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GEOG 381 – Lab 103 – Assignment 3

Assignment 3: Analysis of Kyle Lowry, Kawhi Leonard, and the Toronto Raptors' Shot Efficiency in the 2017-2018 and 2018-2019 NBA Seasons

Introduction/Background

This report maps the shot efficiency of the Toronto Raptors during the 2017-18 and 2018-19 NBA seasons. Part 1 analyzes the performance of Kyle Lowry compared to the Raptors as a whole during the 2017-18 season to better understand team dynamics. Part 2 looks into the 2018-19 regular season and playoffs, in which the Raptors were champions, and compares the performances of Kyle Lowry and Kawhi Leonard to analyze the correlation between shots, position, and environmental pressures.

Study Subjects & Data

This analysis is on the shots taken by Lowry, Leonard, and the Raptors in the 2017-18 and 2018-19 seasons. Data for Part 1 was taken from NBA Savant by entering the relevant player and team names and downloading it as a CSV. There was also a GeoTIFF storing the image of the court provided in the assignment. Data for Part 2 was imported for each player from the nba_api Python module.

Part 1 —

Methods/Process

My flowchart can be found as **FIGURE 1** in the appendices.

I used the **XY Table to Point** tool to convert the shot data CSVs into point polygons. The inputs were the shots CSVs and fields x and y, the coordinate system was GCS_WGS_1984 (to maintain consistency with the map despite not being directly relevant), and the outputs were point feature classes called KyleLowryPoint and TorontoRaptorsPoint.

To create a choropleth representation of the data, I first used the **Generate Tessellation** tool. I chose the extent input to be equal to the court GeoTIFF since this would cover only the necessary area. I chose a size of 300 (~1 meter) for each hexagon, since this is roughly the area that it takes to make a basketball shot. The output was a hexagon tessellation FC called HexagonTessellation.

I then used the **Spatial Join** tool to join the tessellation with the shot points. The inputs were HexagonTessellation as the target feature and each of the point FCs as the join feature. The join operation is One to One and the match option is intersect since we want to join all points that intersect with each hexagon polygon. I deselected "Keep All Target Features" since I didn't want to show hexagons where there are 0 permits – this makes the court visible in some locations which makes the map easier to interpret. I also used the *Add Field* tool within this operation to also get the sum of made shots. The inputs to this were the point tables, the field "shot_made_flag", and the action "Sum". The outputs were the hexagon FCs KyleLowry_SpatialJoin and TorontoRaptors_SpatialJoin. To get the direct comparison between Lowry and the Raptors, I used **Spatial Join** again but changed the target feature to KyleLowry_SpatialJoin and the join feature to TorontoRaptorsPoint.

Finally, I used **Calculate Field** to get the efficiency in each of these cases. The inputs were each of the spatial join FCs as the input table, the new field name as "ShotEfficiency", the expression type as Python, and the expression as `(!shot_made_flag_Sum! / !Join_Count!) * 100` for the individual shot maps, and `!ShotEfficiency! - ((!shot_made_flag_Sum_1! - !shot_made_flag_Sum!) / (!Join_Count_1! - !Join_Count!) * 100)` for the direct comparison shot map.

Results or Analyst Summary

Based on **FIGURE 3**, we see that Lowry took mostly 3-point shots or shots close to the net. In the

mid distance area there are many holes and most of the hexagons are either red (0-10%) or green (90-100%), meaning that there were fewer consolidated points here. Most of the hexes are clustered in the middle of the court. Lowry's 3-pointers from the right side seem better, which he often makes more than 60% of the time compared to 0-40% in other 3-pointer locations. He makes the majority of layups/dunks (50-70%) and is better from the left of the net.

From **FIGURE 4**, we see that the Raptors shoot from a much wider variety of areas. The shooting area is almost completely full, apart from a few empty areas in the left and right mid distance. The team is generally best in the center, especially for layups/dunks where they achieve 70-80% success. They consistently miss most of the time from the far outside the 3-point line, at usually only 0-20% success. They make around 30-40% of 3-pointers overall.

Looking at **FIGURE 5**, note that positive values indicate Lowry beating his teammates. They are evenly matched in most areas (such as layups, with -20 to 20%). Lowry is around 10-20% better than his teammates at 3-pointers in most locations. However, he is consistently worse than his team in the middle mid-distance area, where he is -100 to -20% worse.

Discussion & Conclusion

In terms of distribution, since Lowry is the point guard, his main role is handling the ball and setting up plays for others. This may explain why he stays near the center of the court, since this is where most plays are started from. Additionally, from this position he'd be able to run back and collect the ball easier if the direction of play changes. Furthermore, Lowry doesn't shoot from as many areas as the full team. This is because while he is responsible for coordinating offensives, he may not always be the one taking the final shot.

