



TOYOTA

AI IS599 Course - Spring 2019

Analysis and Interpretation of Data

**Twitter Sentiment Analysis
of Toyota brand by States in USA**

Acknowledge

- **Research Objective:** Analyze customer behavior towards Toyota auto brand in US market in May.
- **Research design:** collect Tweets and user's data; using Python to analyze sentiment polarity and text measures; using Tableau to visualize analysis.
- **Significance of study:** understand customer behavior and trends of auto buyers on social media, events such as politics that impact on brand's recognition, new product's expectation.

Outline

- Introduction : Toyota background and SWOT
- Hypotheses and Analysis Questions
- Significance of study
- Scope and Sampling
- Sentiment Analysis by US states
- Word Cloud
- Summary, Trends , Recommendations, and Future Study
- References
- Appendices

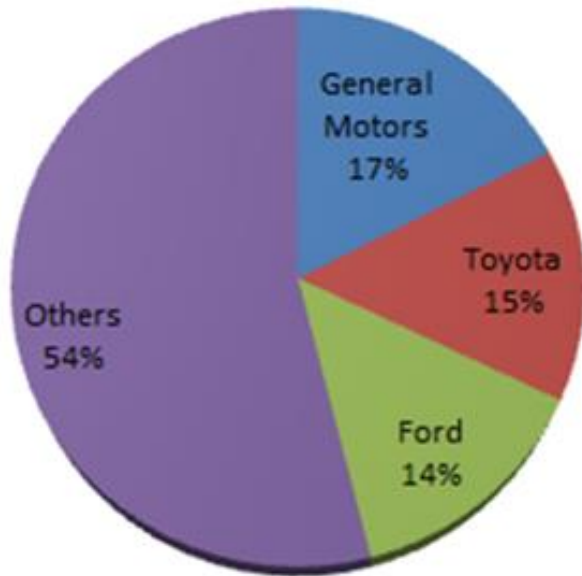
About Toyota Motor Corporation

- Japanese company, founded in 1926
- Core business: design, manufacture, and sale of automobile, materials handling equipment and textile machinery.
- Automobile: vehicles, car electronics, car air-conditioning compressors, engines.
- Main countries: Japan, North America, Europe and Asia
- Brands: Toyota, Lexus, Daihatsu and Hino



Toyota in USA - 1957

Toyota market share in USA 2018



33 YEARS MANUFACTURING ² IN THE U.S.	2,426,672 2018 VEHICLES SOLD IN THE U.S.	1,241,615 2018 VEHICLES PRODUCED IN THE U.S. ²	\$32.6B PARTS AND MATERIALS PURCHASED ³
\$27.3B DIRECT INVESTMENT IN THE U.S. ⁴	OVER 179,000 PEOPLE WORKING ACROSS THE U.S. ⁵	10 PLANTS IN THE U.S. AND 14 IN NORTH AMERICA. ⁶	NEARLY 1,500 TOYOTA AND LEXUS DEALERS
27.6M VEHICLES BUILT IN THE U.S. AND COUNTING ²	\$30B DEALER INVESTMENT IN THE U.S. ⁷	OVER \$1M SPENT GLOBALLY EVERY HOUR ON R&D ⁸	\$1.05B IN TOTAL U.S. DONATIONS
NEARLY 116,000 U.S. - BUILT ² TOYOTAS EXPORTED TO 32 COUNTRIES IN 2018	15 HYBRID MODELS IN THE U.S. PLUS THE MIRAI FCV IN SELECT MARKETS ⁹	12 SITES WITH CERTIFIED WILDLIFE HABITAT CONSERVATION PROGRAMS	470,100 JOBS CREATED IN THE U.S. ¹⁰

TOYOTA OPERATIONS BY STATE

UNITED STATES



Dots represent category presence within a state and not quantity of location.

- Offices
- Engineering & Manufacturing
- Design, Research & Development
- Dealerships



Sienna

since 1997
(in IN since 2003)



Sequoia

since 2000



Highlander

since 2009
(Highlander Hybrid in IN since 2013)



Camry

since 1988
(Camry Hybrid in KY since 2006)



Avalon

since 1994
(Avalon Hybrid in KY since 2012)



Lexus ES 350

since 2015

INDIANA

KENTUCKY

TEXAS

MISSISSIPPI



Tacoma

since 1991
(in TX since 2010)



Tundra

since 1998
(in TX since 2006)



Corolla

since 1986
(in MS Since 2011)

SWOT

Strengths

- Strong focus on R&D
- Strong market position and brand recognition
- Extensive production and distribution network

Weaknesses

- Depend on Japanese and US markets
- Poor allocation of resources
- Production recalls could affect brand image

Opportunities

- Innovative car
- Growing automotive industry
- Partnership with BMW

Threats

- Intense competition
- Political/economic impact on dominant markets
- Decline sales on key models

Hypotheses

- Decline sale in April on sedan model Camry and Corolla while RAV4 and Tacoma up:
 - Customer prefer SUV or mini truck instead sedan (sale sedan decrease, slight increase in SUV)
 - Interest rates for foreign cars
 - New models higher price, excess supply
- Political Issues: trading and investment term that influence on the brand.

Analysis Questions

- What is the rate of using data by users?
- What is the percentage of negative/positive sentiment?
- Which states does Toyota brand more popular based on polarity?
- What topic trends that Tweet mention?

