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BAS 320
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NFL Analysis Report:

Quarterback's Passing Performance (2019-2023)

This report provides an in-depth analysis of NFL player statistics from the **2019-2023** seasons, with a primary focus on **quarterbacks and their passing performance**. The objective is to identify trends, evaluate key performance indicators (KPIs), and derive insights that can be used for **talent evaluation, performance forecasting, and strategic decision-making** in football analytics.

Data Overview

The data used for this analysis comes from the "nflfastR" package in R, a comprehensive dataset that includes NFL statistics dating back to 1999. The dataset contains detailed play-by-play information, allowing for granular analysis of player performance. Key variables analyzed in this report include:

Player information (Name, Team, Position)
Passing Metrics:

- **Attempts & Completions** – Measures efficiency in passing plays.
- **Passing Air Yards** – Distance the ball travels in the air before a reception.
- **Yards After Catch (YAC)** – Additional yards gained by the receiver after catching the ball

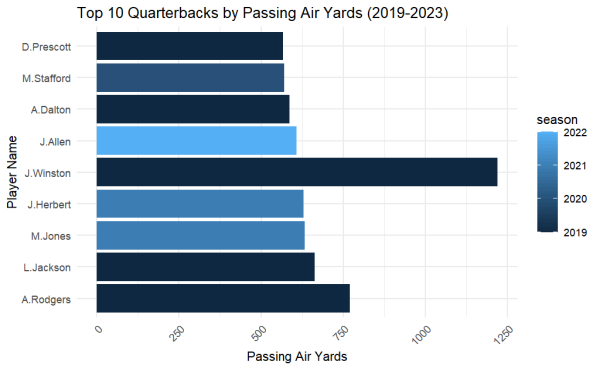
Data Processing & Summary Statistics

To ensure accuracy and relevance, the dataset was **filtered** to include only player statistics from the **regular seasons of 2019-2023**. The data processing steps are shown the the left with a snippet of code, these steps included:

```
seasons <- 2019:2023
QBs <- Players %>%
  filter(position == "QB")
Players <- load_player_stats(2019:2023)
associate(attempts~completions, data=Players)
BySeason <- Players %>%
  group_by(player_name,season)
summary(BySeason)
```

1. **Isolating relevant seasons** to focus on the latest five-year period.
2. **Filtering for quarterbacks**, as they are the primary drivers of passing statistics.
3. **Aggregating yearly totals for each player**, ensuring that comparisons are based on full-season performance rather than individual games.

A **bar chart,** to the left, illustrates the **top 10 quarterbacks** ranked by **passing air yards**, with colors indicating the year of their highest recorded total. One notable observation is that **Jameis Winston (2019)** had a significantly higher passing air yard total than any other quarterback in the dataset—nearly **double** the air yards of other top performers.



The **summary statistics table (below),** “Quarterback Performance Summary”, provides key performance insights:

- **Mean and median values** for **passing air yards, yards after catch, attempts, and completions**, offering a statistical benchmark for quarterback performance.
- Distribution trends that highlight consistency and outliers in quarterback efficiency over the years.

🏈 **Quarterback Performance Summary**

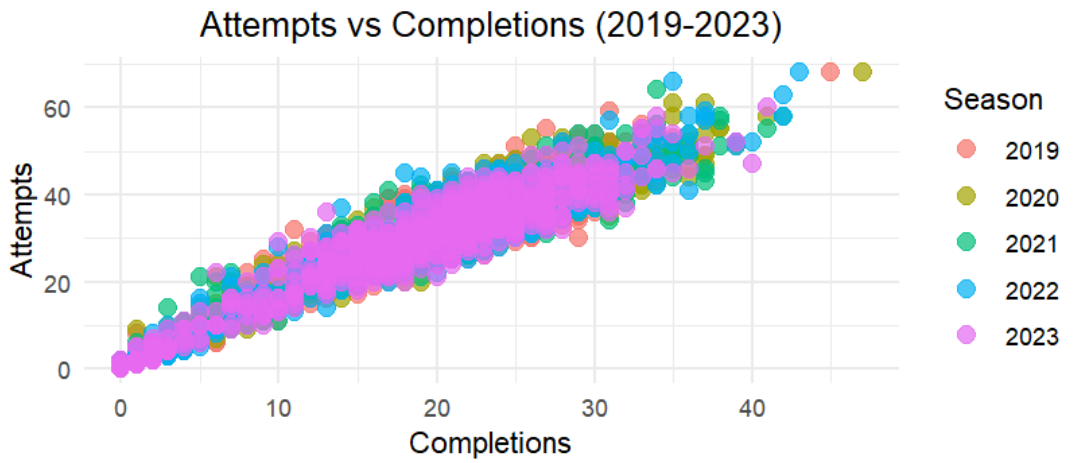
Metric	Passing_Yards_After_Catch	Passing_Air_Yards	Attempts	Completions
Mean	974.3595	2,297.209	292.1471	188.7157
Median	878.5000	2,135.000	269.0000	174.0000
Min	18.0000	17.000	6.0000	3.0000
Max	2,830.0000	6,481.000	733.0000	490.0000

This shows some insight to the type of data we will be analyzing for deeper exploration, allowing us to evaluate performance consistency, identify standout seasons, and assess potential factors influencing passing success.

