

MMA Market Comparison - Toronto vs. Montreal

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1. Introduction

1.1 Background Information

Mixed Martial Arts (MMA) is one of the most rapidly growing sports around the globe, which more and more fans have chosen to follow and participate in. The United States, being the battleground of UFC, Bellator and some other major MMA organizations, has become the Mecca for MMA fans. Being a close neighbor, Canada also has a solid ground for the development of MMA and owns the second largest market in North America. There are also a great number of talented fighters coming out of Canada. For example, the former UFC Welterweight and Middleweight World Champion, George St. Pierre, is from Montreal, Canada. He is not only one of the biggest stars in MMA history, but also a national hero in the eyes of Canadian MMA fans.

1.2 Business Problem

However, unlike national sports such as hockey and baseball, the market of MMA has been proven unbalanced even across the same nation. In the U.S., the biggest market for MMA clearly resides in cities like Las Vegas and New York. And since MMA promoters usually tour events around the country or even the world, they have to acquire the knowledge about which cities have the bigger markets, therefore are able to hold events that generate more revenue. Moreover, the difference in market size can lead to a uneven distribution of resources, including media coverage, training facilities, etc. For promoters, especially nonnative promoters, it is crucial to know and pick the right market for fight promotions; for MMA fans, knowing where the large market is can possibly affect their choice of living (if they have a choice); for upcoming fighters, it is even more important to understand this, since they want to have access to the best and most abundant resources.

1.3 Objective

In Canada, the question about which city is the best ground for MMA has yet been answered. But fans have argued that either Toronto or Montreal should fill the place. In this project, I will deliver an comparative analysis on both cities to potentially determine which city has a bigger MMA market.

2. Data Description

2.1 Data Understanding

In order to determine which city between Montreal and Toronto has the biggest MMA market in Canada, the analysis needs to answer to following two questions:

1. Which city has more MMA fans?
2. Which city has more MMA gyms?

2.2 Data Sources & Methodology

1) To determine the fan base for each city, I chose to scrape data from Wikipedia with the table “List of past UFC events.” The data in this table showcased the past held events in both cities, including dates, their

headline main events, attendance, etc. Through these data, one could determine which city had held more events in the past, had more average attendance, had the max attendance between the two, had the most fascinating fights. These results could be supporting factors to conclude which city has more MMA fans.

2) To determine which city has more MMA-related business, hence gyms and training facilities, I acquired the Foursquare location data on both cities, and explored them to gain information such as which city has a higher amount of MMA gyms and which city has a higher average quality of gyms.

2.3 Assumptions

1) Attendance to the events can correctly reflect local fan base. Unlike other sports where fans get to celebrate their home team in their own cities often, MMA fans have to travel all the time to support their favorite fighters. Therefore, I assume that the attendance of events reflect the city's passion for MMA instead of only one or two fighters (however, this assumption needs to be adjusted in later analysis).

2) All MMA gyms/training facilities are open to fighters of all levels. In order to know whether a city is ideal for upcoming MMA fighters, the training facilities need to be targeting different levels of fighters, such as professionals, semi-professionals, amateurs, kids, etc. Though very few gyms refuse to take in professional fighters, for the sake of accuracy, I still need to declare this assumption.

3) UFC can represents all MMA promotions. The data for events attendance came only from UFC events. Since UFC is by far the largest MMA promotion in the world without a close second, the assumption has been made that UFC events can be the test ground for MMA fan base.

4) Set 10 kilometers as the average radius for venue search. In the second portion of the project, we are trying to find out how many martial arts gyms/facilities there are in Toronto and Montreal in order to extrapolate which city has a better ground for upcoming fighters. In order to do so, the Foursquare API requires a radius from the central coordinates of the city. I used 10 km, which is around 6 miles, as the radius, as I believe it sets a reasonable boundaries on people's willingness to go further for training.

