

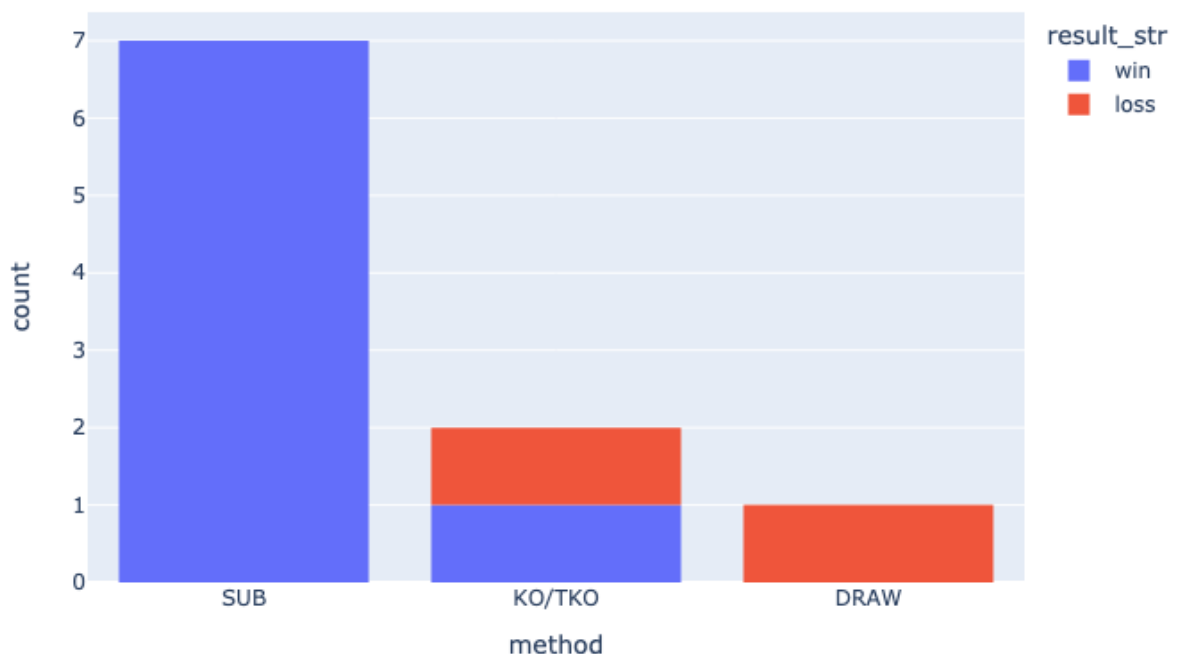
Mixed Martial Arts Data Analysis

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Mixed martial arts or mma is a form of fighting where nearly all techniques and fighting styles are allowed to merge into one. It is one of the ultimate forms of combat sports due to its limited ruleset and allowance for various expressions of different martial arts. In this project I want to show what fighting styles were effective when the UFC started, how people win today, what kinds of techniques correlate together, and what makes certain UFC fighters so dominate.

One of the first documented forms of mixed martial arts was in 648 BCE when the greeks added pankration (meaning all powers) to the Olympic Games. The more modern form of mixed martial arts that we know today, the Ultimate Fighting Championship, started in 1993. One of the main groups of pioneers behind the start of the UFC were the Gracies. The Gracies were a family from Brazil who birthed what we know today as Brazilian Jiu Jitsu, they wanted to showcase the effectiveness of this submission art and thus made a tournament full of different types of martial arts fighters showcasing their skills against eachother. Royce Gracie was the chosen Gracie family member to fight because he was a smaller and less physically opposing person.