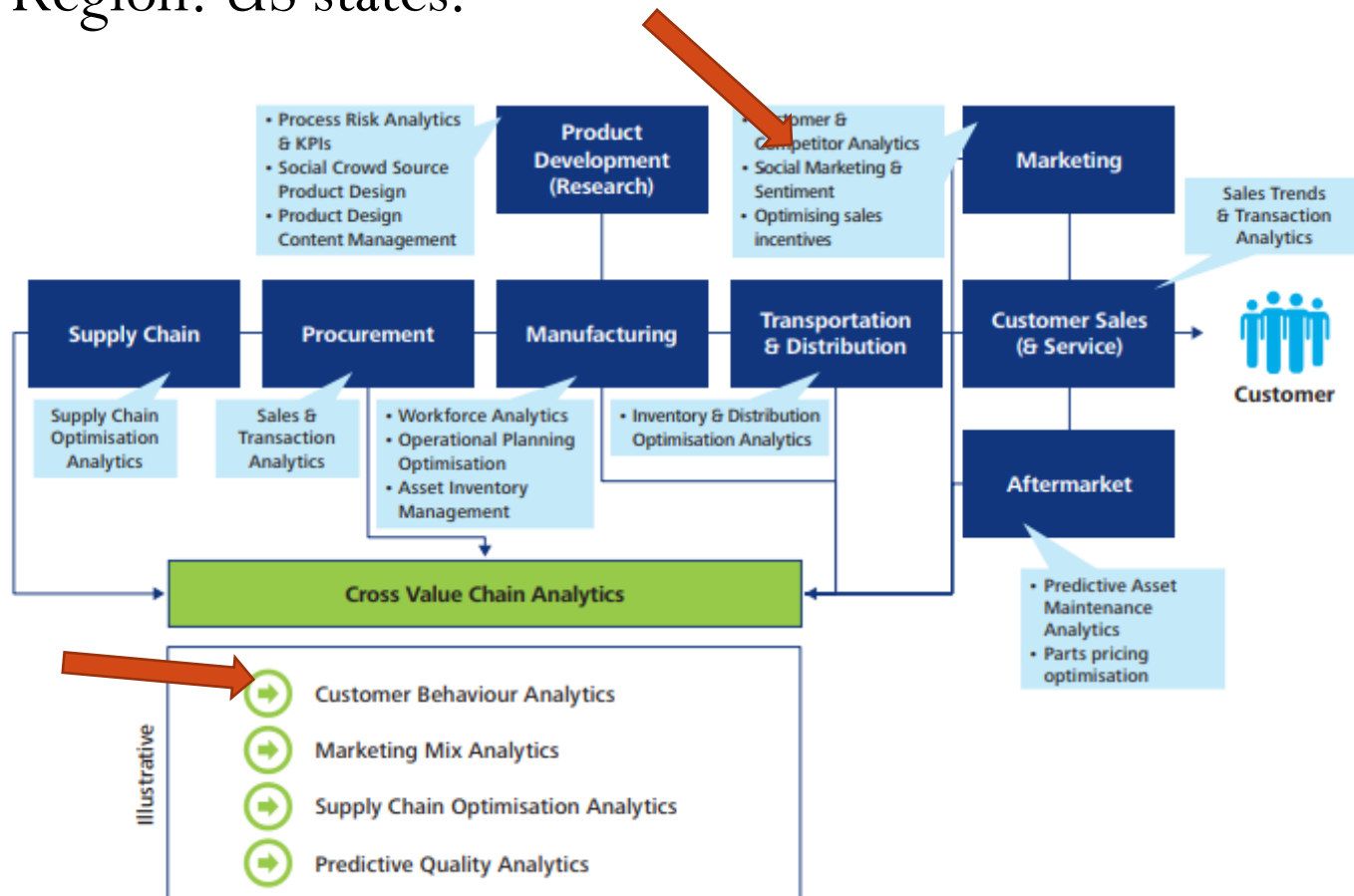
Significance of Study

By analyzing Tweet data focused on US market:

- Understanding customer needs and behaviors to build compelling, differentiated offers throughout the sale and ownership cycle which are relevant in today's digital environment.
- Identifying objective elements impact of brand recognition and sales.
- Understanding potential value of different customer regions.
- Using that knowledge to strategically target new customers whilst maintaining the loyalty of existing customers.
- Improving customer experience to drive retention.

Research Scope

- Social media Twitter, sentiment analytics and word-count
- Region: US states.