3. Data Cleaning

First off, there are two tables in the selected Wikipedia web page - "List of UFC events", which include information about past and future UFC events respectively. Since the list of future events is short and does not contain either of the two cities of interest, the decision has been made to drop the entire table and only keep the one with information about past events. The change was done by adding an ID classifier while transforming scrapped information into a table. The resulted table head (first 5 rows) is shown below.

	number	Event	Date	Venue	Location	Attendance	Ref
0	473	UFC on ESPN: Barboza vs. Gaethje	2019-03-30	Wells Fargo Center	Philadelphia, Pennsylvania, U.S.	11,123	[17]
1	472	UFC Fight Night: Thompson vs. Pettis	2019-03-23	Bridgestone Arena	Nashville, Tennessee, U.S.	10,863	[18]
2	471	UFC Fight Night: Till vs. Masvidal	2019-03-16	The O2 Arena	London, England, U.K.	16,602	[19]
3	470	UFC Fight Night: Lewis vs. dos Santos	2019-03-09	Intrust Bank Arena	Wichita, Kansas, U.S.	7,265	[20]
4	469	UFC 235: Jones vs. Smith	2019-03-02	T-Mobile Arena	Las Vegas, Nevada, U.S.	14,790	[21]

Table 1 - List of Past UFC events

Next stop is to eliminate redundant or disposable columns. Since the goal for this part of the project is to find out which city has a larger MMA fan base, the attendance for each event has the most representative nature to create such insight; also, the location of each event needs to be kept for further data cleaning; the headlining main event of each fight card also plays a role in later analysis; last but not least, the date of each event needs to be kept for visualization purpose. Therefore, the final form of the table should contain the following columns: Event, Date, Location, Attendance, while the rest of the columns are dropped. The resulted table head is shown below.

	Date	Event	Location	Attendance
0	2019-03-30	UFC on ESPN: Barboza vs. Gaethje	Philadelphia, Pennsylvania, U.S.	11,123
1	2019-03-23	UFC Fight Night: Thompson vs. Pettis	Nashville, Tennessee, U.S.	10,863
2	2019-03-16	UFC Fight Night: Till vs. Masvidal	London, England, U.K.	16,602
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4	2019-03-02	UFC 235: Jones vs. Smith	Las Vegas, Nevada, U.S.	14,790

Table 2 - List of Past UFC events (Cleaned)

Next, in order to compare the attendance of events held in Toronto and Montreal, two dataframes for the two cities of interest need to be established, which requires selections of rows based on the “Location” column. Rows with a string of “Toronto” and “Montreal” are selected separately to form the two final tables below. Moreover, the data type of “Attendance” column is transformed into “int64” from “object,” which helps the visualization process later.

	Date	Event	Location	Attendance
13	2018-12-08	UFC 231: Holloway vs. Ortega	Toronto, Ontario, Canada	19039
91	2016-12-10	UFC 206: Holloway vs. Pettis	Toronto, Ontario, Canada	18057
229	2013-09-21	UFC 165: Jones vs. Gustafsson	Toronto, Ontario, Canada	15504
261	2012-09-22	UFC 152: Jones vs. Belfort	Toronto, Ontario, Canada	16800
285	2011-12-10	UFC 140: Jones vs. Machida	Toronto, Ontario, Canada	18303
303	2011-04-30	UFC 129: St-Pierre vs. Shields	Toronto, Ontario, Canada	55724

Table 3 - Toronto UFC events

	Date	Event	Location	Attendance
159	2015-04-25	UFC 186: Johnson vs. Horiguchi	Montreal, Quebec, Canada	10154
245	2013-03-16	UFC 158: St-Pierre vs. Diaz	Montreal, Quebec, Canada	20145
256	2012-11-17	UFC 154: St-Pierre vs. Condit	Montreal, Quebec, Canada	17249
311	2010-12-11	UFC 124: St-Pierre vs. Koscheck 2	Montreal, Quebec, Canada	23152
326	2010-05-08	UFC 113: Machida vs. Shogun 2	Montreal, Quebec, Canada	17647
348	2009-04-18	UFC 97: Redemption	Montreal, Quebec, Canada	21451
369	2008-04-19	UFC 83: Serra vs. St-Pierre 2	Montreal, Quebec, Canada	21390

Table 4 - Montreal UFC events

The same process applies to the location data acquired from Foursquare. After formatting the table extracted from the location data (category filtering, column names cleaning, etc.) with a search query of “MMA Martial Arts” and a radius of 10 kilometers, I selected the following columns and dropped the rest: name (venue name), categories, address, city, country, lat (latitude), and lng (longitude). Furthermore, there are several missing values signaled with “NaN” in the dataframes. And for lack of information on the data absence, I decided to drop all venues with missing value. The resulted table head is shown below.

