Assignment 3: Visualizing NBA Shot Location and Efficiency Using GIS and Python

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Introduction

Spatial analysis has become a valuable tool in professional basketball, allowing analysts to examine where on the court players are most effective. This report uses GIS and Python to visualize and compare NBA shot efficiency. Step 1 maps Stephen Curry's 2021-22 shot efficiency in ArcGIS Pro and compares it to the Golden State Warriors. Step 2 uses Python to compare Curry to Nikola Jokic, two players whose positions and roles shape very different shot profiles.

Step 1: Player and Team Shot Efficiency

Method

The analysis began by importing the provided shot location data and the georeferenced court image into ArcGIS Pro. Shots for the target player were isolated using “Select by Attributes” and exported to a new feature class. A hexagonal grid was then generated over the court using the “Generate Tessellation tool” at a hexagon size of 450 units, and the shots were spatially joined to these hexagons so that each hexagon counted the attempts falling within it. A size of 450 units was chosen to balance spatial detail against reliability, as smaller hexagons would contain too few shots to produce stable percentages while larger hexagons would obscure local variation in shooting efficiency. Because the dataset records each shot as made or missed in a TRUE/FALSE field, a new integer field was created assigning 1 to made shots and 0 to missed shots. Summing this field per hexagon gives the number of makes, and field goal percentage was then calculated as:

$$FG\% = (\text{made shots} / \text{total attempts}) \times 100$$

To avoid unreliable values, hexagons containing no shot attempts were removed so that zones without observations would not produce undefined percentages. For the difference map, a stricter threshold of five attempts per player was applied to reduce noise from low-volume hexagons that would otherwise show extreme differences. The resulting field goal percentages were symbolized using five manual class breaks with a sequential red-to-green colour scheme, where red represents low efficiency and green represents high efficiency. The full workflow is shown in Figure 1.

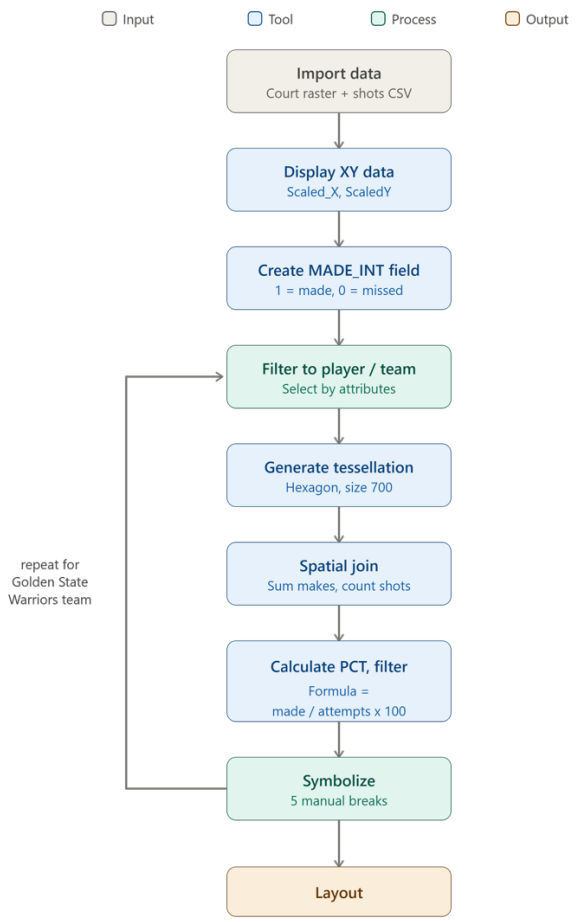

Figure 1. *Workflow for producing the Step 1 shot efficiency maps in ArcGIS Pro.*

Stephen Curry's shot efficiency

Curry's shot efficiency map (Figure 2) shows a player who is effective across most of the court. He is highly efficient around the rim, reflecting his ability to finish at the basket on drives and layups, and he is similarly outstanding at the three-point arc, the area most associated with his game. His efficiency in the free-throw and mid-range area is also high. The main cold zones appear toward the wings, where his field goal percentage drops into the 0 to 33% range. Overall, the spatial pattern shows that the majority of his shots are taken at high efficiency (above 50%), with his strongest and most consistent zones being behind the three-point line and through the mid-range and free-throw area.

