An Analysis of Losing Unimportant Points in Tennis

Kush R. Varshney
IBM Thomas J. Watson Research Center
1101 Kitchawan Road, Yorktown Heights, New York
krvarshn@us.ibm.com

ABSTRACT

The hierarchical scoring system of tennis creates points with unequal importance and allows for the possibility of purposefully losing unimportant points. We empirically estimate set-level point importances from eight years of Grand Slam match statistics and use these values to study whether players should take this approach. The data indicates that playing well consistently on all points is a winning strategy.

Categories and Subject Descriptors

H.2.8 [**Database Management**]: Database Applications—*Data Mining*

Keywords

motivation; point importance; sports analytics; tennis; win probability

1. INTRODUCTION

Like many other tennis commentators, Brad Gilbert lauds Rafael Nadal for his tenacity. Gilbert said about Nadal [2], "Rafa's fortitude is just off the charts. He just doesn't give up, whether or not it's 40-love up or 40-love down. He just doesn't take a point off." Other tennis players, however, are commended for 'picking their spots wisely,' i.e., playing with the most effort and quality on the points that are the most important in determining the final outcome. Playing strategically in this way can be viewed negatively as the *tanking* of unimportant points.

Although losing the battle to win the war is appreciated in several domains, it is a taboo subject in sport, and has even lead to disqualification for breaking the spirit of sportsmanship rather than breaking the rules [3]. Beneficial tanking is most often encountered in the round robin stage of a tournament where losing the final match may allow for better placement in the knockout stage. Tennis, unlike many other sports such as basketball, lacrosse or team handball, provides an opportunity for in-match tanking due its scoring system. Because of the hierarchical winner-takes-all setup, there is no eventual difference between a game in which a player does not win a single point in a game and a game in which he or she reaches deuce but loses. Similarly, there is no eventual difference between losing a set 6-0 and 6-4.

In fact, it is possible for a player to win more points than the opponent, but nevertheless lose the match. A recent study found that approximately 5% of professional men's singles matches ended this way among all ATP World Tour and Grand Slam matches played between 1991 and 2011 [11]. A similar phenomenon is seen with presidential elections in the United States in which a candidate may receive the most popular votes, but lose the vote in the Electoral College or House of Representatives—this has happened four times out of 57. The voting system, combined with limited budgets of time and funds, leads candidates to campaign most heavily in so-called battleground states while nearly ignoring other states [1]. Tennis player John Isner relays a similar sentiment [5]: "I need to have as much energy as possible in my service games. If I'm up a break in a set, I can just ride out my serve. That doesn't necessarily mean that I'm tanking the return games, but it gives me the opportunity to conserve energy for the service game." Points such as when the opponent is serving at a set score of 3-5 and game score of 40-0 are not very important for Isner to win.

As stated in [10], all individual points are not created equal. The outcome of individual points does not fully determine the outcome of games, sets, or matches. In particular, certain points are more important in a quantifiable way. In prior work, Morris formulated the concept of point importance and empirically found importance values for points within games [6]. His quantifications revealed that 30-40 is the most important point and 40-0 is the least important point in determining the winner of a game. However, due to the limited data used in his study, he was unable to quantify point importance at the set level or match level; for example, how important the 3-5, 40-0 point is in determining the winner of the set. Point importance in tennis is closely related to win probabilities and leverage scores that have become popular in sports analytics to quantify the probability of victory given the current state of a game in sports such as baseball and football [4].

Although the concepts of not taking any points off versus picking the right battles, and the varying importance of tennis points throughout a match have been philosophized about in the past and studied through data separately, we are not aware of any prior work that studies the two issues in a unified manner quantitatively. In this work, we examine the individual point statistics from eight years of men's and women's main draw singles matches at the four Grand Slam tournaments to first estimate set-level point importance values, and then apply these point importance values as weights or as stratification variables to then study higher-level outcomes. Critically, our analysis examines all of the individual points in detail, which is in contrast to the work of [11] which only examines aggregated point totals per match. We attempt to answer the question of whether it is good strategy to lose unimportant points.

2. SET-LEVEL POINT IMPORTANCE

As discussed in the introduction, not every point in a tennis match plays an equal role in determining who wins a game, set, or match. In this work, we examine this further at the set level, i.e., how do individual points affect the eventual winner of the set. The importance of a point is measured by the effect its outcome has on the outcome of the set. First, let us define what we mean by an individual point. The player who serves has a distinct advantage; the way tennis scores are reported reflects this asymmetry. The server's score is reported first followed by the returner's score. Scores are reported hierarchically from coarse to fine, and can thus be decomposed into three levels: a match score, a set score, and a game score. For example, a match score of 1-1, set score of 2-5, and game score of 15-40 means that the server and returner have both won one set each, the server has won two games in the current set and the returner has won five games, and the server has won one point in the current game and the returner three points in the current game.[1] Since we are working at the set level, we discard the match score and only consider the set score and game score. Each unique combination of set score and game score constitutes an individual point. The set score and game score represent the score at the instance before the point is played.