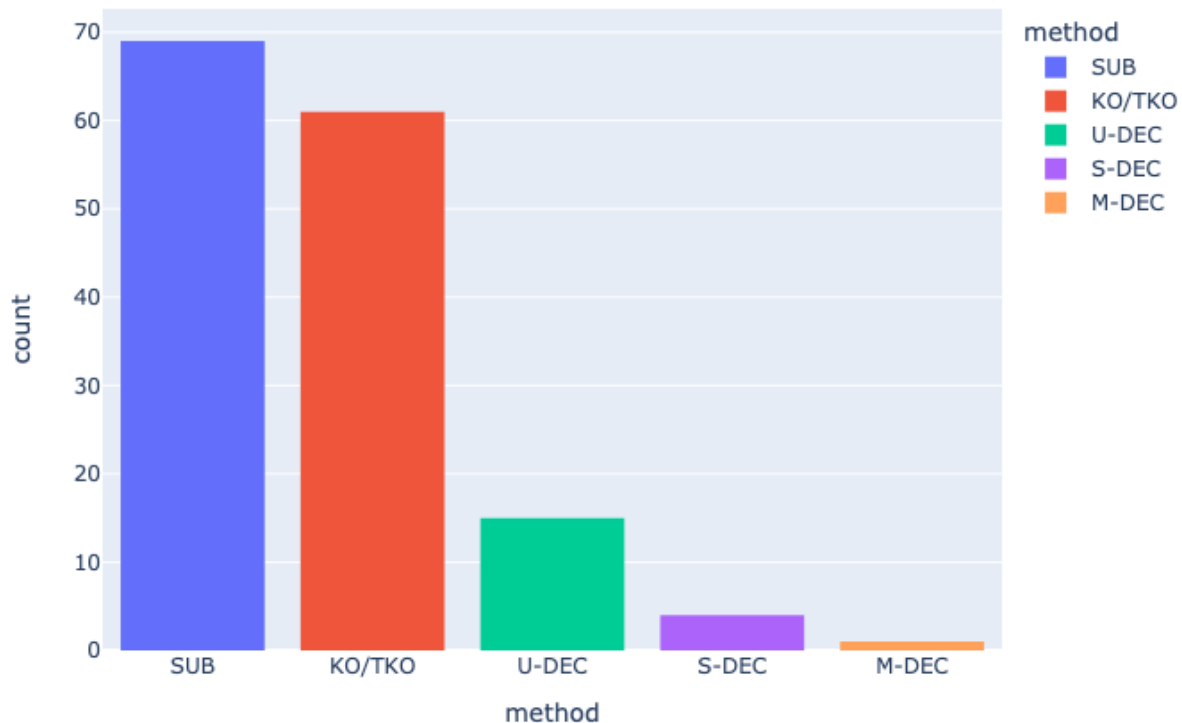
Royce Gracie Fight Results



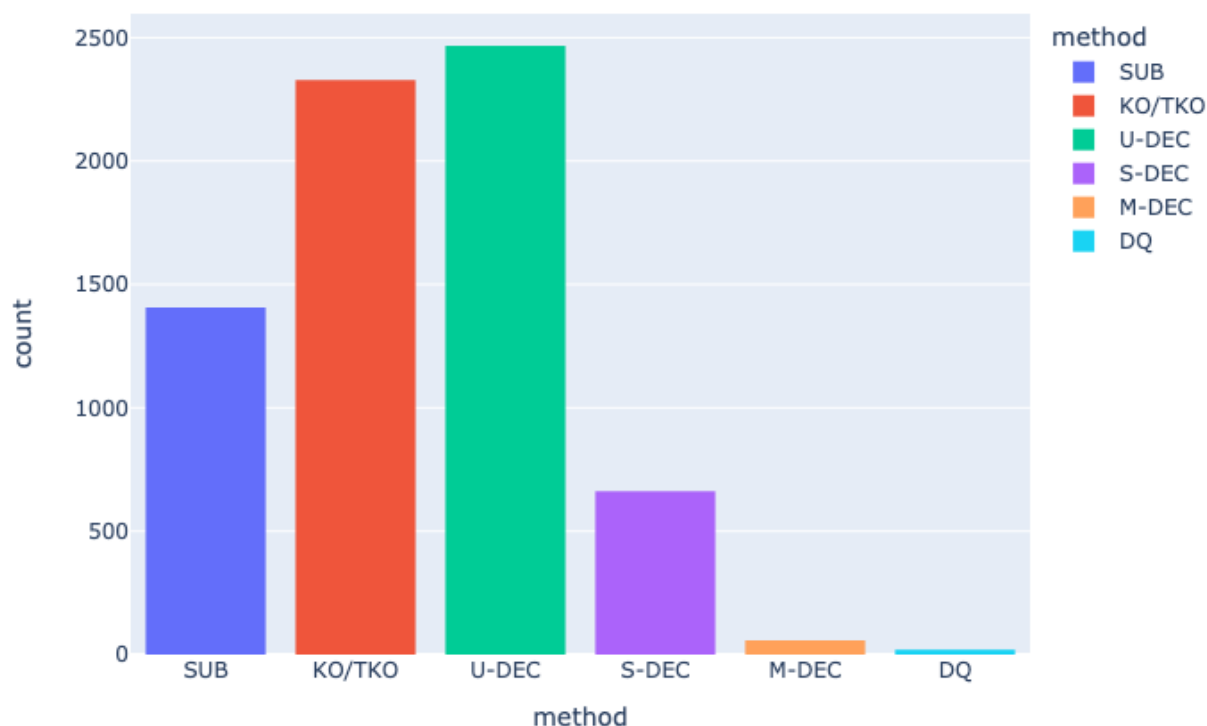
The graph shows that Royce Gracie fought a total of 10 times in the Ultimate Fighting Championship. He won 8 times, 7 times he won by submission, 1 time he won by a knockout, 1 time he lost by knockout, and 1 time the contest was called a draw. 70% of the time that Royce walked into the cage he left with a submission; clearly brazilian jiu jitsu was very effective in the