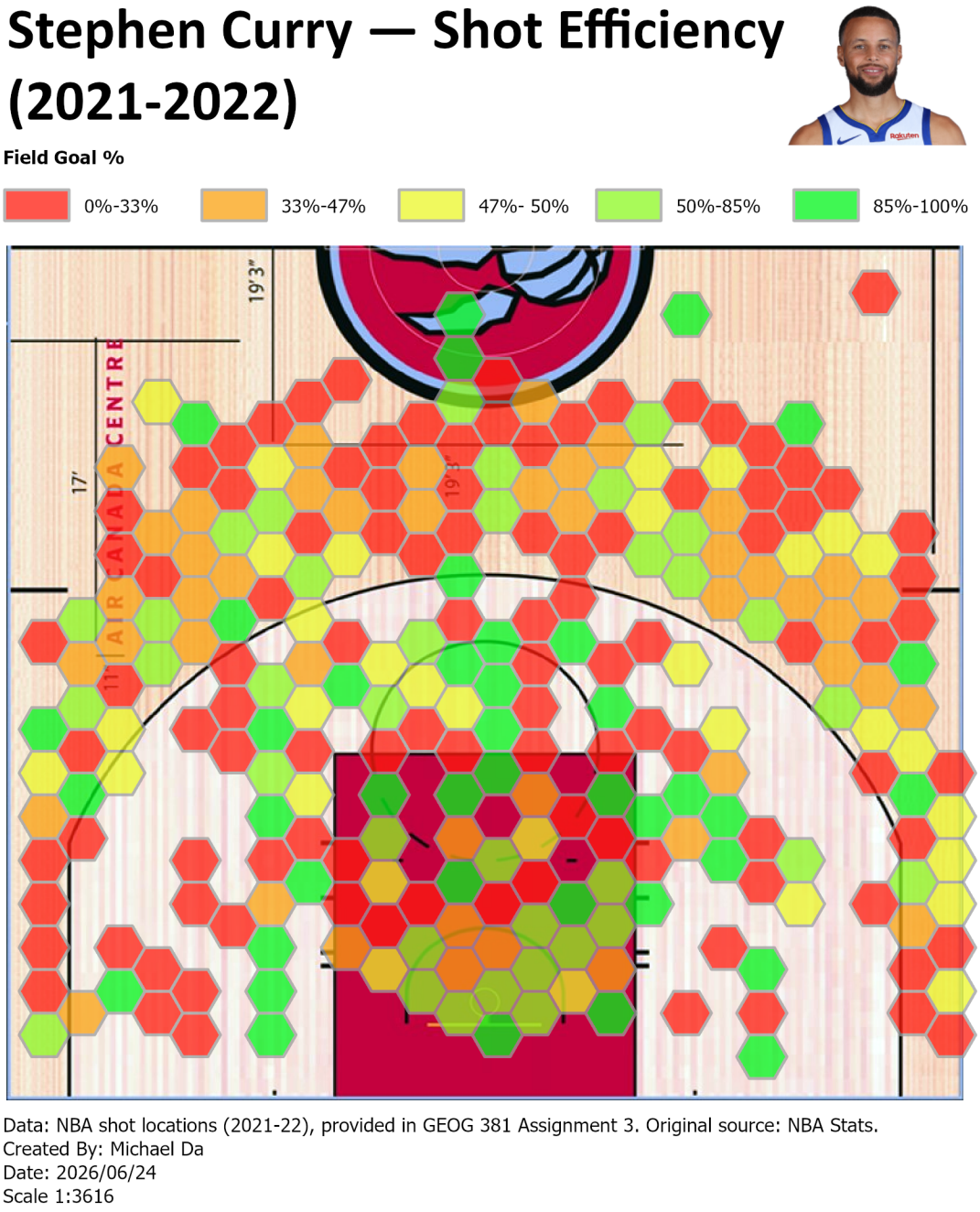

Figure 2. *Stephen Curry field goal percentage by court zone, 2021-22 season. Hexagons are symbolized from red (low efficiency) to green (high efficiency).*