In terms of accuracy, we see that Lowry is slightly better at shooting overall than his average teammate. Point guards are one of the most important positions on a basketball team, so it makes sense that he is a good all-around player. Lowry is likely worse than his team in the mid distance because his position often prevents him from shooting in this location.

This analysis can help the Raptors identify strengths and weaknesses of their players. If Lowry is aware of his weakness in the center mid distance, he can practice shots from these areas to improve. Furthermore, analyzing trends with the whole team can help coaches to design plays suited to their player's strengths and improve their spacing, ball movement, and cohesiveness as a whole. Finally, teams can repeat this analysis on opposing teams in order to find weaknesses and make personalized offensive and defensive strategies for each game.

Part 2 —

Methods/Process

My flowchart can be found as **FIGURE 2** in the appendices.

The first step was to import the relevant modules into Python, which included the `nba_api` module. From this module, we imported all the player data into a stored dictionary. Then, to get individual player data, we accessed this dictionary using the full names of each player as input ("Kyle Lowry" and "Kawhi Leonard") and got each player's number as output. The next step was getting the shot charts by calling the `shotchartdetail` function. The inputs were `player_id=player_num`, `season_nullable='2018-2019'`, and `season_type_all_star='Regular Season'` or `season_type_all_star='Playoffs'`. The output was a table with all of each player's shots over the given season type. Next, successes and failures were split by differentiating between the field SHOT_MADE_FLAG being 1 or 0, and plotted. The court map was also plotted. Finally, the hex plot was

created using the `plt.hexbin` function (from the Matplotlib library) on our successes/failures inputs, including appropriate titling for each player and season type. The output was 4 hexagon tessellation choropleth shot maps saved automatically as PNGs.

Results or Analyst Summary

From **FIGURE 6**, we see very similar data to Part 1 (data clustered towards the center, ~50% chance of a 3-pointer, 60-90% chance of a layup, few mid distance), which implies that Lowry is consistent in his shot efficiency over different seasons.

From **FIGURE 7**, we see that Lowry did not shoot that much in the playoffs. There are very large holes in the mid distance, especially on the left side. However, we again see that the trend of success is consistent with the regular season.

From **FIGURE 8**, we see that Leonard shoots from a very large variety of areas. Most of the shooting area is covered, apart from some holes just inside the 3-point line (since he would likely take a step back before shooting to get an extra point). There are not as many solid groupings of colours and much of the mid distance is somewhat of a random spattering of hexes. Leonard is consistently around 10-50% successful at 3-pointers and 60-80% successful at layups/dunks. He does better when shooting from the right side of the mid range almost perpendicular to the backboard, where he achieves 70-100% success consistently. His worst location is the opposite side of the court to his best, where he consistently gets ~0-10% success.

From **FIGURE 9**, we see that Leonard still shot a lot during the playoffs. He shot from similar areas to the regular season, but with different success. We see that his best areas (under the net, right mid distance) remain the same, but he is now shooting much worse from the center and 3-pointers.

Discussion & Conclusion

My general hypothesis is that the shooting patterns of players in different positions are vastly different and that pressure can have an impact on shooting accuracy.

Lowry is a point guard, which we discussed in Part 1, while Leonard is a power/small forward. While Lowry is more focused on making plays, Kawhi's main role is to shoot and score points. This is why he shoots much more often than Lowry and also from anywhere in the shooting area. He is not confined by as much responsibility to run back for the ball and can make plays from anywhere. Kawhi is also slightly more accurate overall compared to Lowry. This is due to his role being solely focused on scoring points and completing plays.

Since the Raptors won the 2018-2019 championship, there was a lot of pressure during the playoffs to perform. This may affect how accurately a player shoots. We saw that Lowry was very consistent in his shooting locations and accuracy both across seasons and between the regular season and the playoffs. However, he did shoot significantly less during the playoffs. Leonard was a much more inconsistent shooter in the playoffs – he did significantly worse in some locations and better in others. However, he did keep up the pace and continued to shoot a lot. This may point to indications of Lowry growing tired and Leonard beginning to crack under the pressures of the playoffs.

Overall, comparing the accuracy and locations of different positions can help the Raptors to construct better plays that suit the strengths of each player. This analysis can also be done on opposing teams to find the best defensive matchups in terms of which player should guard which enemy. Furthermore, if the team is missing a player who's strong in a certain location or has players that don't align with their position, this may be a factor in the next draft. Analyzing the effects of pressure on player's shooting styles can also be helpful when preparing for high-stress games. Players who are more resilient may be better suited to be a captain, leader, or point guard of the team.