	name	categories	address	city	country	lat	lng
0	Elite Martial Arts Toronto	Martial Arts Dojo	98 The Esplanade	Toronto	Canada	43.649088	-79.372551
1	Innercity Martial Arts	Martial Arts Dojo	403 Dundas Street W	Toronto	Canada	43.653528	-79.395286
2	Martial Arts	Student Center	146 Danforth Ave.	Toronto	Canada	43.676447	-79.357845
3	Sunrise Martial Arts	Martial Arts Dojo	40 Wellesley Street East	Toronto	Canada	43.665427	-79.382894
5	Openmat Mixed Martial Arts	Martial Arts Dojo	593 Yonge St.	Toronto	Canada	43.666172	-79.384767

Table 5 - Toronto MMA Facilities (head)

	name	categories	address	city	country	lat	lng
0	Montreal Martial Arts - Arts Martiaux Patenaud...	Martial Arts Dojo	6968 St-Denis	Montréal	Canada	45.537279	-73.612443
1	Apex Martial Arts	Martial Arts Dojo	750 Decarie	Saint-Laurent	Canada	45.511093	-73.580599
2	Gelinas Academy of Mixed Martial Arts (GAMMA)	Martial Arts Dojo	429 Mayor Street	Montréal	Canada	45.505486	-73.581564
3	Gelinas Academy Of Mixed Martial Arts	Athletics & Sports	1121 Ste Catherine St W	Montréal	Canada	45.499558	-73.573822
4	Uvolution Fitness & Arts Martiaux	Gym / Fitness Center	4052 rue Wellington	Verdun	Canada	45.463313	-73.566951

Table 6 - Montreal MMA Facilities (head)

4. Analysis & Results

4.1 Statistical Comparison

To compare which city has a larger and more active MMA market, the following criteria of comparison needs to be established: number of events held in the past, average attendance of events, and maximum/minimum attendance of events. By using the “Dataframe.describe()” function in pandas, these statistics can be acquired as below.

Attendance	
count	6.000000
mean	23904.500000
std	15638.197144
min	15504.000000
25%	17114.250000
50%	18180.000000
75%	18855.000000
max	55724.000000

Table 7 - Toronto Stats

Attendance	
count	7.000000
mean	18741.142857
std	4338.757634
min	10154.000000
25%	17448.000000
50%	20145.000000
75%	21420.500000
max	23152.000000

Table 8 - Montreal Stats

As shown in the tables, Toronto held 6 UFC events in the past while Montreal held 7; the average attendance of events in Toronto is approximately 24000 while Montreal had an average of 18741; The maximum attendance pulled by Toronto UFC events is 55724 and the maximum for Montreal events are 23152. So with this initial comparison, we can observe that Toronto events had the advantages in average attendance, and their peak performance almost doubled the maximum attendance of all Montreal events. Although Montreal had held more events in the past, the statistics tended to point out that Toronto had a bigger fan base for Mixed Martial Arts.

4.2 Further Analysis with Perspectives

Although the statistical comparison was straightforward, there are certain perspectives that needs to be included into the equation to make the analysis more convincing.

First, the dates of the events can add a new perspective to the analysis. The figures below demonstrate the attendance for each event within their respective years (although it is more clear to use a histogram, it requires the data to be monotonic, and thus scattered plots are implemented). These figures indicate that the events in Toronto took place in the range from 2011 to 2018, while the events in Montreal took place in the range from 2008 to 2015. The last event held in Montreal took place in April 25, 2015, which means there has not been a UFC event in Montreal for almost 4 years; at the same time, Toronto was much more active as a UFC event venue in recent years and had its last event in December last year. Therefore, no matter what previous statistics indicate, Toronto can be regarded as more active as a UFC/MMA market.

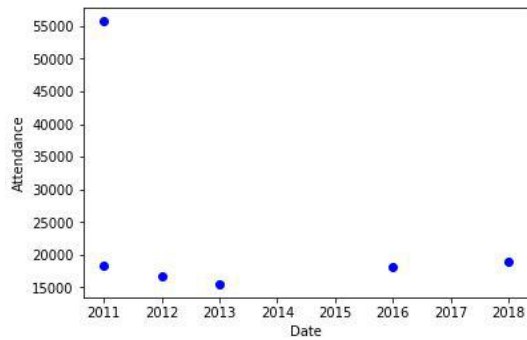


Figure 1 - Attendance vs. Date (Toronto)

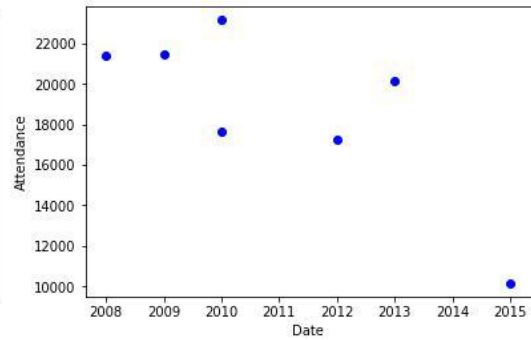


Figure 2 - Attendance vs. Date (Montreal)

