
(Rain,9794)
(Heavy Rain,3963)
(Fair / Windy,3790)
(Thunder in the Vicinity,2589)
(T-Storm,2503)
(Thunder,2255)
(Smoke,2210)
(Light Rain with Thunder,2074)
(Light Drizzle,1818)
(Cloudy / Windy,1602)
(Heavy T-Storm,1447)
(Snow,1419)
(Mostly Cloudy / Windy,1359)
(Partly Cloudy / Windy,856)
(Light Rain / Windy,834)
(Light Thunderstorms and Rain,577)
(Light Snow / Windy,481)
(Sand / Dust Whirlwinds,6)
(Rain Shower,6)
(Light Sleet,6)
(Blowing Snow / Windy,5)
(Light Snow Showers,4)
(Squalls / Windy,4)
(Volcanic Ash,4)
(Light Sleet / Windy,3)
(Small Hail,3)
(Light Thunderstorms and Snow,3)
(Heavy Thunderstorms and Snow,3)
(Snow Grains,3)
(Heavy Ice Pellets,2)
(Drizzle / Windy,2)
(Snow and Sleet,2)
(Partial Fog,1)
(Thunder / Wintry Mix,1)
(Duststorm,1)
(Light Snow with Thunder,1)
(Dust Whirls,1)
(Hail,1)
(Funnel Cloud,1)
(Snow and Thunder / Windy,1)
(Heavy Rain Shower / Windy,1)
(Light Freezing Rain / Windy,1)
(Blowing Snow Nearby,1)
(Sand,1)
(Light Fog,1)
(Freezing Rain / Windy,1)
```

Q 3

The highest temperature recorded in KSA was between 45(113) C(F) – 53(127) C(F) degrees. Count the number of accidents when the temperature is in the range between 100 to 127 degrees Fahrenheit, and when the traffic calm is 'FALSE'. Then, conclude if there is a relation between the temperature and the increased probability of accidents.

Accidents_Count:

(100.0,1186)	(106.9,3)
(100.2,3)	(107.0,182)
(100.4,109)	(107.1,40)
(100.6,1)	(107.2,1)
(100.8,2)	(107.6,22)
(100.9,118)	(108.0,202)
(101.0,587)	(109.0,163)
(101.1,1)	(109.4,17)
(101.3,1)	(109.6,1)
(101.5,2)	(109.8,1)
(101.7,1)	(109.9,26)
(101.8,2)	(110.0,90)
(102.0,897)	(111.0,115)
(102.2,76)	(111.2,10)
(102.4,1)	(111.9,12)
(102.6,1)	(112.0,55)
(102.7,1)	(113.0,40)
(102.9,110)	(114.0,28)
(103.0,446)	(114.1,8)
(103.5,5)	(114.8,4)
(104.0,595)	(115.0,19)
(104.4,1)	(116.0,4)
(104.7,1)	(116.1,1)
(104.9,1)	(116.6,2)
(105.0,246)	(117.0,12)
(105.1,68)	(118.0,3)
(105.4,2)	(118.4,3)
(105.8,34)	(119.0,4)
(106.0,365)	
(106.3,1)	
(106.5,1)	

Q 4

Find the minimum and maximum temperatures when accidents occurred in the following states: TX, GA, AL, and FL. Group by the state

```
(AL,196.0,25.0)
(FL,156.0,27.0)
(GA,97.0,18.0)
(TX,129.2,14.0)
```

Q 5

The sand cover in the Kingdom of Saudi Arabia constitutes 34% of the total area of the Kingdom, which increases the activity and speed of sandstorms. Wind speed varies during sandstorms in Saudi Arabia, and increases to range between 54-63 km/h and low humidity(%). For each severity level, find how many accidents happened when the wind speed(mph) is 20 or above and humidity is less than 30%

```
Accidents_Count:
(2,3158)
(3,114)
(4,157)
```

Q 6

What is the average wind speed for accidents in each county when the wind is blowing from the west and the temperature is 25 degrees or lower?