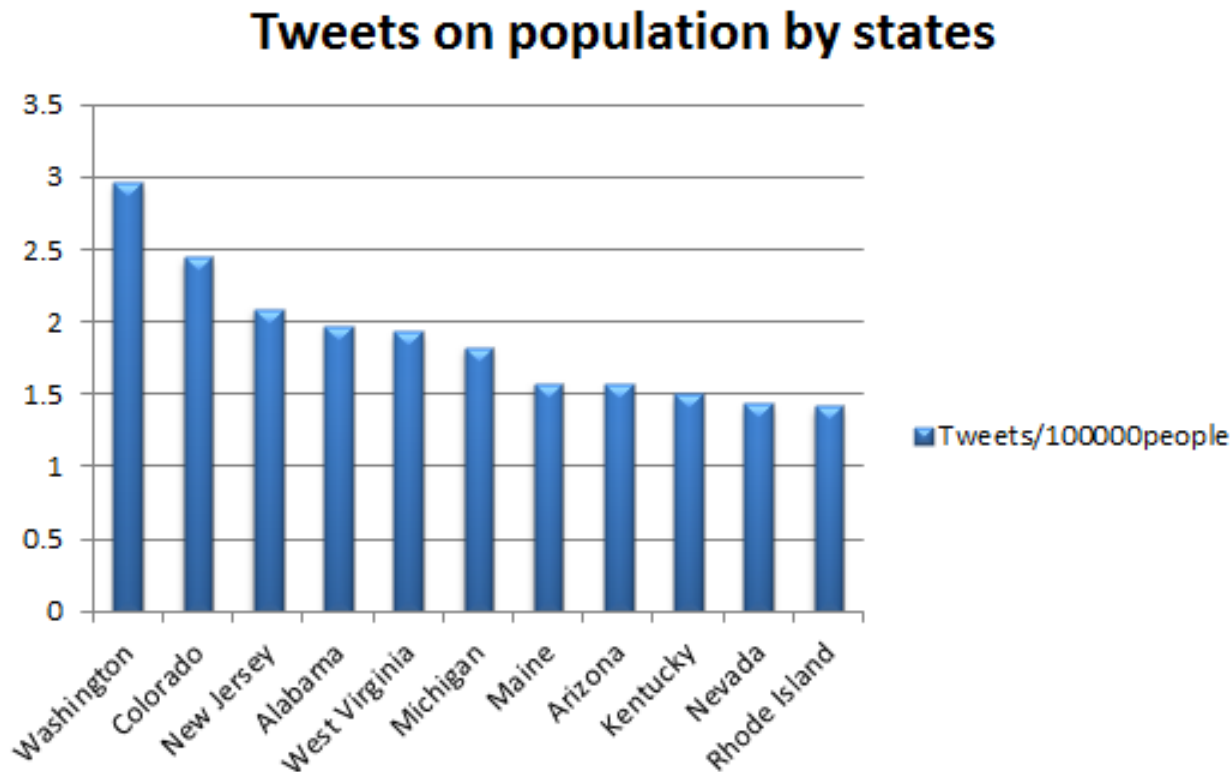
Sampling

- Collect data from Twitter using the twitter API.
- Search keywords: “@Toyota” “#Toyota”
- 52 states of US
- Date: May 10 – Jun 3

	Number of records
Data collected from API	16,016
Data selected by USA:	6,193
Data by detailed state	5,736

Tweets on population

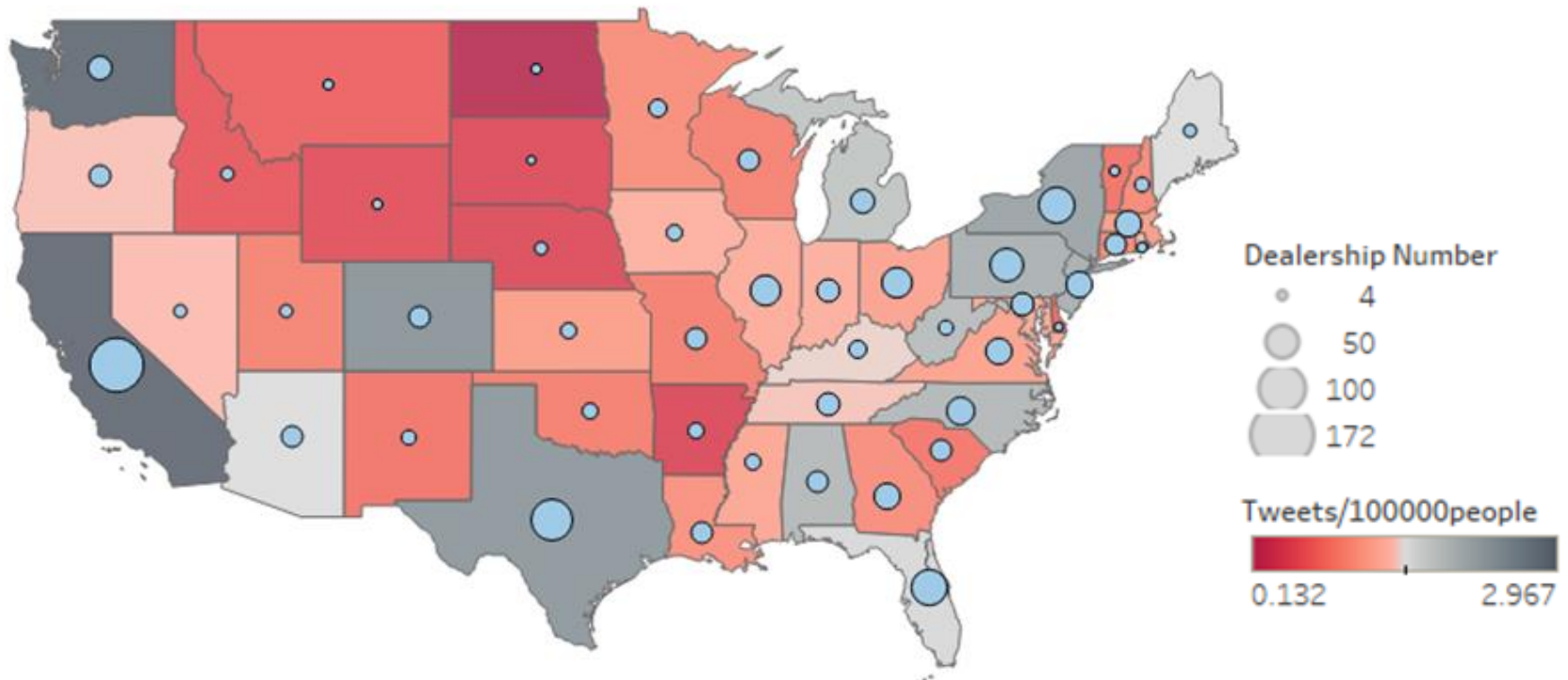
- The top high density of Tweets by states is Washington, Colorado, New Jersey → more Tweets posts from these states



Tweets Density in US states

Tweet Density by States vs. Number of local Dealership

- California stands 1st rank in number of Tweets and dealership while Washington and Colorado has low number of dealership but high Tweet density.