Appendices

FIGURE 1 – Part 1 Flowchart

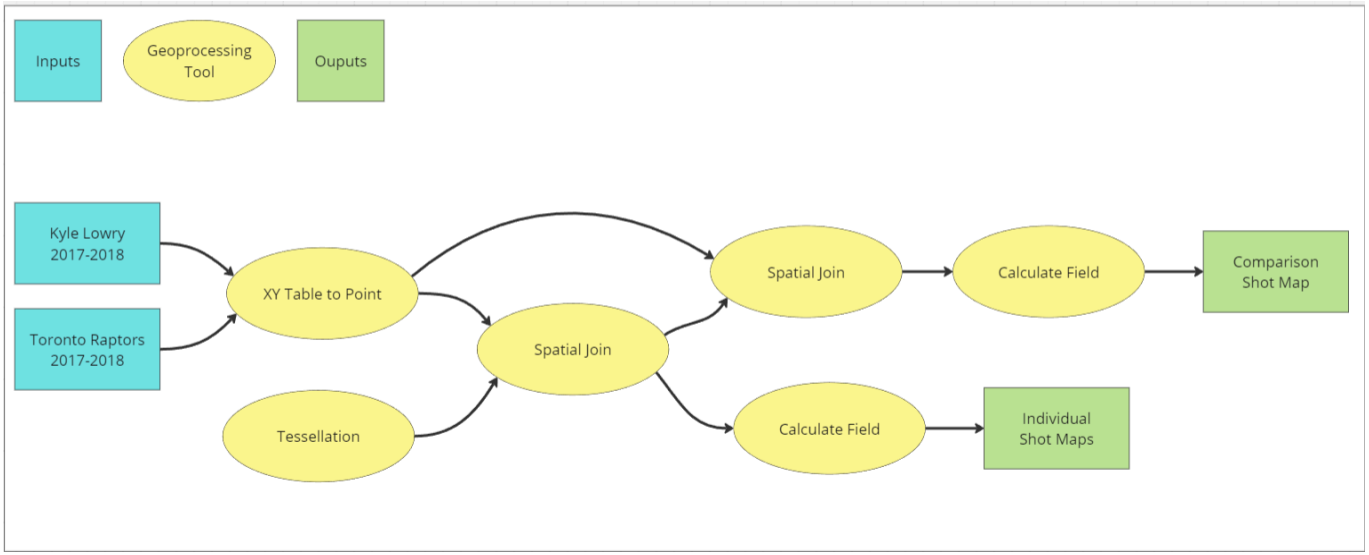

FIGURE 2 – Part 2 Flowchart