beginning of the UFC. This was one of the major reasons that jiu jitsu has spread so rapidly across the United States.

In the beginning of the UFC submission grappling was dominant because it was not very well known and people with the skills were able to easily get to submissions on people who did not know how to defend. I split the dataframe to look at the first 150 fights when jiu jitsu was not widespread knowledge and looked at the methods of victory.

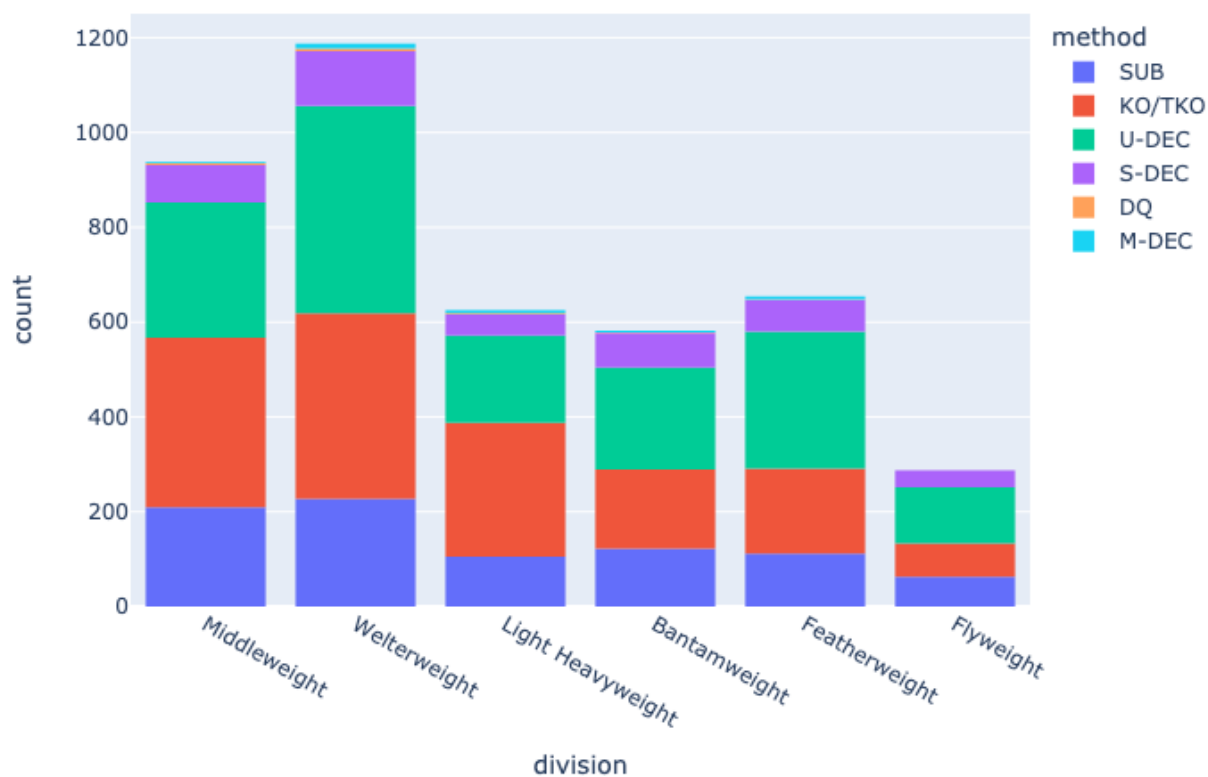


Submissions make up the majority of victories. Obviously KO/TKO is very close second and the unanimous, split, and majority decision victories come next but are not very prevalent. Next I wanted to look at the entire dataframe to see if this distribution of methods of victory remained similar.

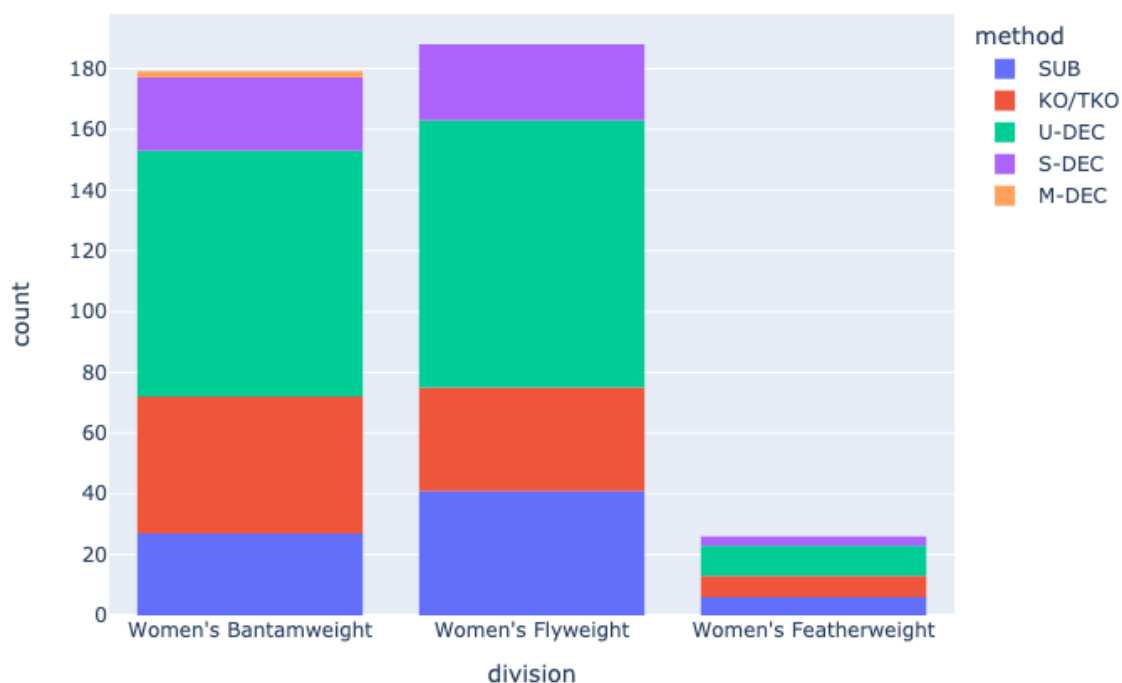


Looking at all of the data shows that submission victories are no longer the overall dominant method of winning mixed martial arts fights. Not only that but KO/TKO is the second most effective next to unanimous decision. This is because initial mixed martial arts were mostly no time limit and would go until someone either got knocked out or submitted. Time limits were eventually introduced that capped mma fights at 15 or 25 minutes which lead to decision victories from the judges becoming more prevalent.

My next thought was whether or not different weight classes would effect the methods that are used in fighting. My intuition would be that larger people (heavyweights) would maybe favor KO/TKO victories because of the force that they would be able to generate. I first looked at the mens divisions because they had a similar amount of fights and it was easy to look at the distributions.