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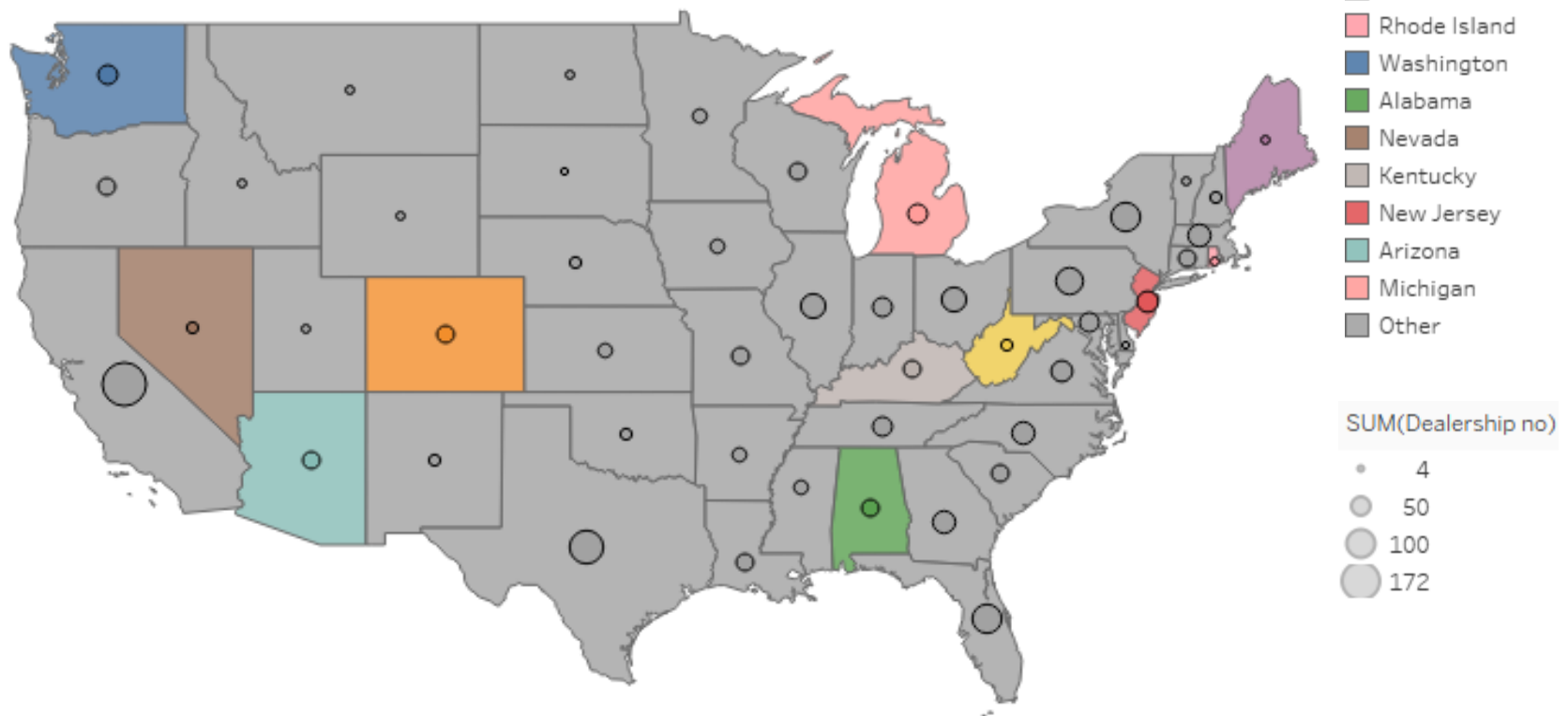
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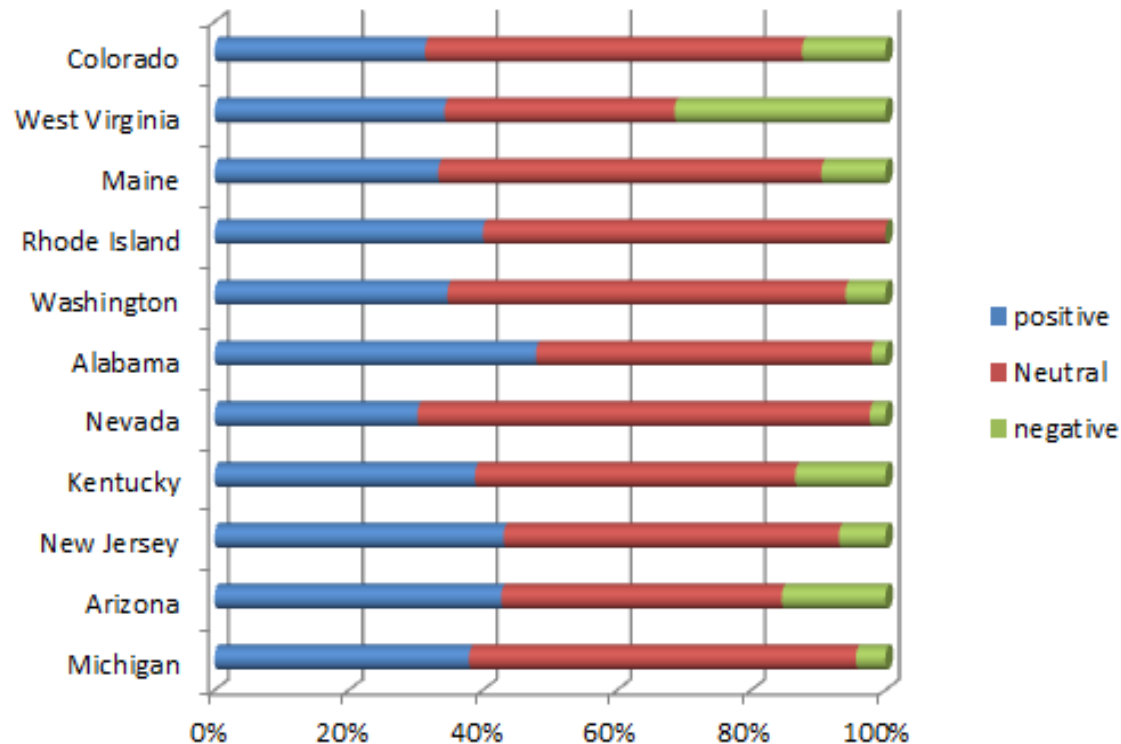
Tweets Density in US states

