## Introduction

Background:

The Wimbledon Championships (hereinafter, “the Wimbledon”), arranged in Wimbledon, London, is prestigious for its long history, unique tradition, and worldwide popularity. Since its founding in 1877, Wimbledon has become one of the four Grand Slam tournaments. During the fortnight, there typically are hundreds of thousands of guests sitting around the grass courts and millions of impressions received by its official social media.

2023 witnessed a magnificent occurrence in the Wimbledon final where the 20-year-old player, young Carlos Alcaraz, defeated the experienced defending champion, Novak Djokovic. With several incredible turning points, we can feel that success breeds success. Within each small winning, one critical factor is the “momentum” in them.

(momentum定义，未写，视建模情况而定)

Restatement:

1.建立一个模型，说明“动量”的存在，并根据各项指标评价运动员在赛程中的表现。可视化这个模型。可视化比赛流程（flow）不是模型

Task 1: Prove that "Momentum" Exists by Evaluating the Performance of Players.

Develop a model to illustrate the flow of play at the occurrence of points, which can quantify and rank the performance of players. Then describe the model with visualized tools.

2. 提供证据证明比赛中的波动是由“动量”而不是随机性决定的。应该是让我们根据模型判断是否正确并且给出证据，没有直接说‘波动就是对的’

Task 2: Convince the Coach of the Impact of "Momentum".

Offer evidence to prove that the swings in a match are determined by "momentum" instead of randomness.

3.建立一个模型，预测波动。如果有的话说明什么因素可以影响“动量”，并且筛选出最关键的影响因素。根据所建立的模型，为运动员提供一个建议，让他们在与新对手比赛时做好准备。

Task 3: Identify the Influencing Factors of "Momentum".

Develop a model that clarifies the influencing factors of “momentum” and, if any, the most influential one. Then according to the model, provide players with suggestions to play in other matches against new opponents.

4.用其他比赛的数据测试我们所建立的模型，检测我们的模型对比赛局势扭转状况的预测准确性。当模型表现不佳时，确定未来需要包含在模型考虑范围中的因素。检测我们的模型在运动员性别变化、比赛类型变化、比赛场地变化、比赛项目变化时的通用性

Task 4: Examine the Generalizability of the Model.

Apply data from other matches to test the accuracy of the model when predicting the swings in the match. If occasional deviation happens, improve the model with factors that may be taken into consideration. Then detect the generalizability of the model under different genders of players, types of matches, surfaces of courts, and events of matches.

Task 1: Evaluation Model Based on

1.The Identification of Evaluation Indicators}

评价指标如下：

To construct a consistent system for apprising the performance of players in different games, we select several indicators as follows:

1.serve\_no[负]：运动员的发球次数，serve\_no=1时为正常表现，serve\_no=2时为异常表现

SN (the Number of Serves) [negative]

SN=1 represents a normal performance, while SN=2 means an abnormal performance.

2.point\_winner[正]：运动员击球得分

Untouchable Winning Shot [positive]

1. p1\_ace：先手运动员在发球的时候得分

AP (Ace Point): TThe server obtains the point on serve.

1. point\_victor\_common\_win：先手运动员在非发球时得分/后手运动员击球得分

CP (Common Point): The server obtains the point after serving, or the receiver gets a break point..

3.unf\_err[负]：

Unforced Error (negative)

1. p1\_double\_fault：先手运动员发球失误失分

DF (Double Fault): The server misses both the serves and loses the point.

1. p1\_unf\_err\_not\_double\_fault：先手运动员非发球时失误失分/后手运动员接球失误失分

CF (Common Fault): The server or the receiver loses the point for facing an untouchable winning shot.