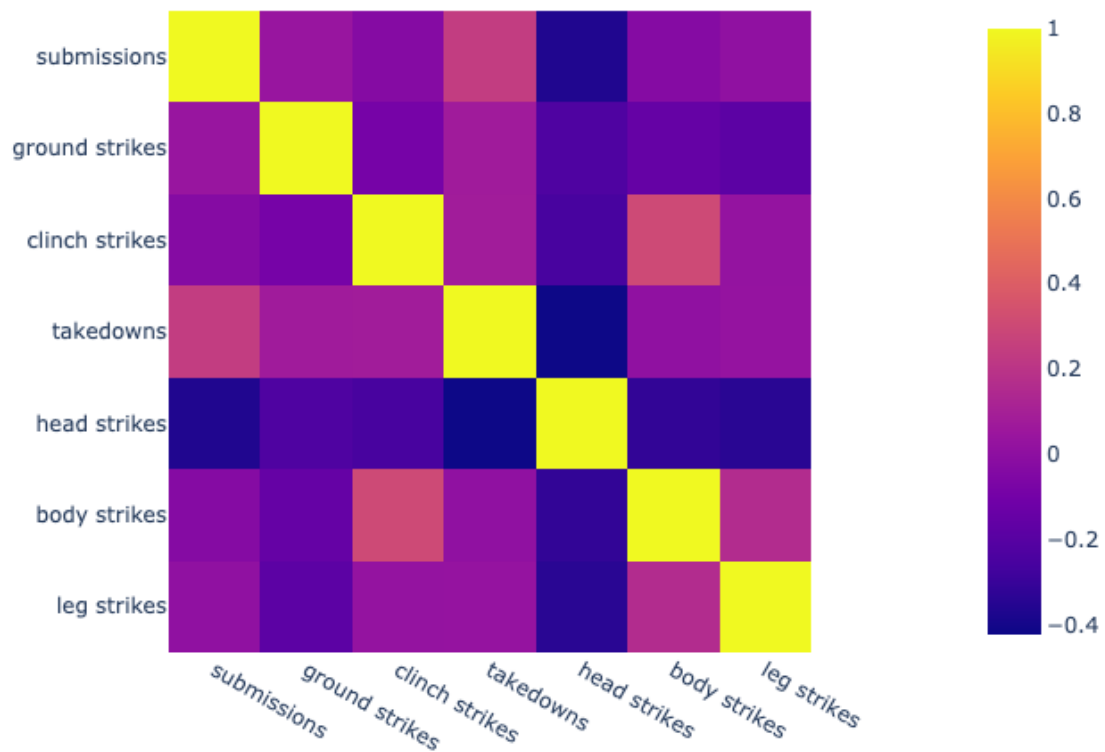


It looks like there is some variation between methods in each division, but overall there seems to be a similar distribution of the types of ways that men win in each division. Next I looked at the women's divisions to see if there was some variation there.



Similar to the mens it seems that there is a similar distribution of the methods of victory for the womens as well.