- 11 states with big gap between number of tweets in 100,000 people and number of dealership



Sentiment Analysis

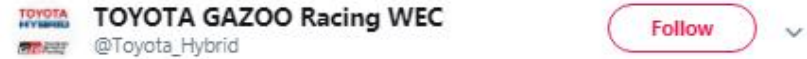
11 States with more Tweets but fewer local dealership (based on ranking) → understand behavior changes and reasons of movement.



- Colorado has largest gap.
- Alabama has highest percent of positive polarity.

Washington: highest Tweets density

- 46% retweets: Toyota Gazzo racing.
- 18% retweets: Boycott products made in Alabama.



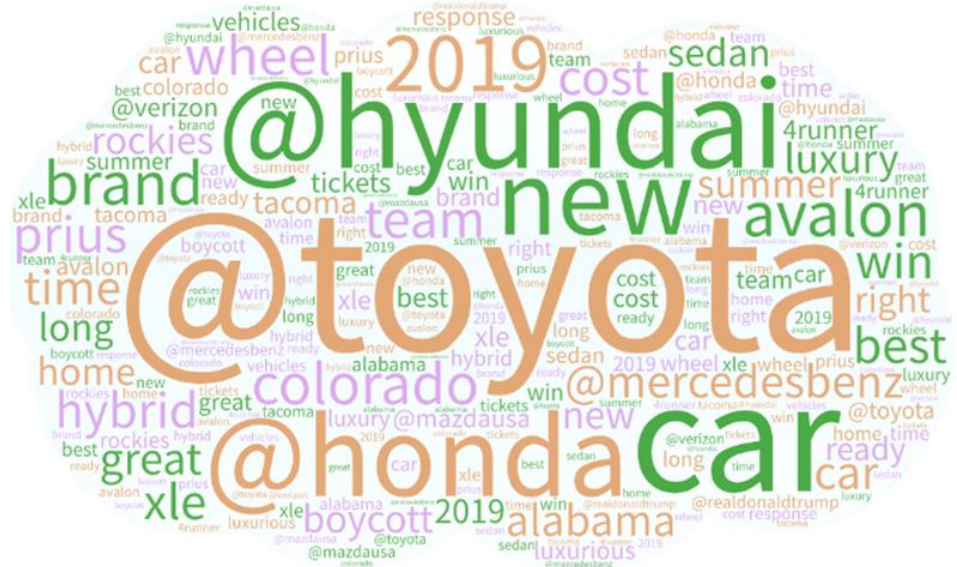
This #ThrowbackThursday we take you back to 1999 where we tackled the @24hoursoflemons in the legendary #TOYOTA GT-One.

It was a bitter sweet event with pole position 🏁, fastest lap 🔄 and a second place finish 🏆, but we sadly missed out the overall #LeMans24 victory. 😞



Colorado: largest gap

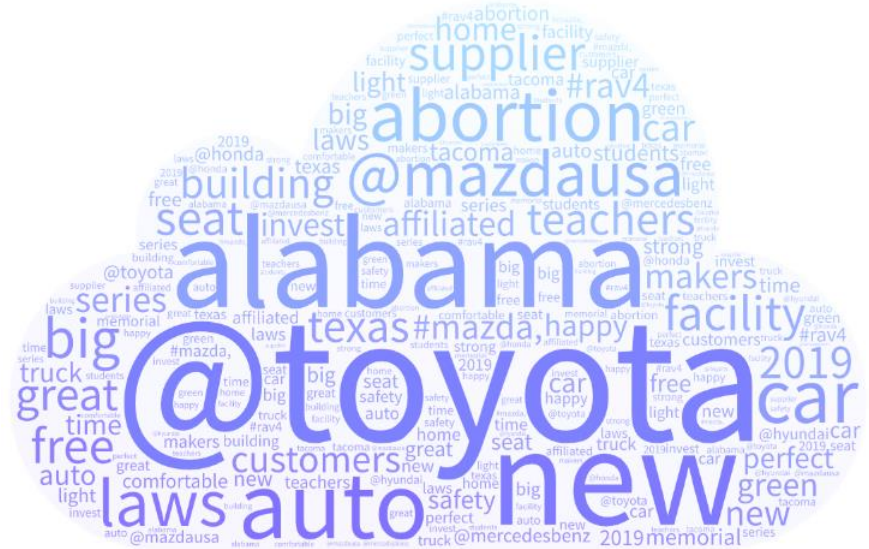
- 18% of Tweets mention Honda and Hyundai.
- 8.6% negative: boycott products made in Alabama, including manufacturers of Toyota and Honda



A number of cars and trucks are manufactured there too: @Toyota @MazdaUSA @Hyundai @MercedesBenz @Honda . Boycott
Boycott Alabama Built Cars Trucks and SUV's@Hyundai @MBUSAnews @Honda @Toyota @MazdaUSA

Alabama: high percent of positive polarity

- 52% retweets: Toyota Gazoo Racing
- Toyota gave \$750,000 to support Alabama's abortion laws by building a facility in Huntsville.
- 38% 'likes' on event of Toyota as a sponsor of B.A.S.S, bass fishing sport in Texas, with prize is a new brand Toyota Tundra truck.



