**Memorandum**

Momentum Momentum

The Secret of

**To:** Coaches

**From:** Team # 2420216

**Subject:** Research on Momentum and Recommendations for Player Preparation

**Date:** February 5, 2024

Dear Sir or Madam:

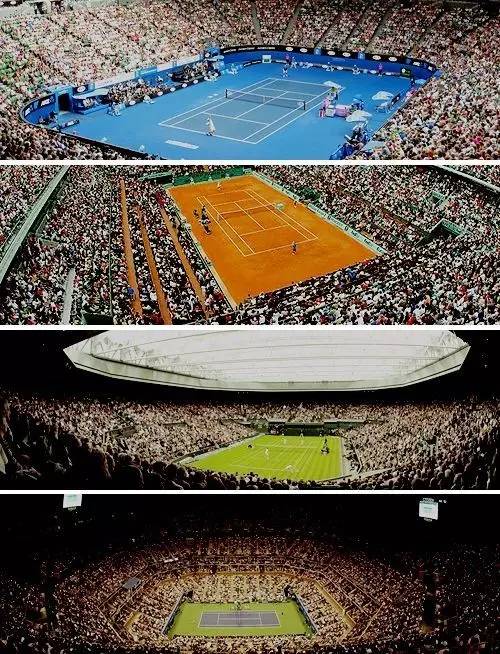
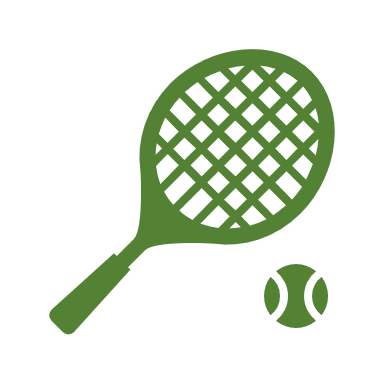
People often attribute incredible swings during a match to "momentum." We reckon that everyone involved, players and coaches alike, would be keen on unraveling the mysteries behind this "momentum."

**I. What is “momentum” ?**

“Momentum” is a relatively abstract concept, specifically in tennis matches, where we define it as the player's performance over the last few points and the additional impact of this performance on the likelihood of winning the next point.

**II. The Secret of Momentum — Our Research Results**

1. We establish a Multi-angle Momentum Evaluation Model to assess players' momentum based on various factors. By calculating the Relative Momentum (RM) between a player and their opponent during a specific time period, we quantitatively determine who is performing better on the court and to what extent.
2. Through a qualitative combined with quantitative analysis, we determine that "momentum" plays a significant role in the game and can serve as a crucial factor in assessing the course of a match. The magnitude of "momentum" shows a high correlation with swings in the game and the likelihood of a player winning.
3. We construct the Relative Advantage Swing (RAS) as an indicator describing changes in the course of a match. Additionally, we develop the XGBoost-SHAP Interpretable Swings Prediction Model. Our findings reveal that overall point differentials, recent scores, the server, and the number of successful serves are the four most correlated factors influencing the shift in the match dynamics from one player to favoring another. The corresponding SHAP values are 0.32, 0.30, 0.17, and 0.16, respectively.
4. Our model shows strong generalization across tennis matches of different genders and surfaces, but might not be as effective for players with distinctive traits or in matches where one side significantly outweighs the other in strength.

**III. Recommendations for coaching your players**

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Next, please allow us to offer recommendations regarding the role of "momentum," how to prepare players, and how to address events that can impact the course of tennis matches.

1. Emphasize daily training in serving and receiving serves. Serving-related metrics are crucial factors influencing momentum and the course of the game. Strengthening serving and receiving skills can help your players gain a greater advantage.
2. Develop tactical strategies based on the situation of your players and opponents. For instance, if the opponent is stronger and has consistently performed well in the earlier rounds, encourage your players to adopt a relatively aggressive approach during the match, initiating proactive attacks to gain an advantage. If your players have superior skills but show noticeable momentum fluctuations in the early rounds, advise them to employ a relatively steady strategy during the game, seeking stability for eventual victory.
3. Maintain a good status. The "momentum" exhibits a certain cyclicality, and sustaining a good condition is beneficial in handling various match situations. When players experience consecutive point losses in a game, they should believe they still have a chance; and when in an advantageous position, be prepared for the possibility of the opponent launching a counterattack. This encompasses physical health, outstanding performance, superior fitness, and a stable mental state.

We sincerely hope that our model and research findings prove helpful to you. Wishing you and your players great success in your matches!

Yours sincerely,

Team # 2420216