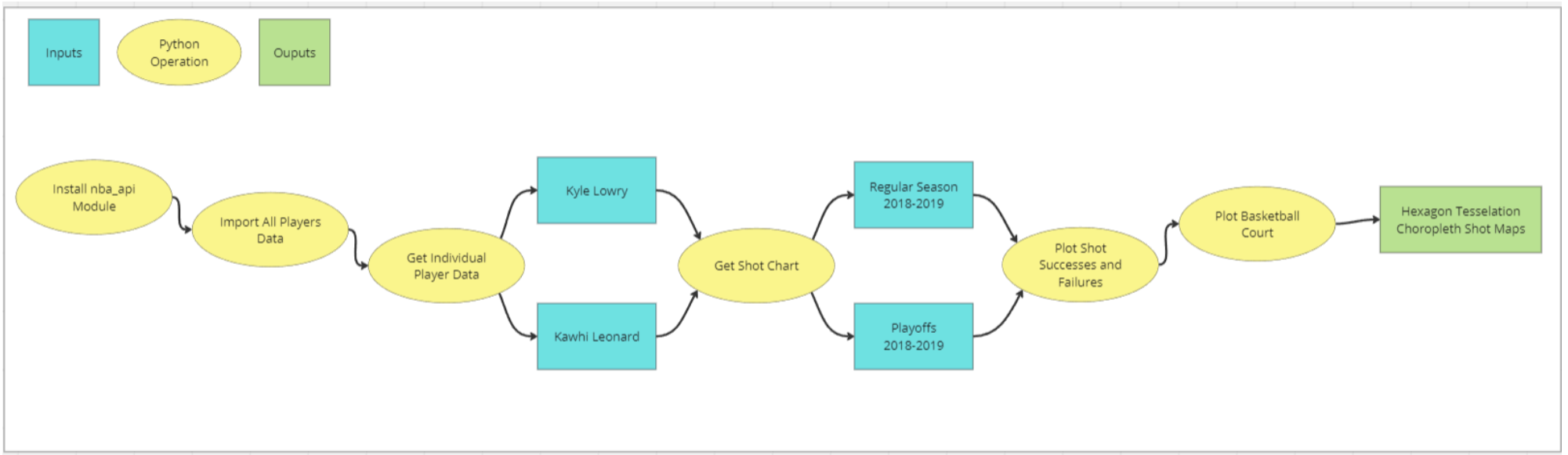

FIGURE 3 – Part 1 Kyle Lowry Map

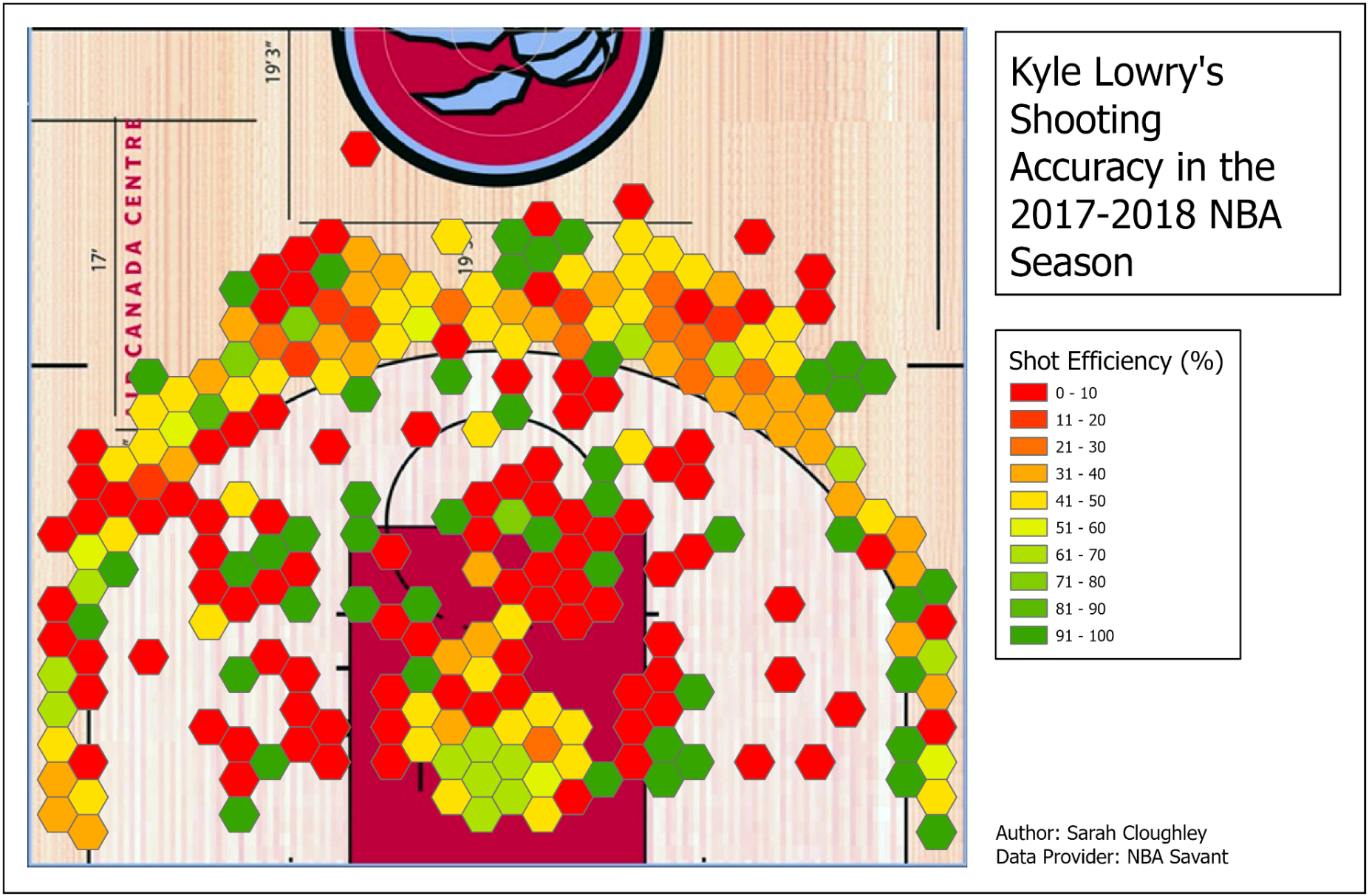