Word Cloud of all States

- Repeat of Honda, Hyundai → intense competition.
- Alabama is states which Toyota plan to invest building more manufacturer, but with the boycott all brands made in Alabama due abortion ban protest.



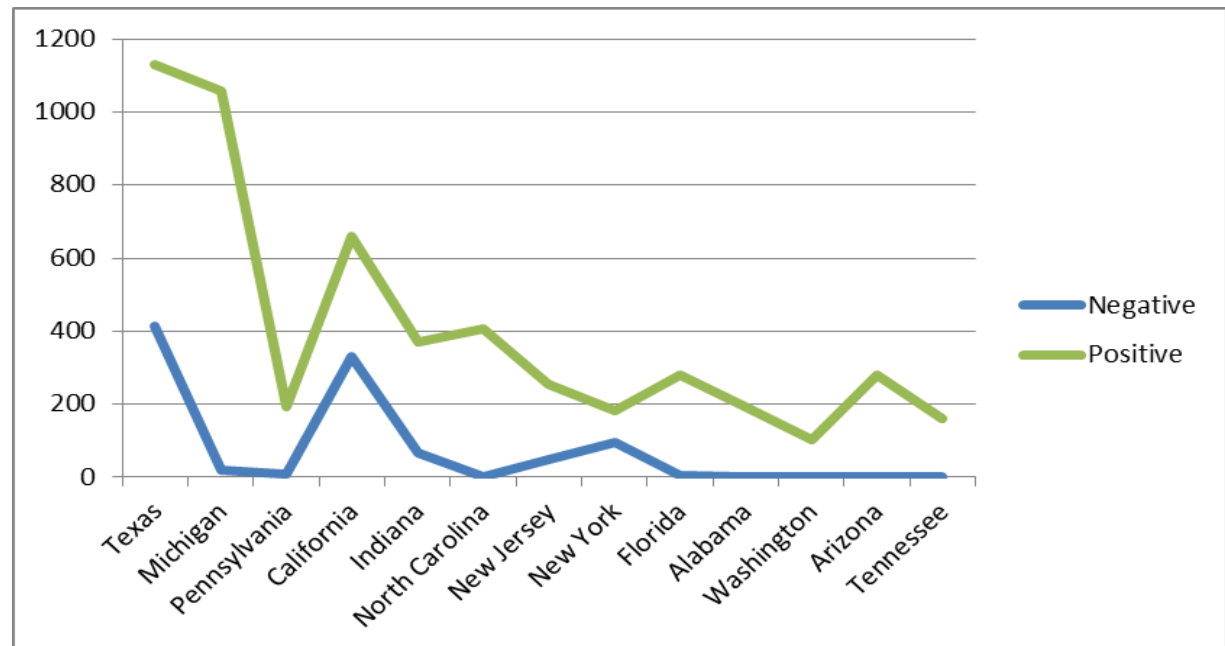
Word Cloud of all States (cont.)

- RAV4 get more attention as SUVs model
- Supra GR 2020, new luxury couple car Twin-turbo BMW straight-six power.



'Likes' by states

- Top states has high LIKES
 - High LIKES of positive Tweets : Texas, Michigan, California
 - High LIKES of negative Tweet: Texas, California
- What topic of Tweets? Seasonal events or permanent switch?



'Likes' by topic: Positive Tweets

Texas:

- Toyota is co-organizer of NBA's Houston Rockets.
- The final game was played in Toyota Center Houston on May 10
- Tweets run the small online advertising game, Run as One, before the final match
- Rewards: entrance ticket with floor seats, suite ticket, autographed merchandise.





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'Likes' by topic: Positive Tweets

Michigan:

- Popular compact SUV choices of 2 new models: 2019 Honda CR-V vs. 2019 Toyota RAV4.
- Political news: the president announced to investigate imports of vehicles and auto parts, and claimed that foreigner brand harm national security by having led to a declining market share for domestic carmakers. Toyota investments are not welcomed even though the company spending more than \$60 billion building operations in US.