Second, the headlining main event of each fight card has a tremendous influence on the attendance rate. For example, Conor McGregor, one of the biggest stars and the greatest draw in MMA history, drew the top 3 gate attendance in UFC history by himself. In this case, the biggest draw is Canadian MMA star George St. Pierre (a.k.a. GSP). As Canada's number one MMA star, GSP headlined 5 out of 13 events in both cities, one in Toronto and four in Montreal. Because GSP was born and raised in Montreal, fighting in his hometown was a huge selling point to his fights. Therefore, 4 out of 7 events in Montreal had him as a deciding factor instead of the entire local market. Moreover, he was responsible for both cities' biggest UFC events with the most attendance. However, the Toronto event with him in the headlining match drew an attendance of 55724 people, which was much higher than any of the 4 events he headlined in Montreal. Therefore, what appears to make Montreal a success in MMA promotion may not be a huge local MMA fan base, but the star power of one single athlete.

	Date	Event	Location	Attendance
245	2013-03-16	UFC 158: St-Pierre vs. Diaz	Montreal, Quebec, Canada	20145
256	2012-11-17	UFC 154: St-Pierre vs. Condit	Montreal, Quebec, Canada	17249
303	2011-04-30	UFC 129: St-Pierre vs. Shields	Toronto, Ontario, Canada	55724
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369	2008-04-19	UFC 83: Serra vs. St-Pierre 2	Montreal, Quebec, Canada	21390

Table 9 - Events in Toronto & Montreal with GSP in the main event

4.3 Predictive Model

In order to predict the future trend for UFC attendance in both cities, a predictive model needs to be established through regression. Unfortunately, due to a small data sample, it was difficult to fit the data perfectly without under/over-fitting using commonly used models. Moreover, since a lack of sample size, I decided to not split the datasets into training and testing set, as all data points were used as training set.

For the dataframe based on Toronto events, a polynomial model with a maximum power of 2 was implemented, which produced a fitting as below. The figure indicates that the attendance in Toronto events may be heading towards a rise in the future.

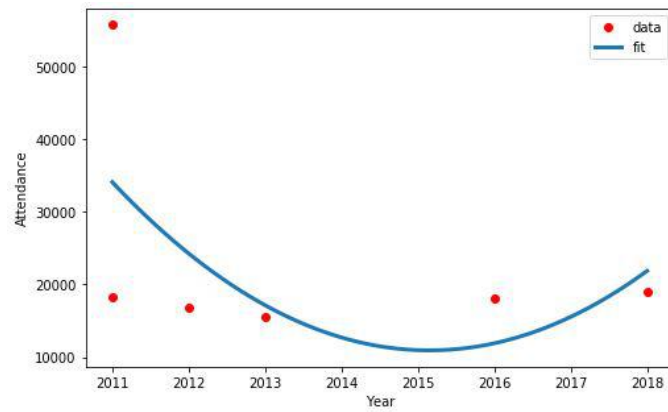


Figure 3 - Predictive Model 1 (Toronto)

For the dataframe based on Montreal events, a linear regression model was implemented, which produced a fitting as below. The figure indicates that the attendance in Montreal events has a clear tendency to decline in the coming years.

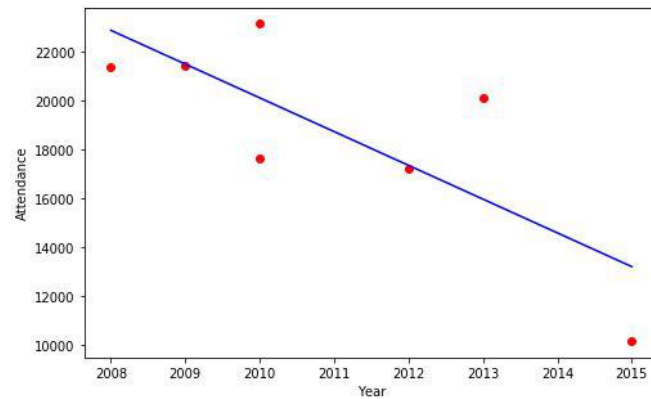


Figure 4 - Predictive Model 2 (Montreal)

4.4 Gyms/Training Facilities Distribution

As for MMA gyms/facilities, we observe from the shape of finalized venue tables, that Toronto has 24 more martial arts training grounds than Montreal within 10km of city centers, which means Toronto offers more options and thus has a more ideal environment for professional MMA athletes, upcoming fighters, and MMA fans to pursue their career and/or passion.

