Problem Chosen	2025 MCM/ICM Summary Sheet	Team Control Number
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title

Summary

abstract content...

Keywords: Momentum Analysis; Predictive Modeling; Random Forest; Sliding Window; Logistic Regression; Data Visualization; Generalization Capability

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Coach Movement Between Different Countries For coaches moving between different countries, we calculate the change in medal counts for both countries involved, multiply by the weight coefficients, and compute the difference between the positive growth in the target country and the negative growth in the original country to obtain the weight ww of the directed edge.

$$W = W_A - W_B \tag{1}$$

- A is the inflow country;
- B is the outflow country;
- wA is the weighted score of medal count changes in country A;
- wB is the weighted score of medal count changes in country B.

Lang Ping's Coach Movement Between China and the U.S.

In this model, Lang Ping's coaching movement is treated as an influence transfer between countries, from the U.S. to China or vice versa. We need to calculate the weight of Lang Ping's transfer from the U.S. to China based on the changes in medal counts.

For instance, Lang Ping coached the U.S. women's volleyball team from 2005 to 2008, and in 2008, the U.S. team won a silver medal. In 2012, she returned to China and led the Chinese women's volleyball team to a gold medal at the 2016 Rio Olympics.

By utilizing the data extraction method, we calculate the medal counts for the U.S. women's volleyball team in 2004, 2008, 2012, and 2016, as well as for China in 2012 and 2016. The weight calculation method involves calculating the changes in medal counts, applying the weight coefficients, and determining the impact of Lang Ping's coaching movement on both countries.

According to the weight calculation method, since Lang Ping was coaching in the U.S. in 2008 without any coach movement, a self-loop edge is drawn for the U.S. The difference between the medal counts in 2008 and 2004 is calculated: ΔG = +0, ΔS = +1, ΔB = +0. By multiplying these changes by the medal weight coefficients, the total score is 2.

During the period of 2016, Lang Ping moved from the U.S. to China.

Sport	Coach	Years	Medals	Change in Medals	Points
Volleyball	Lang Ping	2004→2008 (USA self-loop)			
	Gold	+0	2		
			Silver	+1	
			Bronze	+0	
	Lang Ping	2012→2016 (USA→China)			
	Gold	USA+0, CHN+1	5		
			Silver	USA-1, CHN+0	
			Bronze	USA+1, CHN+0	

Table 1: Coach Lang Ping's Medal Changes and Points from 2004 to 2016

3.0.1 Flow Calculation

Sport	Coach	Flow Path	Total Flow	Bottleneck Flow
Volleyball	Lang Ping	2004→2008 (USA self-loop): Gold +0, Silver +1, Bronze +0, Score = 2 2012→2016 (USA → China): USA Gold +0, Silver -1, Bronze +1; China Gold +1, Silver +0, Bronze +0, Score = 5	7	2

3.1 Model Results and Analysis

This section analyzes the changes in medal counts for China, the U.S., and France, focusing on the impact of the "great coach" effect. Using the flow network model, we quantify the effect of coach movements on medal counts and propose investment strategies based on the model results.

(1)China: Table Tennis, Diving, Gymnastics

- **Table Tennis:**Under Liu Guoliang's coaching, table tennis exhibited a relatively large total flow (6), but the bottleneck flow was -2, indicating that although the coach's contribution was evident, certain limiting factors restricted the potential for improvement.
- **Diving:**Zhou Jihong's coaching period was relatively stable, with a total flow of 4 and a bottleneck flow of -2, suggesting that despite the coach's contribution, the project experienced significant volatility, especially between 2008 and 2012.
- **Gymnastics:**Under Huang Yubin, the gymnastics team showed poor performance, with a total flow of -2 and a bottleneck flow of -5, demonstrating limited coach contribution and significant external restrictions on the project's performance.

Sport	Coach	Traffic Path	Total Traffic	Bottleneck Flow
Table Tennis	Liu Guoliang	2004: Gold +1, Silver +1, Bronze +0, Score = -2 2004→2008: Gold +2, Silver +0, Bronze +0, Score = 8	6	-2
Diving	Zhou Jihong	2004→2008: Gold +1, Silver -1, Bronze +2, Score = 4 2008→2012: Gold -1, Silver +2, Bronze -2, Score = -2 2012→2016: Gold +1, Silver -1, Bronze +0, Score = 2	4	-2
Gymnastics	Huang Yubin	1996: Gold +1, Silver -1, Bronze +1, Score = 3 1996→2000: Gold -1, Silver +0, Bronze -1, Score = -5	-2	-5

Table 3: Sports Statistics

Table tennis is the most promising project. Despite the bottleneck flow, the coach's contribution is significant, suggesting that further investment in the "great coach" effect is warranted in this area. Diving, although stable, requires improvements in other factors due to the presence of bottleneck flows. Gymnastics requires more attention and enhancement, as the coach's contribution is minimal, and both total flow and bottleneck flow indicate significant room for improvement.