Pearson Correlation Analysis: Relationship Between Pass Attempts and Completion Rate

Understanding the Scatter Plot

The scatter plot below visualizes the relationship between **quarterback pass attempts and completion rate** for the **2019-2023 NFL seasons**. Each data point represents a quarterback's season performance, and the colors indicate the specific year in which the data was recorded, as shown in the legend to the right.



Pearson Correlation Test Results

To quantify the relationship between **pass attempts and completions**, we conducted a **Pearson correlation analysis**, which measures the strength and direction of a linear relationship between two continuous variables. The results are as follows:

- **Pearson correlation coefficient (r): 0.9898**
- **t-value: 1153.6**
- **Degrees of freedom (df): 27,688**
- **p-value: < 2.2e-16**

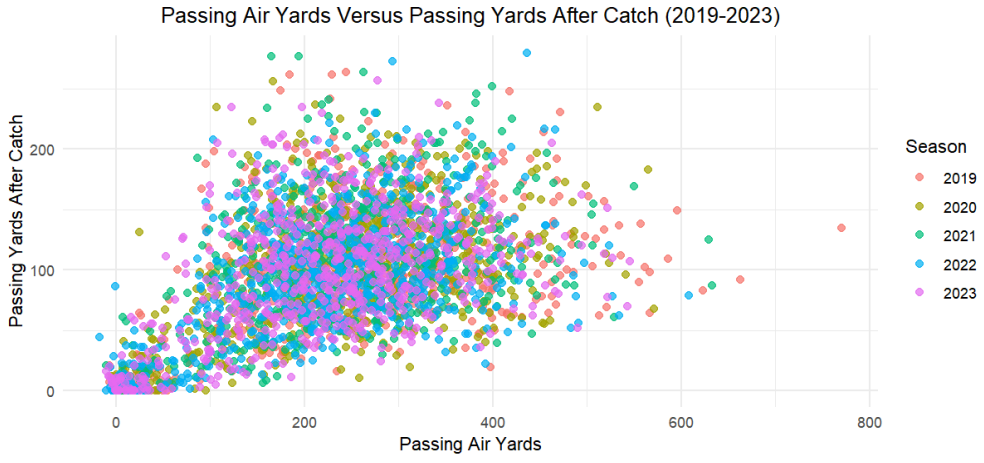
Interpretation

- The Pearson correlation coefficient of **0.9898** indicates an **extremely strong positive correlation** between pass attempts and completions. This means that as the number of pass attempts increases, the number of completions also increases in a highly predictable manner.
- The **p-value (< 2.2e-16)** confirms that this relationship is **statistically significant**, meaning the likelihood of this correlation occurring by random chance is virtually zero.
- From a **business perspective**, this suggests that quarterbacks with higher passing volume (more attempts) tend to complete more passes at a nearly linear rate. This is expected in football analytics, as passing volume typically correlates with higher yardage and offensive efficiency.
- This insight can be used in **quarterback evaluation**, **play calling strategy**, and **fantasy football projections**, as it reinforces the importance of consistent passing opportunities in driving a quarterback's overall effectiveness.

Spearman Correlation Analysis: Relationship Between Passing Air Yards and Yards After Catch (YAC)

Understanding the Scatter Plot

The second scatter plot **(shown below)** visualizes the relationship between **passing air yards and passing yards after catch (YAC)** for quarterbacks from **2019-2023**. Unlike the first dataset, this distribution is **less linear** and includes **several outliers**, such as a quarterback who recorded **800 passing air yards but only 140 YAC**.



Spearman Correlation Test Results

Since this dataset does not exhibit a strong linear relationship, we performed a **Spearman rank correlation analysis**, which is more appropriate for assessing **monotonic relationships**, particularly when the data contains non-linearity or outliers. The results are as follows:

- **Spearman correlation coefficient (ρ): 0.5212**
- **S-statistic: 3,027,223,083**
- **p-value: < 2.2e-16**

Interpretation

- The **Spearman correlation coefficient of 0.5212** suggests a **moderate positive correlation** between **passing air yards and YAC**, meaning that quarterbacks who throw longer passes tend to have higher yards after catch, but not in a strictly linear way.
- The **p-value (< 2.2e-16)** confirms that this correlation is **statistically significant**, meaning that the relationship is unlikely to be due to chance.
- Unlike pass attempts and completions, this relationship is **less predictable**, indicating that factors beyond air yards influence YAC—such as **receiver ability, defensive coverage, and offensive scheme**.
- From a **football analytics perspective**, this insight suggests that while quarterbacks who throw deep passes can create opportunities for YAC, **it is not guaranteed**—meaning teams should consider receiver skill, play design, and defensive tendencies when evaluating a quarterback's effectiveness in gaining yards beyond the catch.

References

Microsoft Corporation. (2025). *Copilot: Your AI Companion*. Retrieved from https://privacy.microsoft.com/en-us/privacystatement

OpenAI. (2025). *ChatGPT: Language Model Developed by OpenAI*. Retrieved from https://www.openai.com/