'Likes' by topic: Positive Tweets

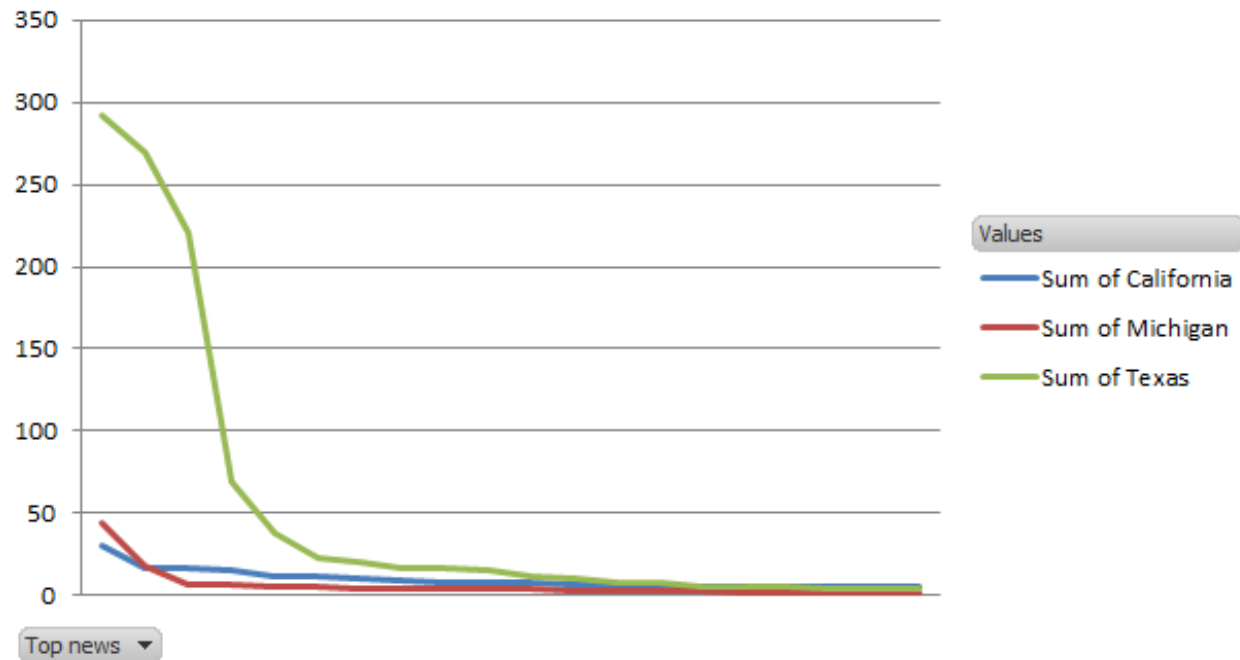
California:

- Toyota has partnered with the Orleans Parish School Board to reward a student with perfect attendance with brand new car 2019 Toyota Yaris IA.
 - Toyota built new test track, calling Toyotaring with special design and friendly environment
 - UPS starts using Toyota's zero-emission hydrogen semi truck
- More diverged to other topics



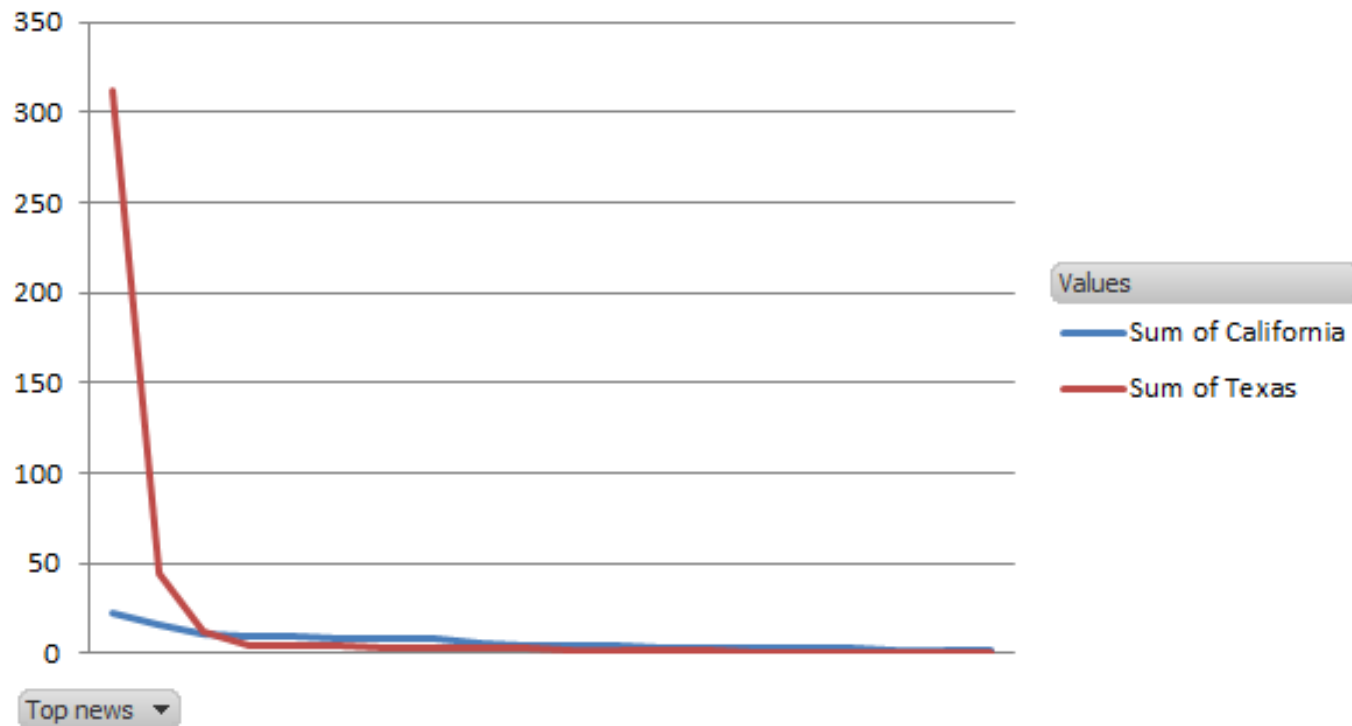
'Likes' by topic: Positive Tweets

- In top 20 LIKES positive texts, Michigan and California is more diverged to other topics.
- Texas is more temporary attention in seasonal basketball game.










'Likes' by topic: Negative Tweets

- In top 20 likes negative texts, California is more diverged to other topics.
- 75% texts from Texas is about basketball games in Houston



Summary of findings

- New luxury Supra 2020 marketing campaign.
- Investment finds difficult on particular states such as Alabama.
- RAV4 is potential best sale as SUV cars, and this model is made in Canada with import taxes → less competitive price.