```
(Natrona,33.400001525878906)
(Clear Creek,32.25)
(Allegany,28.799999237060547)
(Stearns,27.050000190734863)
(San Bernardino,25.299999237060547)
(Twin Falls,24.200000762939453)
(Lincoln,24.200000762939453)
(Minidoka,23.0)
(Rensselaer,22.449999809265137)
(Cuyahoga,21.99090931632302)
(Covington City,21.899999618530273)
(Centre,20.700000762939453)
(Albany,19.950000127156574)
(Niagara,19.600000381469727)
(Van Wert,19.600000381469727)
(Lebanon,19.600000381469727)
(Eaton,19.600000381469727)
(Ingham,19.0)
(Onondaga,18.61875009536743)
(Saginaw,18.439999961853026)
(Elkhart,18.399999618530273)
(Mckean,18.399999618530273)
(Prince George's,17.300000190734863)
(Lee,17.299999237060547)
(Loudoun,17.299999237060547)
(Chippewa,17.299999237060547)
(Morris,16.699999809265137)
(Winnebago,16.53333282470703)
(Saint Louis,16.100000381469727)
(Henrico,16.100000381469727)
(Bronx,15.824999809265137)
(Northampton,15.550000190734863)
(Waukesha,15.488888846503365)
(Norfolk,15.314285414559501)
(Shawano,15.274999856948853)
(Westchester,15.199999809265137)
(Bland,15.0)
(Camden,15.0)
(Carbon,15.0)
(Lehigh,15.0)
(Fairfax,15.0)
(Mono,15.0)
(Burlington,15.0)
(Somerset,14.999999364217123)
(Berrien,14.799999986376081)
(Clinton,14.78333330154419)
(Hennepin,14.771014420882516)
(Jefferson,14.588888592190212)
(Cambria,14.0)
(Genesee,13.985714571816581)
(Westmoreland,13.800000190734863)
(Warren,13.800000190734863)
(Davis,13.800000190734863)
(Dunn,13.800000190734863)
(Clearfield,13.566666497124565)
(Wright,13.466666539510092)
(Queens,13.139999961853027)
(Ramsey,13.086111214425829)
(Portage,13.066666603088379)
(Nassau,13.050000031789144)
(Kalamazoo,12.900000190734863)
(Sauk,12.699999809265137)
(Rock,12.699999809265137)
(Frederick,12.699999809265137)
(Scott,12.699999809265137)
(DeKalb,12.699999809265137)
(St. Louis,12.699999809265137)
(Windham,12.699999809265137)
(Butler,12.699999809265137)
```

Q 7

How many accidents occurred during the sunset when the humidity percentage was between 85 and 100?

(85683)

Q 8

How many accidents with a distance of the car drifting to a stop of more than 3 miles and with the highest severity of 4?

(5188)

Q 9

How many accidents happened that had a distance of or more than 0.5 miles and with a severity of 2 or more? Split the results for each accident side and save each of them in a separate dataset.

(L, 27288)

(R, 392535)

Q 1 0

What is the average distance for accidents for each side?

```
(L,0.31062299907573987)
(R,0.9159718676994905)
```

Q 1 1

Show accidents that occurred with their severity, month and year that have the weather condition as 'Sand' or 'Sand / Dust Whirlwinds' or 'Sand / Windy' in ascending order.

```
(2,4,2021,Sand / Dust Whirlwinds)
(2,4,2021,Sand / Dust Whirlwinds)
(2,6,2021,Sand / Dust Whirlwinds)
(2,7,2016,Sand)
(2,9,2021,Sand / Dust Whirlwinds)
(2,9,2021,Sand / Dust Whirlwinds)
(2,9,2021,Sand / Dust Whirlwinds)
(2,10,2021,Sand / Windy)
(2,10,2021,Sand / Windy)
```

Q 1 2

Find the total number of accidents in these cities Cleveland, Westerville, Fairdale, Youngstown, and Lake Forest when the weather is Fog , Fog / Windy, and the Visibility is less or equal to 0.5 mi group by year.

```
(2016,2)
(2017,1)
(2021,11)
```

Q 1 3

What is the Maximum and Minimum visibility value for accidents that occurred at 'night'. Group the result by year.

```
(2016,60.0,0.0)
(2017,60.0,0.0)
(2020,10.0,0.75)
(2021,140.0,0.0)
```

Q 1 4

What is the Maximum and Minimum visibility value for accidents that occurred during the 'day'? Group the result by year.

```
(2016,111.0,0.0)
(2017,80.0,0.0)
(2018,10.0,10.0)
(2019,10.0,10.0)
(2020,10.0,3.0)
(2021,100.0,0.0)
```

Q 1 5

What is the Average wind speed where the severity is 2 and Junction is True? Group by month.