FIGURE 4 – Part 1 Toronto Raptors Map

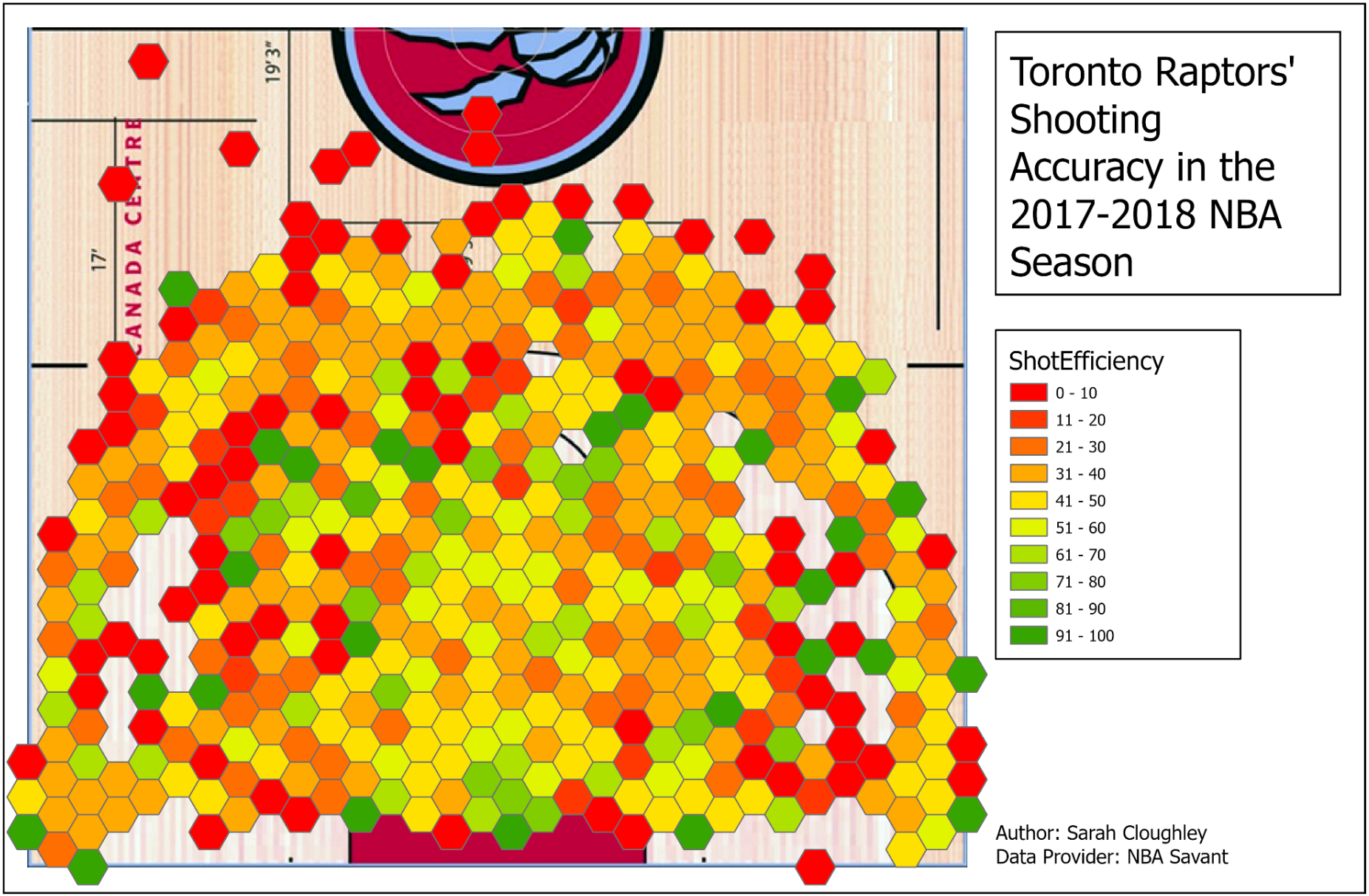

FIGURE 5 – Part 1 Kyle Lowry vs. Toronto Raptors Map