Comparison to the Golden State Warriors

The team map (Figure 3) shows the Warriors are consistent in the mid-range and close to the rim, reflecting reliable interior scoring from big size players such as Kevon Looney and Draymond

Green. They are also efficient along the three-point arc, which is expected given the presence of strong perimeter shooters such as Klay Thompson and Jordan Poole alongside Curry.

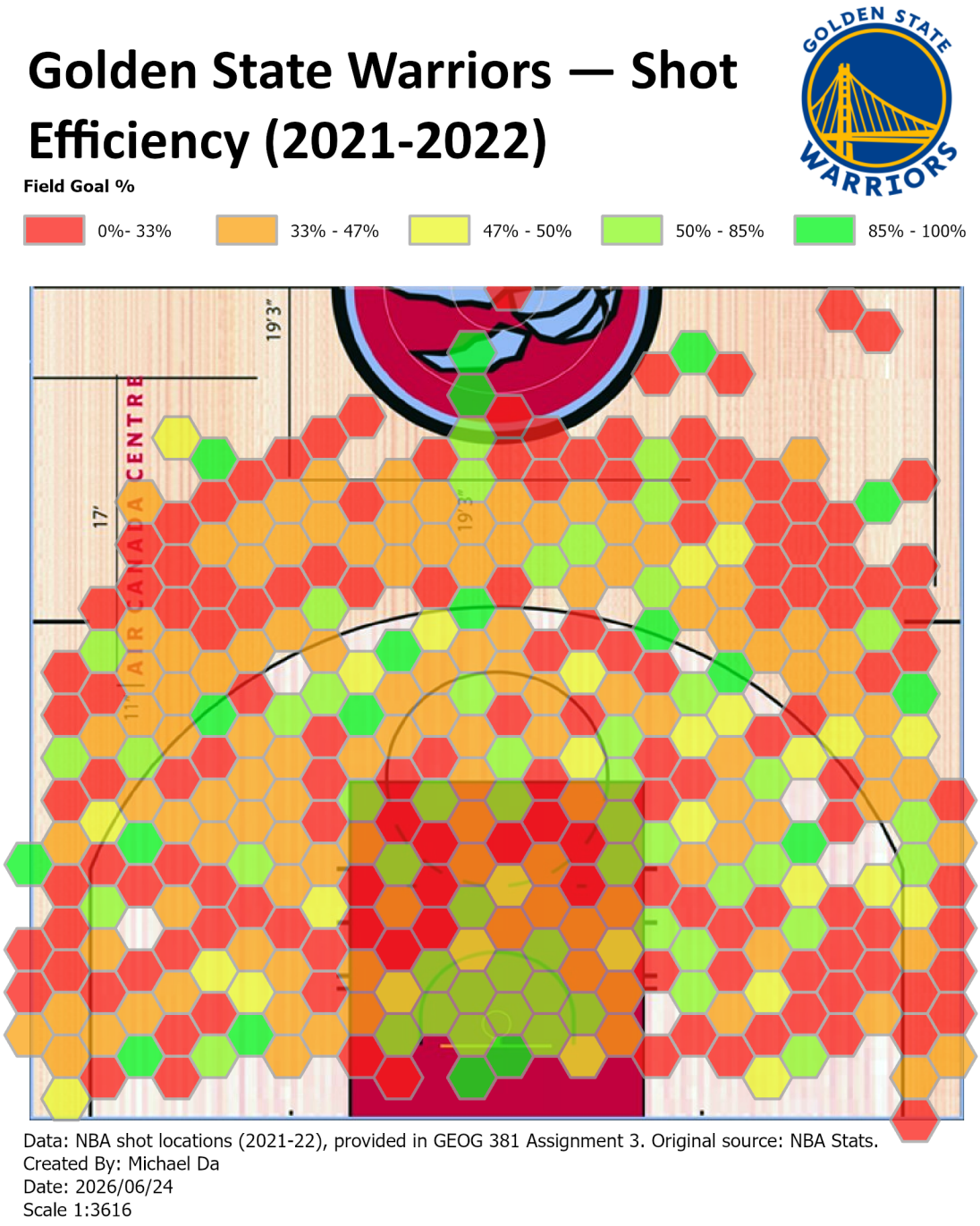

Figure 3. *Golden State Warriors team field goal percentage by court zone, 2021-22 season, using the same hexagonal grid and symbology as Figure 2.*

The difference map (Figure 4) makes the player-versus-team comparison explicit by subtracting team field goal percentage from Curry's at each hexagon. Like the other maps, it was

filtered to remove low-volume hexagons, which reduces noise and makes the spatial pattern clearer. The result confirms that Curry is clearly better than his team along the three-point arc, where many hexagons show him shooting 7 to 20% (and in places more than 20%) above the team average. This aligns with his public reputation as one of the greatest shooters in NBA history. Conversely, he is below the team average at the rim, likely a reflection of his smaller size relative to the bigs who finish at high percentages near the basket.