```
(1,9.246437009520664)
(2,9.758325313236762)
(3,9.188787361927856)
(4,9.007891312005821)
(5,8.796491994434396)
(6,8.275506244828025)
(7,7.768450184093378)
(8,7.304615847548962)
(9,7.301613157509611)
(10,7.4693058304777376)
(11,6.938817196750652)
(12,7.33798948111484)
```

Q 1 6

Find the total number of accidents where the weather condition is cloudy and the state: TX, PX, and FL sort the result by year.

```
(2016,13)
(2017,7)
(2021,18514)
```

Q 1 7

What is the Average precipitation for the occurred accidents grouped by month?

```
(1,0.07783146376025413)
(2,0.036029100425975034)
(3,0.007879681612952693)
(4,0.006063442599513 12)
(5,0.006773309463624175)
(6,0.010632766632945056)
(7,0.010865065153074855)
(8,0.009269080263029672)
(9,0.00807935677003483)
(10,0.006601139358833231)
(11,0.004944148444712884)
(12,0.0074871104426414165)
```

Q 1 8

Find the total number of accidents where the state is Texas or Florida or Alabama and the visibility is 6. Sort the result by the weather condition

```
(Light Rain,473)
(Cloudy,303)
(Haze,260)
(Rain,241)
(Fair,148)
(T-Storm,128)
(Mostly Cloudy,119)
(Overcast,118)
(Light Rain with Thunder,114)
(Partly Cloudy,69)
(Clear,50)
(Heavy Rain,30)
(Thunder,24)
(Light Thunderstorms and Rain,21)
(Scattered Clouds,17)
(Light Drizzle,17)
(Thunderstorms and Rain,12)
(Heavy T-Storm,11)
(Light Rain / Windy,8)
(Shallow Fog,7)
(Thunder in the Vicinity,5)
(Heavy Thunderstorms and Rain,5)
(Haze / Windy,4)
(Widespread Dust,4)
(Rain / Windy,3)
(Light Snow,2)
(Smoke,2)
(,2)
(T-Storm / Windy,1)
```

Q 1 9

How many accidents occurred where there was a roundabout?

(47)

Q 2 0

Number of accidents where the Stop sign is True

(19075)

06

Dataset Preprocessing

Handling outliers

THE FIRST STEP WE DID IS DETECTING OUTLIERS IN THE COLUMNS USING A BOX PLOT.

Handling outliers

DEFINED A FUNCTION CALLED 'OUTLIERS'

```
def outliers(df,ft):
  Q1 =df[ft].quantile(0.25)
  Q3 =df[ft].quantile(0.75)
  IQR = Q3 - Q1

  lower_bound = Q1 - 1.5 * IQR
  upper_bound = Q3 + 1.5 * IQR

  ls = df.index[ (df[ft] < lower_bound) | (df[ft] > upper_bound) ]

  return ls
```

Handling outliers

CREATING AN EMPTY LIST

```
index_list = []
for feature in ['Distance(mi)','Wind_Chill(F)','Pressure(in)','Visibility(mi)',
  index_list.extend(outliers(df, feature))
```

DEFINE A FUNCTION CALLED 'REMOVE'

```
def remove(df, ls):
  ls = sorted(set(ls))
  df = df.drop(ls)
  return df
```

Implementing oversampling

WE WILL OVERSAMPLE THE FIRST AND SECOND CATEGORY.

Severity	count
3	329
2	506721
4	9363

ISOLATE ALL THE DATA WHERE THE SEVERITY IS 2 AND THEN THE DATA WHERE THE SEVERITY IS 3

```
severity2_df = sparkDF.filter(col("Severity") == 2)
severity3_df = sparkDF.filter(col("Severity") == 3)
```

Implementing oversampling

CALCULATE THE RATIO TO DETERMINE THE DIFFERENCE

```
ratio = int(severity2_df.count()/severity3_df.count())
print("ratio: {}".format(ratio))
```

```
ratio: 1540
```

WE CAN NOW SEE THAT THE SEVERITY3_DF HAS A NEW SIZE WHICH IS QUITE SIMILAR TO SEVERITY2_DF

```
#duplicate the minority rows
oversampled_df = severity3_df.withColumn("dummy", explode(array([lit(x) for x in a]
```

```
3 oversampled_df.count()
506660
```

Implementing oversampling

COMBINE BOTH ROWS.