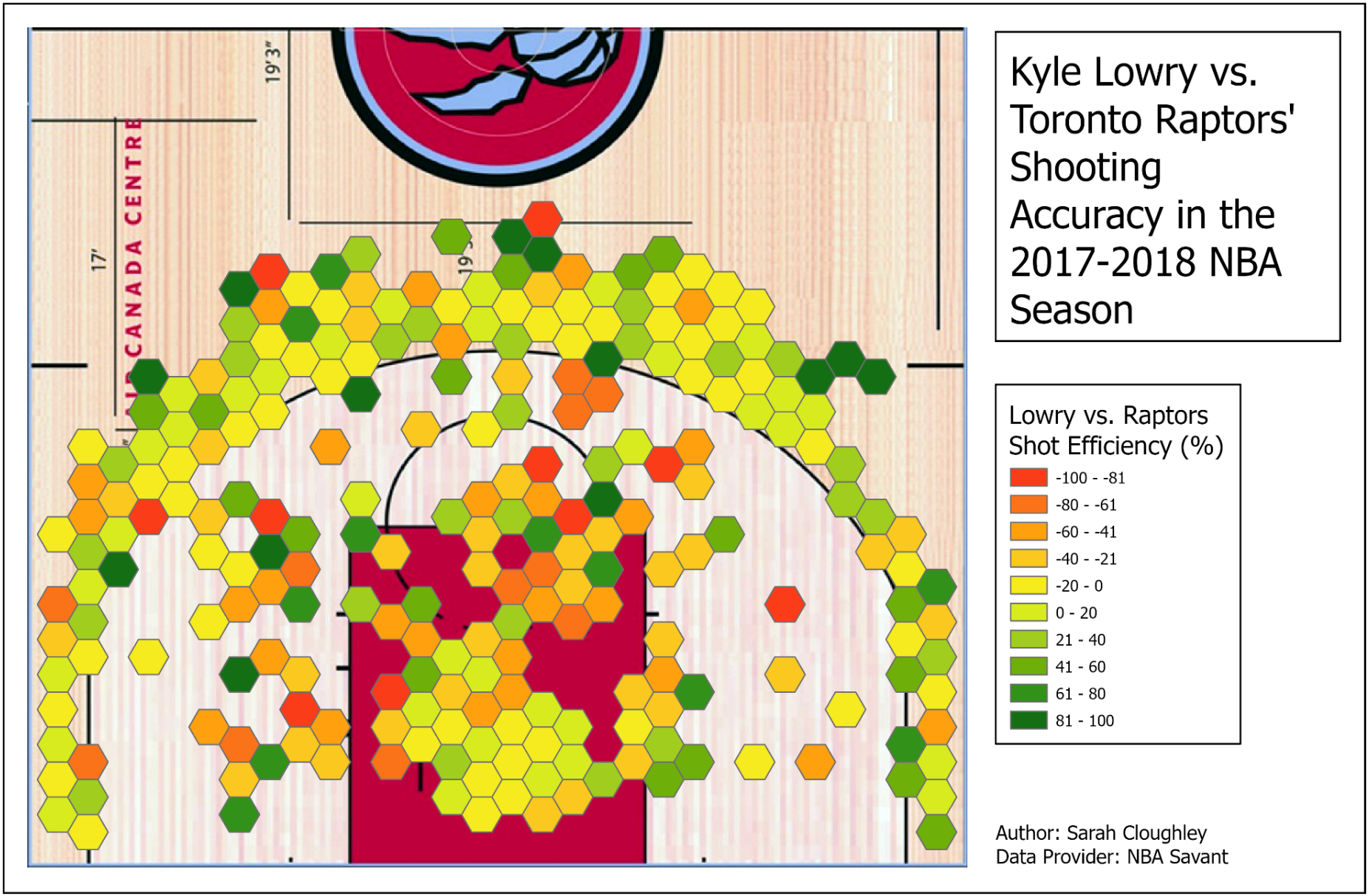

FIGURE 6 – Part 2 Kyle Lowry Regular Season Map

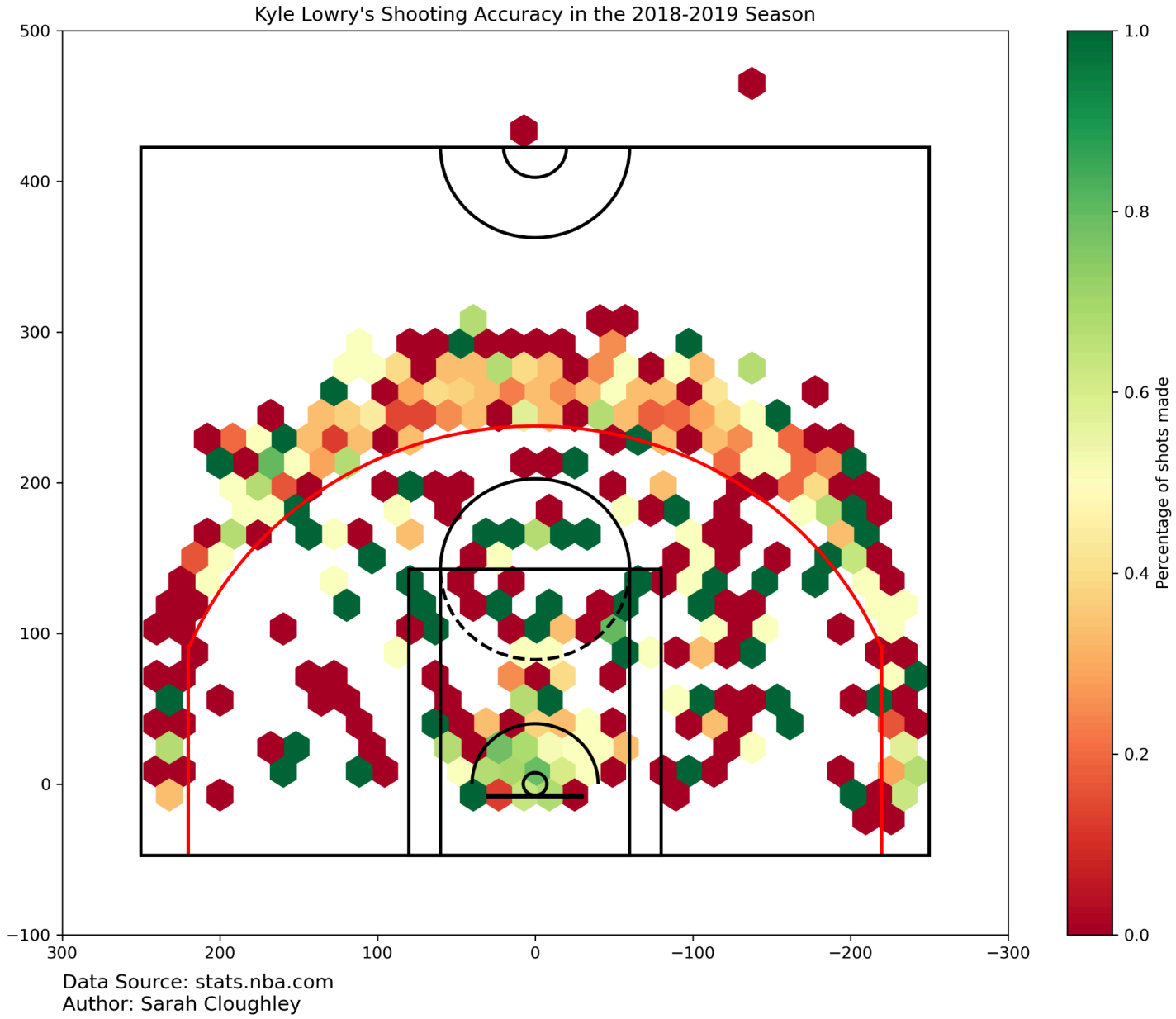