We would like to examine two conditional probabilities in order to assess point importance [6], the likelihood that the server wins the set given that she wins the point and the likelihood that she wins the set given that she loses the point. The point importance is defined as the difference between these two likelihoods. The point importance takes values in the range $[-1, +1]$. Negative values imply that losing that individual point is better than winning it in terms of the probability of winning the set. Although we have stated the point importance from the server's perspective, the quantity is equally valid from both the server's and returner's perspectives because it equals the difference between the likelihood that the returner wins the set given that she wins the point minus the likelihood that the returner wins the set given that she loses the point.[2]

3. POINT IMPORTANCE ESTIMATION

Having defined set-level point importance above, we now estimate the importance values for all of the different individual points that can occur in a set using official match statistics from the main draw singles of the 2005-2012 Grand Slam events. After excluding walkovers and other matches that did not complete normally as well as the anomalous Isner-Mahut match of Wimbledon 2010, we are left with data from 3,866 men's matches constituting 14,195 sets, and 3,973 women's matches constituting 9,135 sets. This amounts to 710,071 total points for men and 447,122 total points for women. We estimate the point importance values for men and women separately. Other breakdowns, such as by year, event, or surface could also be computed.

We estimate the point importance values simply through empirical frequencies (without any smoothing, e.g. through logistic regression). The results are shown graphically in Fig. 1(a) for men and Fig. 1(b) for women. The left panel shows results for regular game scoring and the right panel shows results for tiebreaks. The vertical axis indicates the server's set and game score, and the horizontal axis indicates the returner's set and game score. Thus for example, a cell whose vertical value reads "3, 40" and whose horizontal value reads "4, 30" indicates the set score 3-4 and game score 40-30. The redder shades are more important points and the bluer shades are less important points. Black cells indicate points that are either impossible or did not have at least 100 samples for each of the two likelihoods to allow reliable estimation.

Table 1: Men's Negative Importance Points

Point	Importance	Tanking Benefit
1-0, 40-0	-0.039	server
3-5, Ad In	-0.015	returner
1-0, 30-0	-0.009	server
1-3, 30-0	-0.009	returner
2-5, 40-15	-0.009	returner
5-1, 30-0	-0.007	server
4-1, 15-0	-0.006	server

Table 2: Women's Negative Importance Points

Point	Importance	Tanking Benefit
3-5, 40-0	-0.102	returner
4-4, 40-0	-0.023	server
0-5, 0-15	-0.015	returner
0-5, 15-0	-0.010	returner
0-5, 15-15	-0.009	returner
4-0, 15-0	-0.008	server
0-3, 15-30	-0.006	returner

The intuition that break points and tiebreak points are the most important is captured, as they are the most red and yellow in the figure. Among points whose importance we could reliably estimate, the most important point for men is 6-5 in the tiebreak, followed by 5-5 in the tiebreak, 5-6 in the tiebreak, 6-6 in the tiebreak, and 5-4 in the tiebreak. The most important non-tiebreak point among the men is 2-2, advantage out (advantage to the returner). Tiebreaks are not as frequent among the women, so most tiebreak points did not have at least 100 samples of each likelihood. The most important point among women is 4-4, 30-40.

Thirteen men's points and twelve women's points have negative importance values. It is beneficial for one of the players to purposefully tank these points to increase the odds of winning the set. Several of the most negative points are given in Table 1 and Table 2 along with an indication of which of the two players benefits from tanking. That there exist negative importance points supports the perspective that taking some points off may be a good strategy. However, plotting a histogram of all points in the data set by importance in Fig. 2, we see that those points are rare.

4. IMPORTANCE AND OUTCOMES

As discussed in [11, 10], it is possible for sets and matches to be won by a player who wins fewer points. That analysis treats all points equally without regard for their importance.

[1]Due to space restrictions, we do not fully explain the concept of deuce and advantage or the concept of the tiebreaker, but assume the reader to be familiar with them.

[2]Another option for defining point importance is the likelihood ratio, taking values in the range $[0, \infty)$, but we follow the convention of [6].