Rank 2019 	Rank 2018 	Models 	Sales 2019 YTD 	Sales May 19 	'+/-' 2019 Var 	'+/-' May 19 
1	1	Ford F-Series	368.972	84.355	-0,8%	-0,3%
2	3	Ram pick-up	231.382	62.250	21,8%	33,1%
3	2	Chevrolet Silverado	211.620	52.617	-9,8%	-2,5%
4	4	Toyota RAV4	161.458	43.499	0,5%	13,9%

Summary of findings (cont.)

- Toyota is successful with commercial sponsors for sport games such as basketball, fishing, racing → interact with users/customers on social media.
- Washington, Alabama and Texas have high Tweet density due to seasonal events and political news impact.
- Compared with Washington, Colorado concentrates less on major topics.
- California has most stable tweet density with attention diverged on several different topics.

Trends

- People are more attending in sport games.
- Distributed allocation of E&M, not depend on few states
- Camry, Corolla is old model, intense competition especially from Honda and Hyundai. The brand need innovation, new concept model.
- RAV4 is modest trend with comfortable seats, more space, capacity and height compared with sedan, more fuel efficient, reliable on off-roads, safety and cheaper insurance in long-run (in appendix)

Recommendations

- Expand E&M in diverged locations such as Washington, Colorado.
- RAV4 made or assembly in USA
- Expand target segment, not only convenient affordable car, but also innovation on modest design, example of the success of Prius hybrid.

Future Study

- Verify the changed sentiment of the users before and after event (law suits, political issues, new product).
- Collect full data of users: age, gender, income.
- Apply MongoDB to organize data and optimize collection for queries.

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<https://www.toyota.com/upcoming-vehicles/gr-supra/>

Appendix 1

- Toyota Motor North America sales fell 4.4 percent to 183,866, the sixth consecutive year-over-year decline.
- Brands: Toyota down 4.8%; Lexus down 1.3%.
- Notable nameplates: Toyota Corolla down 24%, Camry down 2.1%, RAV4 up 10%, Tacoma up 8.3%; Lexus ES up 8.7%, RX down 2.4%, NX down 5.9%
- Incentives: \$2,205 per vehicle, down 2% from a year earlier, ALG says.
- Average transaction price: \$32,358, up 0.2% from a year earlier, according to ALG.








Appendix 2

Top auto brand sale in USA in 2018 vs 2019

Rank 2019	Rank 2018	Brand	Sales YTD 2019	May 2019	'+/- YTD 2019	'+/- May	Share YTD 2019	Share May 2019
1	1	Ford	970.617	222.403	-3,1%	-4,0%	14,0%	13,9%
2	2	Toyota	837.068	197.637	-3,6%	4,1%	12,1%	12,4%
3	3	Chevrolet	781.315	172.456	-6,6%	-5,4%	11,3%	10,8%
4	4	Honda	579.475	131.985	-0,6%	-5,9%	8,4%	8,3%
5	5	Nissan	540.313	121.570	-5,9%	1,1%	7,8%	7,6%
6	6	Jeep	379.455	90.326	-7,0%	-7,2%	5,5%	5,7%
7	7	Subaru	278.014	63.972	5,7%	6,4%	4,0%	4,0%
8	8	Hyundai	269.126	66.121	1,7%	1,8%	3,9%	4,1%
9	9	Ram	257.941	67.117	23,6%	29,4%	3,7%	4,2%
10	10	Kia	248.043	60.062	4,7%	1,0%	3,6%	3,8%

Appendix 3

Top car model sale in USA in 2018 vs 2019

Rank 2019 	Rank 2018 	Models 	Sales 2019 YTD 	Sales May 19 	'+/- 2019 Var 	'+/- May 19 
1	1	Ford F-Series	368.972	84.355	-0,8%	-0,3%
2	3	Ram pick-up	231.382	62.250	21,8%	33,1%
3	2	Chevrolet Silverado	211.620	52.617	-9,8%	-2,5%
4	4	Toyota RAV4	161.458	43.499	0,5%	13,9%
5	8	Chevrolet Equinox	150.350	29.445	7,8%	-0,7%
6	7	Toyota Camry	147.119	36.208	-2,3%	20,8%
7	5	Nissan Rogue	146.573	28.600	-17,7%	-25,5%
8	6	Honda CR-V	146.517	30.893	0,2%	-14,0%
9	9	Honda Civic	139.421	32.800	-3,8%	-4,5%
10	10	Toyota Corolla	123.999	25.712	-7,0%	-13,1%

Appendix 4

Sedan list values

Chevrolet Cruze - \$16,975

Honda Accord - \$18,640

Ford Fusion - \$22,750

Honda Civic - \$18,640

Honda Civic - \$18,640

Toyota Camry - \$18,640

Nissan Altima - \$22,500

SUV list values

Honda CR-V - \$24,045

Chevrolet Equinox - \$22,120

Subaru Forester - \$22,395

Toyota RAV4 - \$24,140

Nissan Rogue - \$23,820

Ford Explorer - \$30,185

Jeep Grand Cherokee - \$30,395

Appendix 5

Insurance cost of SUVs and Sedans

Average annual insurance cost: sedans

Chevrolet Cruze - \$1,372

Honda Accord - \$1,421

Honda Odyssey - \$1,451

Nissan Altima - \$1,504

Honda Civic - \$1,463

Toyota Camry - \$1,478

Toyota Corolla - \$1,486

Average annual insurance cost: SUVs

Honda CR-V - \$1,230

Chevrolet Equinox - \$1,277

Subaru Forester - \$1,324

Toyota RAV4 - \$1,329

Nissan Rogue - \$1,338

Ford Explorer - \$1,354

Jeep Grand Cherokee - \$1,391