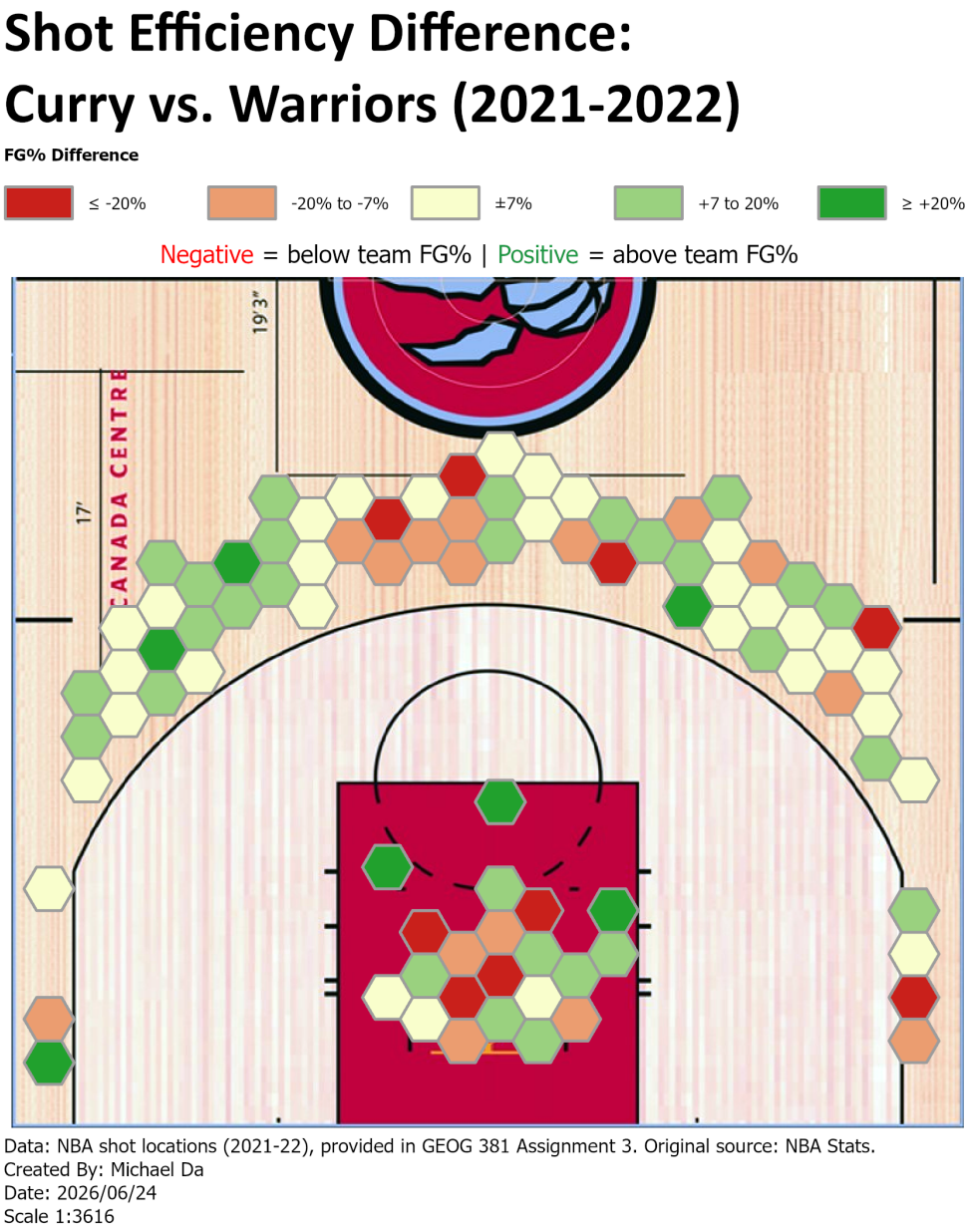

Figure 4. *Difference in field goal percentage between Stephen Curry and the Golden State Warriors per court zone, 2021-22. Green indicates zones where Curry shoots above the team average; red indicates below.*

Step 2: Player Comparison (Curry vs Jokic)

Hypothesis

Stephen Curry and Nikola Jokic were chosen because both were central to their teams' success in the 2021-22 season: Curry won the championship and Finals MVP with the Golden State Warriors, while Jokic won the regular-season MVP. Both players play very different positions, which should produce very different shot profiles. The hypothesis is that Curry, as a point guard, takes significantly more shots from three-point range and fewer near the rim, while Jokic, as a center, takes more shots in the mid-range and near the rim because of his size, and only occasionally shoots from three. This difference is expected to reflect each player's position, role, and physical attributes.

Method