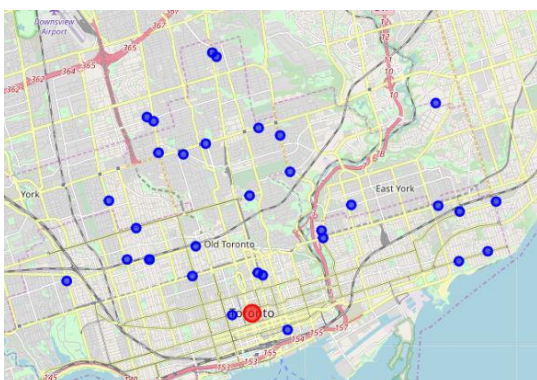


Figure 5 - Martial Arts Training Facilities (Toronto)

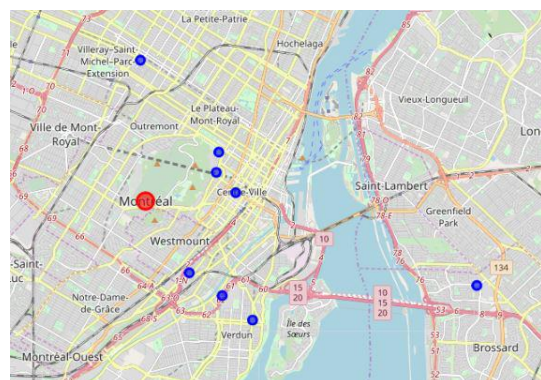


Figure 6 - Martial Arts Training Facilities (Montreal)

5. Discussion (Potential Modification)

Market is a complex entity that takes insights from a lot of aspects to understand. To understand the MMA market in Toronto and Montreal, a larger data pool and a more comprehend methodology is required for a more detailed analysis.

1) Besides finding out the attendance rate for each UFC event, the attendance rate for other MMA events may also count. A more thorough analysis can be done with a layered comparison between two cities, where layers represents the attendance rate of events on different levels, such as professional, semi-professional, local, amateur, etc. Not only does this comparison provides more accurate insights, but also branches the market into different levels which may generate a more complex but precise conclusion. It could also feed more data into the machine learning algorithm and produce a more accurate predictive model that shine lights on future market tendency.

2) As mentioned above, fighters can be the deciding factor on the attendance rate of fight events that can even diminish the effect of market size. For example, if UFC's biggest star Conor McGregor fought in Montreal, it may create a national record as his fans from Ireland, USA, and all around the world may fly in and support him. Therefore, obtaining data on whether each audience attending the event lives in surrounding areas may help sorting out the local fans, hence giving a more accurate result on local market scale and constrain the effect of star power to the minimum.

3) Although modification #2 may sort out the local fans, it still does not reflect the local market. Because some audiences may not be passionate about the sport and jut be there to be with friends or families, some may be first time viewers and later decide MMA is not for them, some may even got the tickets for free and just do not want to waste them. Therefore, attendance for events may reflect the market to some degree, but never be the sole indicator. Some other factors may be considered, such as peripheral products consumption, local media coverage, etc.

4) The number of martial arts facilities may not be the best, at least not the only indicator for MMA training environment, and the venue data acquired from Foursquare may generate more insights than merely counts. Each venue's ratings may be important for fighters to consider, if a city only has one gym but getting a 100+ five stars review, it may be a more ideal choice. Furthermore, information could be gained about which professional fighters each gym produced and how good are they, which will also help to determine the better MMA training ground.

6. Conclusion

The world of MMA has been developing around the globe for decades. It is now one of the most uprising sports in the industry. Canada, being a close neighbor to USA and the second largest country in the world, had a lot of potential to be one of the biggest foreground of MMA development. According to the analysis and comparison undertaken in this project, we can now draw the conclusion that Toronto owns the biggest market for MMA in Canada.

However, due to a lack of data access and restricted time frame, these results are tenable but hardly comprehensive. More data on different perspectives, followed by renewed methodology and modeling, may be in dire need to make a final and cogent conclusion on the matter. Even so, the conclusion may not stand for long, since the answer to the question "which city has the largest MMA market in Canada?" may evolve overtime.