CISC 5950 — Project 1

In CISC 5950, we have learned the following topics,

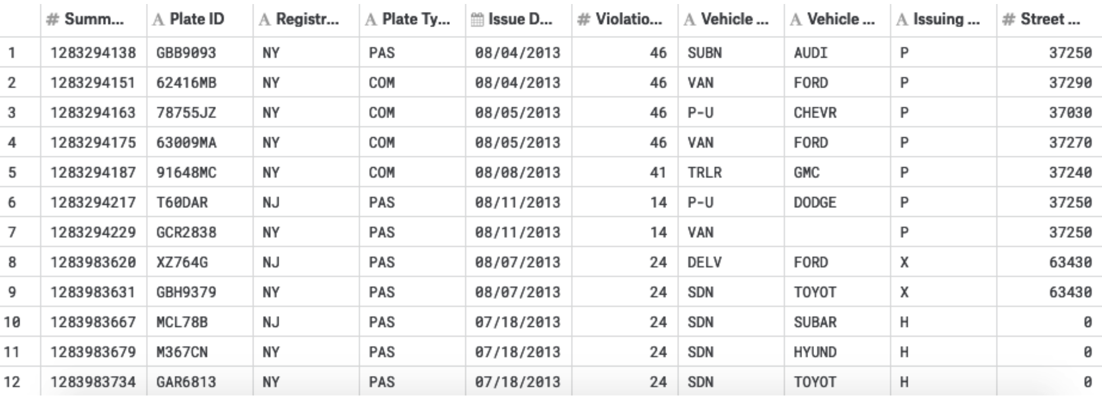
1. Set up a 3-node cluster with Hadoop Distributed File System and run examples.
2. On top of HDFS, set up the cluster with MapReduce programming framework.
3. Run examples of MapReduce programs.
4. Scheuling on the Cloud.

In this project, we are going to design our own Hadoop MapReduce-based program to analyze the data. The project consist of two parts.

NY Parking Violations

The NYC Department of Finance collects data on every parking ticket issued in NYC (10M per year!). This data is made publicly available to aid in ticket resolution and to guide policy-makers.

You can find the data from the Link of NYC Parking Data.



	# Summ...	A Plate ID	A Registr...	A Plate Ty...	Issue D...	# Violatio...	A Vehicle ...	A Vehicle ...	A Issuing ...	# Street ...
1	1283294138	GBB9093	NY	PAS	08/04/2013	46	SUBN	AUDI	P	37250
2	1283294151	62416MB	NY	COM	08/04/2013	46	VAN	FORD	P	37290
3	1283294163	78755JZ	NY	COM	08/05/2013	46	P-U	CHEVR	P	37030
4	1283294175	63009MA	NY	COM	08/05/2013	46	VAN	FORD	P	37270
5	1283294187	91648MC	NY	COM	08/08/2013	41	TRLR	GMC	P	37240
6	1283294217	T60DAR	NJ	PAS	08/11/2013	14	P-U	DODGE	P	37250
7	1283294229	GCR2838	NY	PAS	08/11/2013	14	VAN		P	37250
8	1283983620	XZ764G	NJ	PAS	08/07/2013	24	DELV	FORD	X	63430
9	1283983631	GBH9379	NY	PAS	08/07/2013	24	SDN	TOYOT	X	63430
10	1283983667	MCL78B	NJ	PAS	07/18/2013	24	SDN	SUBAR	H	0
11	1283983679	M367CN	NY	PAS	07/18/2013	24	SDN	HYUND	H	0
12	1283983734	GAR6813	NY	PAS	07/18/2013	24	SDN	TOYOT	H	0

The above figure shows several records, where each row represents a parking ticket and the columns are the details of the tickets.