The shot data was obtained from a Kaggle dataset of NBA shots spanning 2003 to 2024 and processed in a Python (Jupyter Notebook) workflow. The seasons were aggregated into a single dataset, which was then loaded and filtered to the two target players for the 2021-22 season. The raw shot coordinates were stored in compressed units that did not match the court's scale, so the X and Y coordinates were rescaled to align the shots correctly with the court. For each player, a hexbin chart was generated showing field goal percentage by location, where each hexagon is coloured from red (low efficiency) to green (high efficiency, approaching 100%). A made-versus-missed scatter chart was also produced to show shot volume and distribution. To reduce noise, hexagons containing fewer than 3 shot attempts were excluded so that a single make or miss would not distort the field goal percentage. The full workflow is shown in Figure 5.

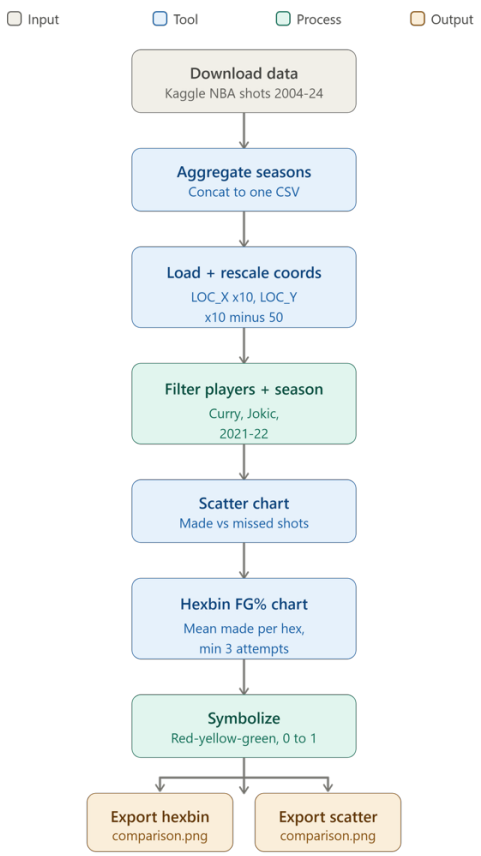

Figure 5. *Workflow for producing the Step 2 shot charts in Python (Jupyter Notebook).*