```
combined_df = severity2_df.unionAll(oversampled_df)
```

CHECKING THE RATIO.

```
#lets isolate all the data where the Severity are 2 and then the data where the Severity are 4.

severity2_df = sparkDF.filter(col("Severity") == 2)
severity4_df = sparkDF.filter(col("Severity") == 4)


#we will calculate the ratio to determine the difference between the number of each severity.
ratio = int(severity2_df.count()/severity4_df.count())
print("ratio: {}".format(ratio))
```

```
ratio: 54
```

THE COUNT OF RECORDS FOR EACH VALUE IN THE 'SEVERITY' COLUMN

Severity	count
2	506721
3	506660
4	505602

07

Apache PySpark Machine Learning models

– Classification –

COMBINE FEATURE COLUMNS

```
cols = final_df.columns #extract the column names from the dataframe
cols.remove('Severity') #remove severity -> we need this to be our label

#vector assembler will take all the columns and convert them into one column called features
assembler = VectorAssembler(inputCols=cols, outputCol='features', handleInvalid = "skip")

#the .transform will apply the changes here
final_df = assembler.transform(final_df)
```

SPLIT DATA

```
# We will now create a new dataframe only consisting of the features column and the label column
df_data = final_df.select(col('features'), col('severity').alias('label'))

#simple data splitting
df_train, df_test = df_data.randomSplit([0.8, 0.2])
```

DECISION TREE CLASSIFIER MODEL

INITIALIZE & FIT THE MODEL

```
# Decision Tree
dt = DecisionTreeClassifier(labelCol="label", featuresCol="features")
model_dt = dt.fit(df_train)
```

MODEL'S ACCURACY

```
from pyspark.ml.evaluation import *

dt_eval= MulticlassClassificationEvaluator(predictionCol="prediction", labelCol="label")
dt_ACC  = dt_eval.evaluate(pred_dt, {dt_eval.metricName:"accuracy"})
print("Decision Tree Performance Measure")
print("Accuracy = %0.2f" % dt_ACC)
```

```
Decision Tree Performance Measure
Accuracy = 0.80
```

MODEL'S CONFUSION MATRIX

	prediction_label	2	3	4
0	2.0	64504	0	19824
1	3.0	227	100360	2432
2	4.0	36294	0	77314

RANDOM FOREST CLASSIFIER MODEL

INITIALIZE & FIT THE MODEL

```
# Random Forest
rf = RandomForestClassifier(labelCol="label", featuresCol="features", numTrees=10)
model_rf = rf.fit(df_train)
```

MODEL'S ACCURACY

```
rf_eval= MulticlassClassificationEvaluator(predictionCol="prediction", labelCol="label")
rf_ACC  = rf_eval.evaluate(pred_rf, {rf_eval.metricName:"accuracy"})
print("Random Forest Performance Measure")
print("Accuracy = %0.2f" % rf_ACC)
```

```
Random Forest Performance Measure
Accuracy = 0.77
```

MODEL'S CONFUSION MATRIX

	prediction_label	2	3	4
0	2.0	58905	927	22745
1	3.0	1181	99433	2633
2	4.0	40939	0	74192

LOGISTIC REGRESSION MODEL

INITIALIZE & FIT THE MODEL

```
# Logistic Regression
lr = LogisticRegression(maxIter=10, labelCol="label", featuresCol="features")
model_lr = lr.fit(df_train)
```

MODEL'S ACCURACY

```
lr_eval= MulticlassClassificationEvaluator(predictionCol="prediction", labelCol="label")
lr_ACC  = lr_eval.evaluate(pred_lr, {lr_eval.metricName:"accuracy"})
print("Logistic Regression Performance Measure")
print("Accuracy = %0.2f" % lr_ACC)
```

```
Logistic Regression Performance Measure
Accuracy = 0.75
```

MODEL'S CONFUSION MATRIX

	prediction_label	2	3	4
0	2.0	65317	0	36479
1	3.0	234	100360	3135
2	4.0	35474	0	59956

NAIVE BAYES MODEL

INITIALIZE & FIT THE MODEL