(2)USA: Gymnastics, Basketball, Volleyball

Sport	Coach	Traffic Path	Total Traffic	Bottleneck Flow
Gymnastics	Bela Karolyi	2004: Gold +1, Silver +4, Bronze +0, Score = 12 2004→2008: Gold +1, Silver +1, Bronze +0, Score = 6 2008→2012: Gold +1, Silver -4, Bronze +0, Score = -4	14	-4
Basketball	Mike Krzyzewski	2004→2008: Gold +1, Silver -1, Bronze +0, Score = 2 2008→2012: Gold +0, Silver +0, Bronze +0, Score = 0 2012→2016: Gold +0, Silver +0, Bronze +0, Score = 0	2	0
Volleyball	Karch Kiraly	2008→2012: Gold +0, Silver +0, Bronze +0, Score = 0 2012→2016: Gold +0, Silver -1, Bronze +1, Score = -1 2016→2020: Gold +1, Silver +0, Bronze -1, Score = 3	2	-1

Table 4: Sports Statistics

- **Gymnastics:**Bela Karolyi's total flow is relatively high (14), indicating significant coach contribution, but the bottleneck flow is negative (-4), suggesting that performance improvement is constrained by external factors.
- **Basketball:**Under Gregg Popovich, the total flow is 2, and the bottleneck flow is 0, indicating stable performance with limited fluctuations. The team has won gold in multiple editions of the Olympics, and the coach's capabilities are notable.
- **Volleyball:**Under Karch Kiraly's coaching, the total flow is 2, and the bottleneck flow is -1, indicating limited coach contribution, with performance volatility due to external restrictions.

Basketball has shown stable performance, but the coach's contribution is relatively small, and the project's performance is constrained. Volleyball shows significant volatility, with the coach's impact being limited. Gymnastics, although the coach's contribution is substantial, requires further improvements due to external constraints. The gymnastics project is best suited for further investment in "great coach" effects.

(3)France: Fencing, Basketball, Football

Sport	Coach	Traffic Path
Fencing	Yu Ge Oubuli	2016: Gold +1, Silver +1, Bronze +1, Score = 7 "2020 (France → China): China Gold +1, Silver -1, Bronze -1; France Gold +1, Silve
Basketball	Vincent Collet	2012→2016: Gold +0, Silver +0, Bronze +0, Score = 0 2016→2020: Gold +0, Silver +1, Bronze +0, Score = 2
Football	Thierry Henry	2016→2020: Gold +0, Silver +0, Bronze +0, Score = 0 2020→2024: Gold +0, Silver +1, Bronze +0, Score = 2

Table 5: Sports Statistics

- **Fencing**Under Yves Guillard, the coach's effect is complex. Although France's performance was relatively high, the negative change after transferring to China suggests significant external constraints. The bottleneck flow is negative, indicating limitations on performance improvement.
- **Basketball:** Vincent Collet's coaching slightly improved the French basketball team's performance, with a bottleneck flow of 0, indicating stable performance with no significant external constraints.
- **Football:** Thierry Henry's coaching had a positive impact on French football, especially in terms of silver medals. The bottleneck flow is 0, indicating a direct effect of the coach's influence on the project's performance.

3.2 Verification and Strategy Recommendations

Sport	Coach	Traffic Path	Total Traffic	Bott
Gymnastics	Bela Karolyi	2004: Gold +1, Silver +4, Bronze +0, Score = 12 2004→2008: Gold +1, Silver +1, Bronze +0, Score = 6 2008→2012: Gold +1, Silver -4, Bronze +0, Score = -4	14	
Basketball	Mike Krzyzewski	2004→2008: Gold +1, Silver -1, Bronze +0, Score = 2 2008→2012: Gold +0, Silver +0, Bronze +0, Score = 0 2012→2016: Gold +0, Silver +0, Bronze +0, Score = 0	2	
Volleyball	Karch Kiraly	2008→2012: Gold +0, Silver +0, Bronze +0, Score = 0 2012→2016: Gold +0, Silver -1, Bronze +1, Score = -1 2016→2020: Gold +1, Silver +0, Bronze -1, Score = 3	2	

Table 6: Sports Statistics

After analyzing the performance of China, the U.S., and France and their respective coaches, this section explores the impact of the "great coach" effect on medal counts, particularly in the context of coach movements. Although athletes may find it difficult to change countries due to nationality requirements, coaches are free to move between countries and have a significant impact on performance. Based on the analysis, we can conclude that the "great coach" effect contributes significantly to certain sports, especially in gymnastics, table tennis, and football, where coach expertise and experience lead to substantial improvements.