FIGURE 7 – Part 2 Kyle Lowry Playoffs Map

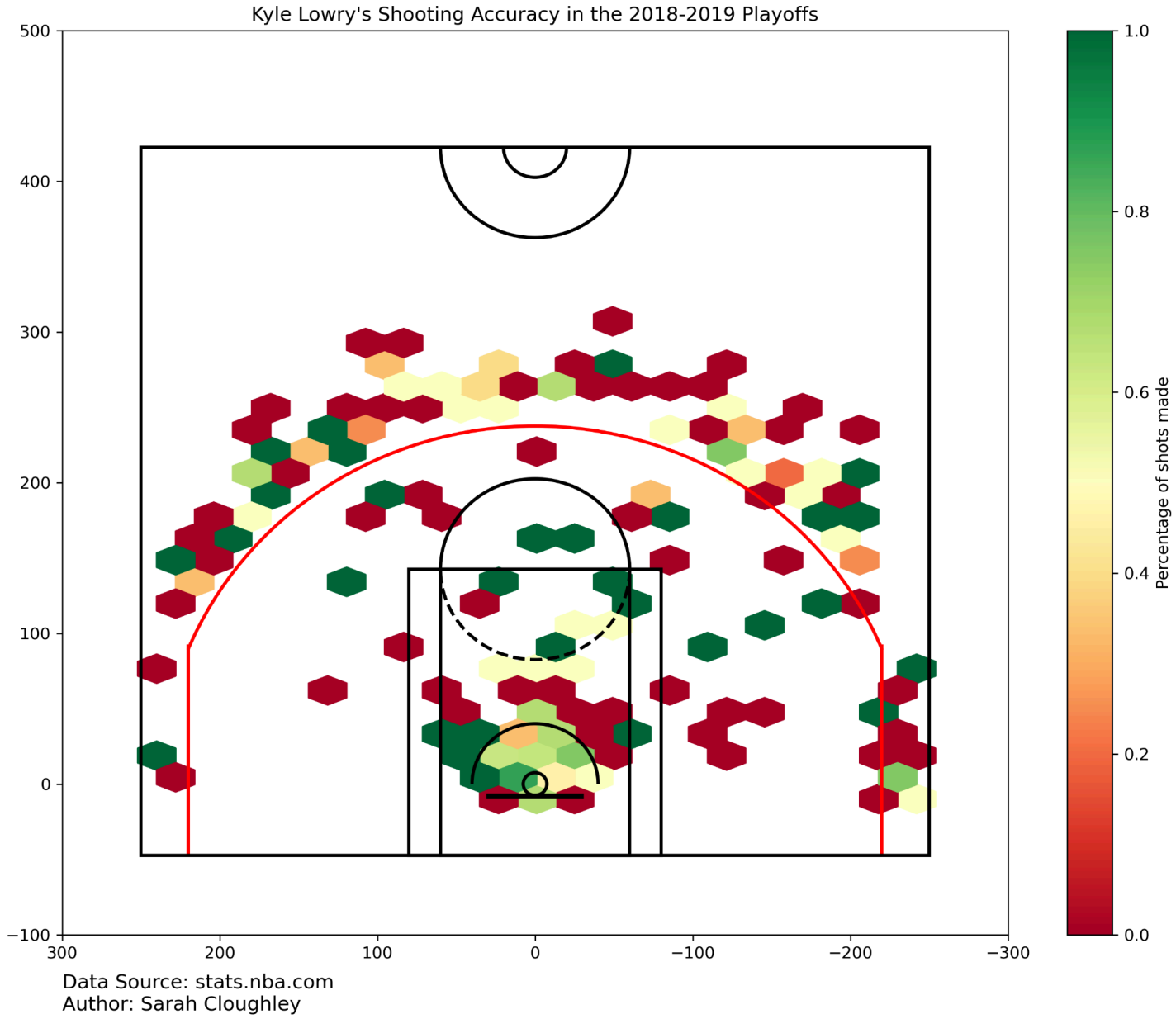