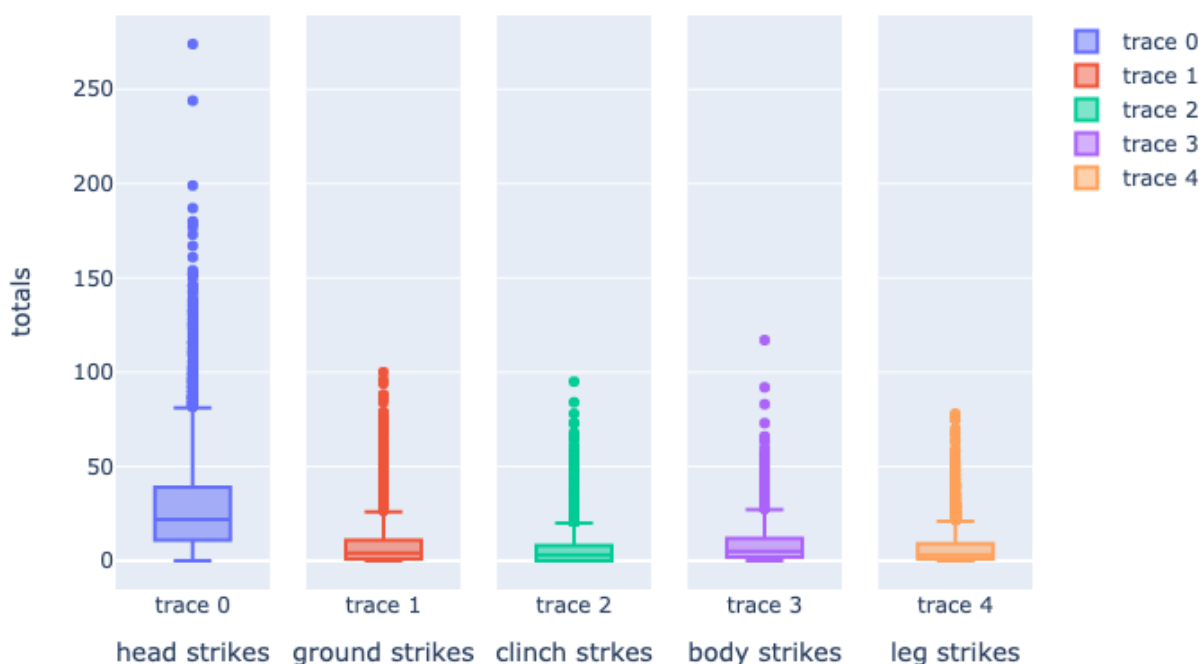
What I was really interested in next was what kinds of techniques were closely correlated with other techniques. I assumed that someone who was really good with submissions might also heavily rely on takedowns to get to submissions. I also thought that maybe someone who was a really good upperbody striker might supplement this with a barrage of leg kicks as well. So I decided to create a heatmap to look at the correlation of techniques for each fighter. In order to do this I had to scale the data since certain statistics like strikes happen way more frequently than something like takedowns. I used sklearn preprocessing to do this.



The correlation matrix supports some interesting ideas. I found that ground strikes and takedowns seemed to be linked which makes a lot of sense. Also head strikes, body strikes, clinch strikes and leg strikes are also all linked. I also found that striking and grappling is usually negatively correlated. For example head strikes and body strikes are pretty negatively correlated with something like submissions, but takedowns and submissions are something that are highly correlated. Very interesting.

The two highest correlations in the matrix besides techniques on themselves were takedowns and submissions, and body strikes and clinch strikes. This is super awesome to see, it supports the ideas that fighters with a grappling base (wrestling, jiu jitsu, judo) are often trying to take down people down and get to submission holds whereas standing fighters (muay thai, kickboxing) are trying to keep the fight off the ground and stay in the range they are best. It is interesting that clinch strikes and body strikes are extremely popular because the clinch is something that is only allowed in muay thai and does not exist in boxing or kickboxing; this leads me to believe that muay thai is having a huge effect on mixed martial arts and the ways that fighters are trying to win.

The last thing that I was really interested in looking at was what makes certain fighters dominant and what is it that they are doing better than other winners. The main person that came to mind is Jon Jones, who is considered to be the greatest mixed martial arts fighter of all time. Jones is a heavyweight fighter with a record of 27 - 1 - 0. His one loss came from a disqualification where he was hitting someone with illegal 12-6 elbows; so besides this one hiccup, Jones went undefeated in his UFC career and displayed dominant performances all throughout his career. I first decided to look at the distribution of landed techniques for all winning fighters in the UFC. I got this plot below.



The q3 for headstrikes is 39; the q3 for ground strikes is 11; the q3 for clinch strikes is 8; the q3 for body strikes is 12; the q3 for leg strikes is 9. There are obviously outliers that extend beyond the interquartile ranges as these may be fighters that just did especially well in one particular category during one particular fight. I next looked at the average in each of these categories for Jon Jones to see where he would fit in. My reasoning is that anytime his average extends beyond the IQR means he is exceptional in this particular category. Although there are outliers extending far beyond the IQR that is only for 1 fight, not that fighters average. To be able to consistently be an outlier is what I would consider exceptional.