Analysis

The comparison supports the hypothesis. The made-versus-missed scatter (Figure 7) shows the clearest contrast in shot location: Curry's attempts are spread across the entire three-point arc as well as the paint, while Jokic's are heavily concentrated in the paint, with a thinner band of attempts along the arc. Curry takes far more three-point shots than Jokic, and Jokic takes far more of his shots near the rim.

The hexbin efficiency charts (Figure 6) reinforce this. Jokic is highly efficient in the paint, where most of his hexagons are green, reflecting a high field goal percentage close to the basket. His three-point attempts are fewer and less consistent. Curry's efficiency is spread across a much wider area, with his most consistent green zones at the rim and scattered strong zones around the perimeter. It is worth noting that Curry's three-point hexagons appear mixed in colour rather than uniformly green; this is because the colour scale measures raw field goal percentage, and even an elite three-point shooter converts these longer shots at a lower rate than a layup, so they appear less "green" despite being highly valuable shots.

These differences relate directly to each player's role, position, and size. Curry is a smaller point guard who moves around the floor and naturally takes shots further from the basket; as one of

the greatest shooters in NBA history, he takes these longer attempts in high volume. Jokic is a large center who operates close to the basket, where his size allows him to score over and through defenders, making the paint both his most-used and most-efficient zone. In short, position and physical attributes shape not only where each player shoots, but where they are most effective.

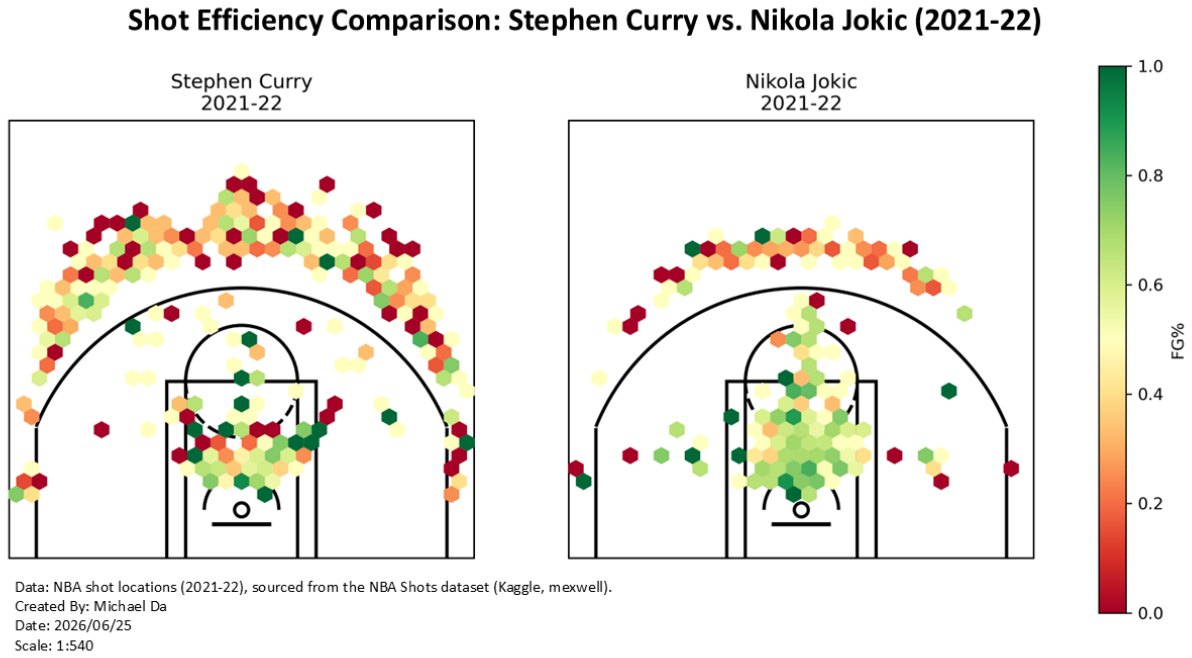

Figure 6. *Field goal percentage by court location for Stephen Curry and Nikola Jokic, 2021-22 season, shown as hexbin charts. Hexagons are coloured from red (low efficiency) to green (high efficiency).*