To start the project, you have to,

1. Start the 3-node cluster
2. Set up the HDFS
3. Store the data in HDFS

4. Set up the MapReduce framework along with the scheduler for resource management.

By analyzing the data, we need to answer the following,

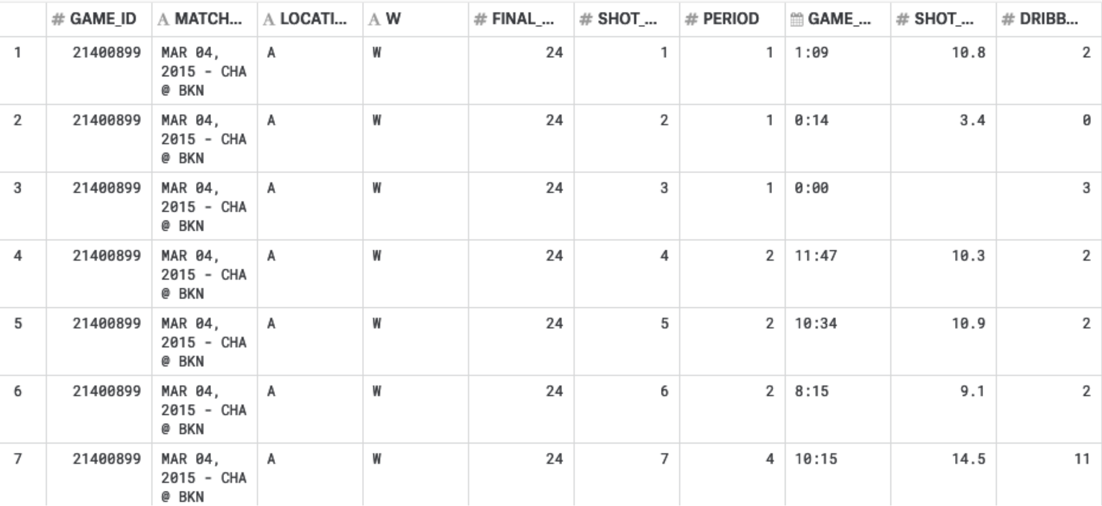
- When are tickets most likely to be issued?
- What are the most common years and types of cars to be ticketed?
- Where are tickets most commonly issued?
- Which color of the vehicle is most likely to get a ticket?

NBA Shot Logs

https://www.kaggle.com/dansbecker/nba-shot-logs

This is the DATA (https://www.kaggle.com/dansbecker/nba-shot-logs) on shots taken during the 2014-2015 season, who took the shot, where on the floor was the shot taken from, who was the nearest defender, how far away was the nearest defender, time on the shot clock, and much more. The column titles are generally self-explanatory.

The above figure shows several records, where each row represents a shot and the columns are the details of the shot, e.g. the game ID, who is the defender, what is the distance between them.



	# GAME_ID	A MATCH...	A LOCATI...	A W	# FINAL_...	# SHOT_...	# PERIOD	GAME_...	# SHOT_...	# DRIBB...
1	21400899	MAR 04, 2015 - CHA @ BKN	A	W	24	1	1	1:09	10.8	2
2	21400899	MAR 04, 2015 - CHA @ BKN	A	W	24	2	1	0:14	3.4	0
3	21400899	MAR 04, 2015 - CHA @ BKN	A	W	24	3	1	0:00		3
4	21400899	MAR 04, 2015 - CHA @ BKN	A	W	24	4	2	11:47	10.3	2
5	21400899	MAR 04, 2015 - CHA @ BKN	A	W	24	5	2	10:34	10.9	2
6	21400899	MAR 04, 2015 - CHA @ BKN	A	W	24	6	2	8:15	9.1	2
7	21400899	MAR 04, 2015 - CHA @ BKN	A	W	24	7	4	10:15	14.5	11

By analyzing the data, we need to answer the following,

- For each pair of the players (A, B), we define the **fear sore** of A when facing B is the hit rate, such that B is closet defender when A is shoting. Based on the **fear sore**, for each player, please find out who is his ”most unwanted defender”.

- For each player, we define the **comfortable zone** of shooting is a matrix of,

  {SHOT_DIST, CLOSE_DEF_DIST, SHOT_CLOCK}

  Please develop a MapReduce-based algorithm to classify each player’s records into 4 comfortable zones. Considering the hit rate, which zone is the best for James Harden, Chris Paul, Stephen Curry and Lebron James.

Bonus Question

The biggest challenge when using K-Means is to decide on the number of clusters. Having more clusters creates some small classes with very few records, while having less clusters leads to classes that are too general.

Based on a K-Means algorithm above, try to answer the following question,

- Given a Black vehicle parking illegally at 34510, 10030, 34050 (street codes). What is the probability that it will get an ticket? (very rough prediction).
- At 10 am, I want to go to Lincoln Center and I just want to walk within 0.5 mile. Where should I park? (Divided into zones).

Grading Rubric

You should complete the lab in groups, up to 3 students.

(70%) P1: NY Parking Violations (17.5% * 4);
(20%) P2: NBA Shot Logs (10% * 2);
(10%) Two Reports the your design and experiments, please as detail as possible and must include your screenshots; In addition, you also need to write two README files for P1 and P2.
(5%) Bonus Question;

Submission

You are expected to upload a zip(or tar) file before the deadline to Blackboard. The zip file should include two (or three) folders and a report,

- Part1: your codes and README
- Part2: your codes and README
- Bonus: your codes and README
- A report

Userful Links

1. Analysis of NYC Parking Tickets.
2. Preliminary Data Visualization.
3. Exploring 42.3M NYC Parking Tickets.
4. NY Parking Violations Issued .
5. Insights From Raw NBA Shot Log Data.
6. Investigating the hot hand phenomenon in the NBA (CODE).
7. Parallel K-Means Clustering Based on MapReduce.
8. NBA 16-17 regular season shot log.
9. The Fear Factor.
10. The Best And Worst Defenders.
11. NBA Classification.
12. Stephen Curry's Decision Tree.
13. Points per Match (ATL vs WAS only).
14. MapReduce-kmeans.