Head Strikes

So I found that Jon Jones's on average would strike his opponent in the head around 29 times which is within the IQR, so he is not above average in this category.

Ground Strikes

Jon Jones has an average of nearly 11 ground strikes per match which again is just on the edge of the IQR so I would say that he is borderline exceptional in this area.

Clinch Strikes Landed

I found that on average Jon Jones only gave about 10 body strikes per match to his opponent which again above the IQR. I would say that Jon Jones has an exceptional ability to strike his opponents in the clinch.

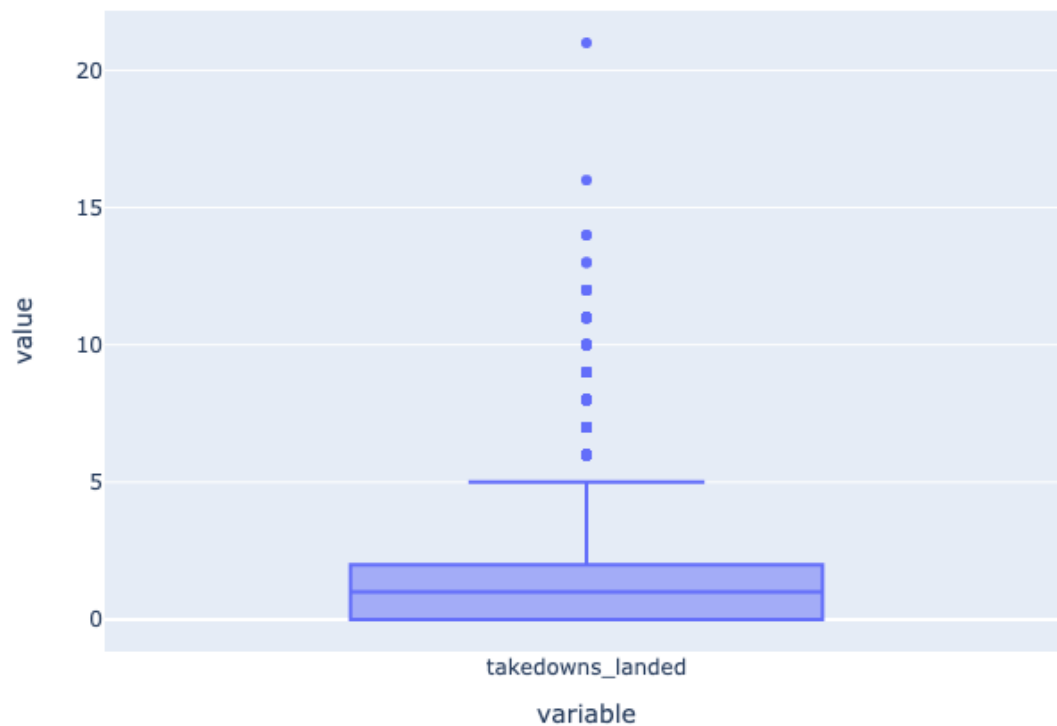
Body Strikes

Jon Jones has an average of 15 body strikes against his opponents during his fights. This is above the IQR and thus I feel that Jon Jones has an exceptional ability to strike his opponents to the body.

Leg Strikes Landed

Jon Jones performs an average of 18 successful leg strikes per each match against his opponent. He is clearly beyond the IQR for this category so I would consider this to be one of Jon Jones's exceptional qualities that distinguishes him from normal fighters. Jon Jones has an exceptional ability to utilize leg kicks.

The last thing I wanted to look at was the boxplot for average takedowns for winners. It did not make sense to put it on the last figure because the scale would have not really worked for this figure.



For takedowns. There is a q3 of only 2 takedowns for winners.

Takedowns Landed

Jon Jones only has an average of 1.9 takedowns in his fight against opponents. So I would again say that this is a borderline exceptional quality for him.

Overall Jon Jones is consistently right around quartile 3 or far extends it for some of the most important techniques used in fighting. He is especially exceptional at kicking his opponents and landing strikes to their body, but he also demonstrates that he is consistently above average for the other statistics measured in fighting. Overall, Jon Jones shows that he can consistently perform across the board and I believe that is why he is such a great mixed martial arts fighter.