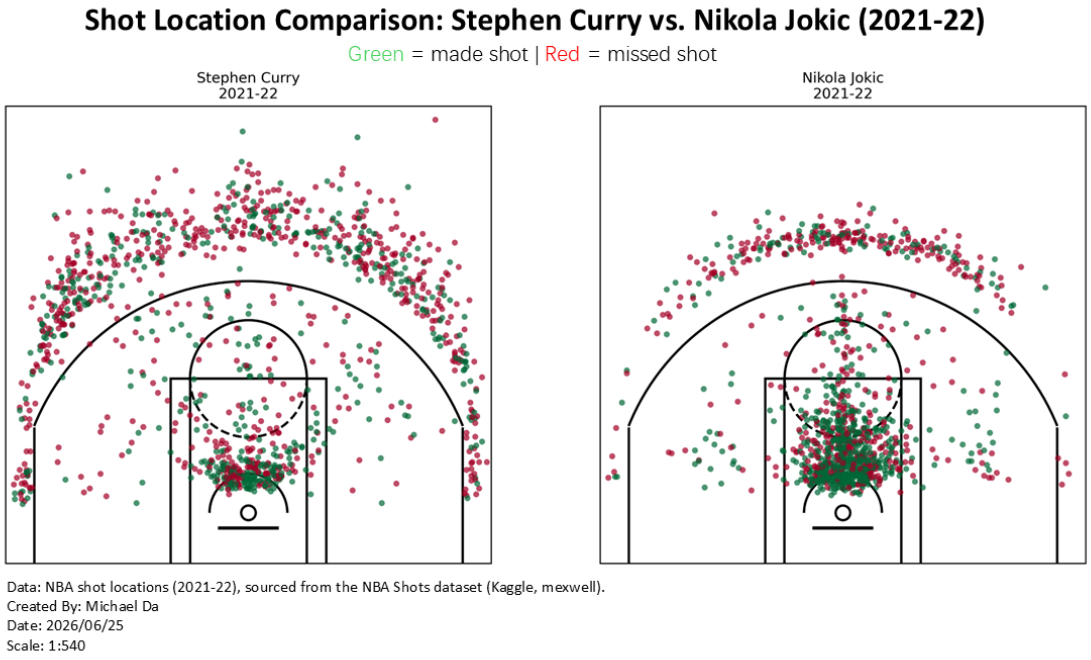

Figure 7. *Made (green) and missed (red) shot locations for Stephen Curry and Nikola Jokic, 2021-22 season.*

Conclusion

This report used GIS and Python to map and compare NBA shot efficiency for Stephen Curry and Nikola Jokic. In Step 1, ArcGIS Pro showed that Stephen Curry is efficient across most of the court, particularly along the three-point arc, and that he outperforms his team from range while finishing below the team average at the rim. In Step 2, a Python workflow compared Curry to Nikola Jokic and confirmed that their shot profiles differ sharply: Curry's attempts spread across the perimeter, while Jokic's concentrate in the paint where he is most efficient. Together, the two analyses show that a player's position, role, and physical attributes shape not only where they shoot, but where they are most effective. These maps demonstrate how spatial visualization can reveal shooting tendencies and location-based patterns that are difficult to identify using traditional box-score statistics alone.

References

Mexwell. (n.d.). *NBA shots* [Data set]. Kaggle. Retrieved June 25, 2026, from https://www.kaggle.com/datasets/mexwell/nba-shots

National Basketball Association. (2022). *NBA shot location data, 2021-22 season* [Data set].