```
# Naïve Bayes
nb = NaiveBayes(labelCol="label", featuresCol="features", modelType='multinomial')
model_nb = nb.fit(df_train)
```

MODEL'S ACCURACY

```
nb_eval= MulticlassClassificationEvaluator(predictionCol="prediction", labelCol="label")
nb_ACC  = nb_eval.evaluate(pred_nb, {nb_eval.metricName:"accuracy"})
print("Naïve Bayes Performance Measure")
print("Accuracy = %0.2f" % nb_ACC)
```

```
Naïve Bayes Performance Measure
Accuracy = 0.13
```

MODEL'S CONFUSION MATRIX

	prediction_label	2	3	4
2	0.0	12292	3406	6923
1	1.0	49422	83100	45762
0	2.0	39311	13854	46885

08

Apache PySpark ML models Comparison

ML Evaluation as Dataframe

COMPARING ALL OF OUR MODELS USING DIFFERENT METRICS

	Accuracy	F1-Score	Weighted Precision	Weighted Recall
Decision Tree	0.804698	0.802729	0.806786	0.804698
Random Forest	0.772640	0.769755	0.773808	0.772640
Logistic Regression	0.749723	0.747623	0.745891	0.749723
Naïve Bayes	0.130621	0.131254	0.131894	0.130621

09

Best Apache PySpark ML model improvement

Model Optimization

THE DECISION TREE CLASSIFIER IS OPTIMIZED WITH A MAXIMUM DEPTH OF 19

```
# Decision Tree - with the best params -> max depth = 19
dt = DecisionTreeClassifier(labelCol="label", featuresCol="features", maxDepth=19)
model_dt = dt.fit(df_train)
```

```
Decision Tree Performance Measure
Accuracy = 0.94
```

05

Apache Kafka Application

Apache Kafka weather-related tweets sentiment analysis application

- The US accident dataset strongly relays on the weather factor.
- we implemented a sentiment analysis app for weather-related tweets using Kafka
- The number of tweets collected is 5000 tweets.

Pie Chart for representing polarity as proportions for the collected tweets

Word cloud for positive sentiments

weather
cold weather
weather forecast
good
people
cold
amp
warm
top story
story
plus
one
check today
today
top
plus weather
forecast
celebrity
holiday
birthday
celebrity birthday
weather turn
last minute
please
help
week
want
right
new year
day
flight
still
family
day history
world cup
going u
home
always
winter weather
thank
happy
look back
nice
take
go
time
know
hope
even
thing
make
snow
keep
much
high
border
work
better
best
lol
come
due
history check
southwestair
good morning
temperature
ericgarcia
safe
new
well
way
year
really
back day
love
great
need
many
see
got
turn last
look
birthday
yes
think
minute
christmas
every
global warming
climate change
warming
weather condition
weather
condition
around
area
change
cooking
house
morning
weather
warmer
weather
year
present
warmer
weather
holiday
weather
warming
climate change
warming
change
around
area
change
cooking
house
morning
weather
condition
weather
condition
around
area
change
cooking
house
morning
weather
condition
weather
condition
around
area
change
cooking
house
morning
weather
condition
weather
condition

Word cloud for negative sentiments

weather
people
pressure
hpa
wind
sk
regina
weather
temp
ericgarcia
southwestair
airline
dew
pressure
weather
temp
dew
flight
today
due
day
cold
new
need
know
one
time
bad
snow
kph
u
amp
back
go
going
mood
risk
chill
humidity
border
dec
weather
freezing
weather
related
bad
weather
related
health
headache
pain
health
migraine
kph
humidity
temperature
state
issue
buffalo
texas
let
think
illegal
blame
low
severe
weather
stop
year
home
fault
good
life
want
death
delay
around
air
current
country
storm
migrant
much
many
hate
climate
workeveryone
southwest
american
right
point
take
condition
outside
area
winter
storm
shit
worst
left
feel
rain
way
already
never
sick
travel
street
christmas
continue
system
even
man
happen
got
problem
cause
wind
chill
weather
cold
climate
change
make
thing
pain
mood
briangist
headache
migraine
headache
getting
see
say
week
crisis
update
nothing
really
least
still
wrong
fuck
kph
wind
weather
winter
weather
event
weather
condition
weather
warm
weather
winter
warm
weather
winter
weather
warm
weather
winter
weather
warm
weather
winter
weather

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Conclusion and Future Work

Thank you

Champions Team