FIGURE 8 – Part 2 Kawhi Leonard Regular Season Map

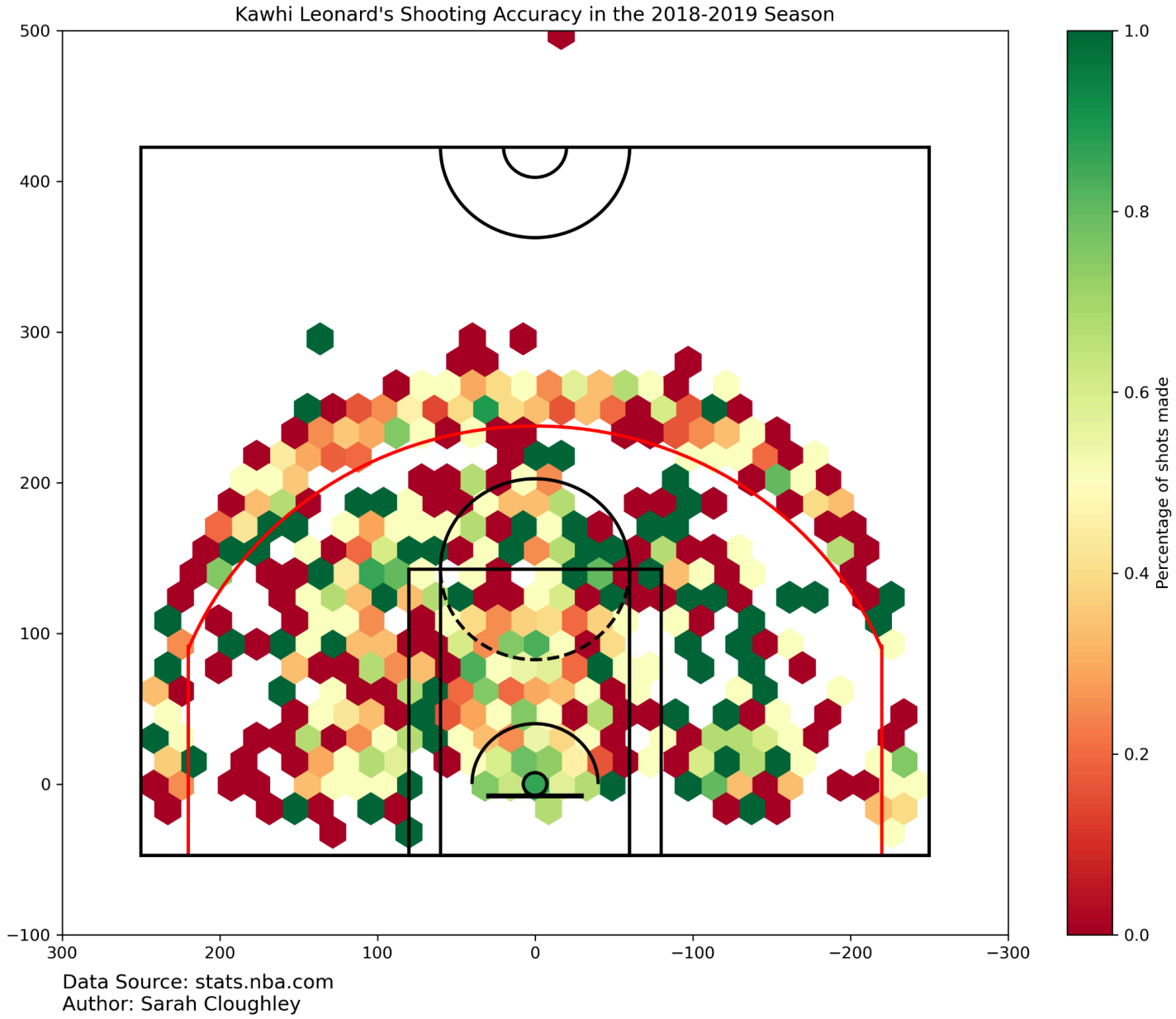

FIGURE 9 – Part 2 Kawhi Leonard Playoffs Map