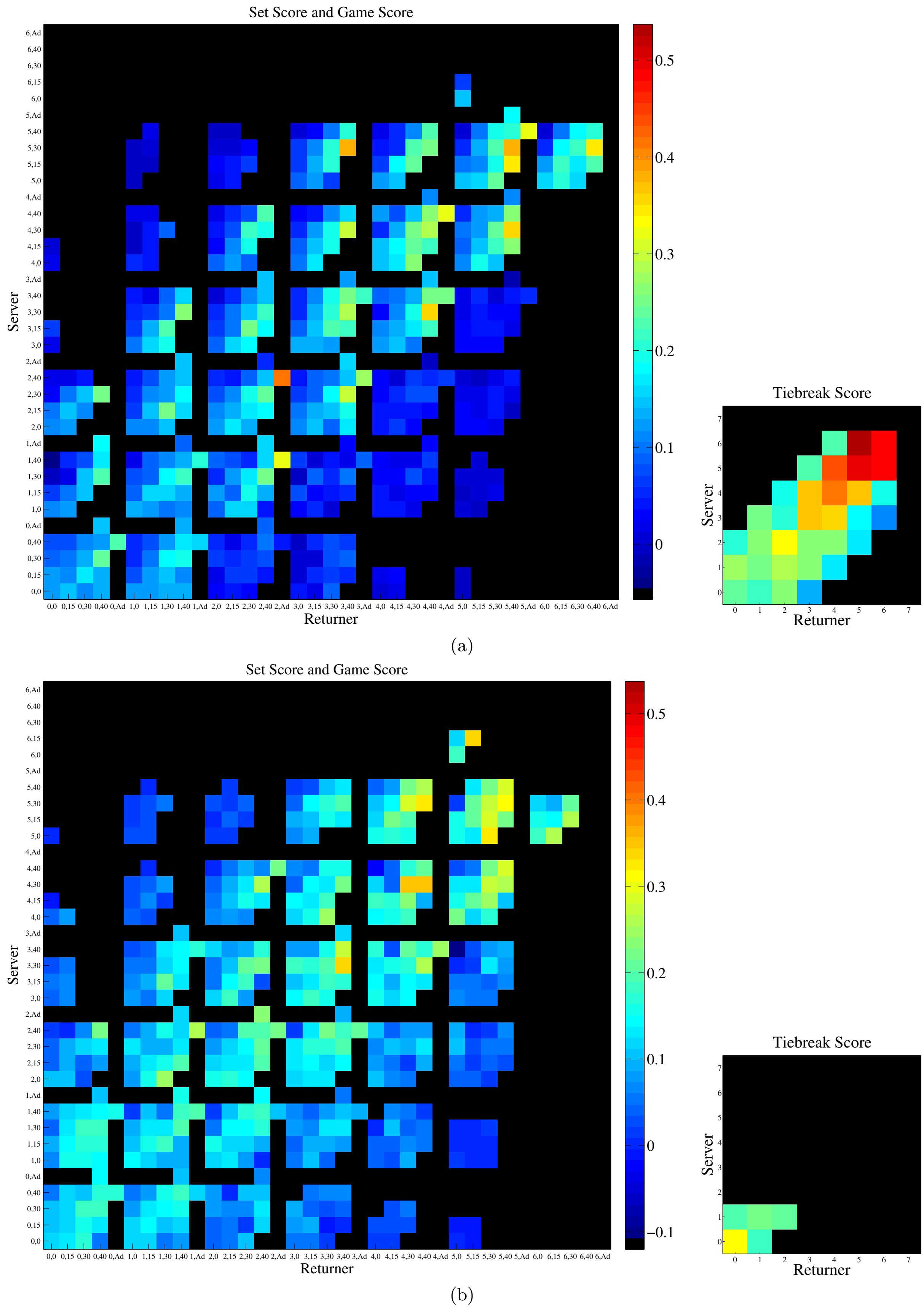

Figure 1: Set-level point importance for (a) men's singles and (b) women's singles.

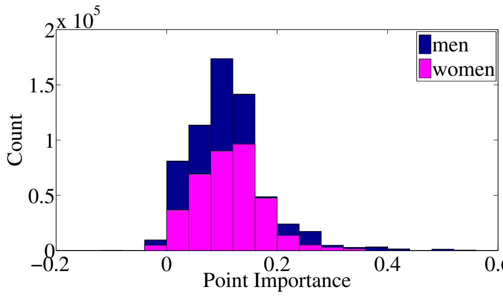

Figure 2: Histogram of individual points in the data set by set-level point importance.

Now that we have a measure for point importance, we can use it to weigh points unequally and see what effect there is on this phenomenon. The previous analysis is performed for matches, whereas since we are working at the set level, we examine this phenomenon at the set level as well. Giving equal weight to all points (and working at the set level), 3.07% of men's sets and 1.49% of women's sets in our eight-year Grand Slam data set exhibit the phenomenon of the set winner having won fewer total points. We apply the point importance as a scalar multiplier, with the overall mean importance value 0.112 given to points for which we do not have reliable importance estimates. After this weighting, only 1.28% of men's sets exhibit the phenomenon—a steep drop. The percentage for women remains approximately the same at 1.59%; the lack of change in the women's result can be mostly attributed to the fact that most tiebreak points were given an average importance weight due to their unreliable estimation rather than much larger importance values that they should have. Thus, we see that using point importance values as weights better reflects overall outcomes than simple unweighted point counts. Moreover, this result elucidates the fact that it is precisely the points with small importance magnitude that have little bearing on the final set outcome.

Going deeper into this topic, we determine which players lose unimportant points at a greater rate than important points by stratifying with the point importance variable. We compare the winning rate among points in the most important quintile and the most unimportant quintile for each player in our data set with at least 1,000 points played. A positive difference indicates a player performs much better on the important points than on the unimportant points, thereby utilizing the in-match tanking strategy. There are no particularly famous or championship-caliber players at the top of the list seen in Table 3. In fact, the top player Eduardo Schwank was fined $1,000 for "lack of best effort" at the 2010 US Men's Clay Court Championships [8], which is out of sample to our data set. Most highly successful players have values extremely close to zero, such as Kim Clijsters (-0.001), Rafael Nadal (0.002), and Novak Djokovic (0.003), which indicates that not taking points off is a successful strategy.

5. DISCUSSION

In this work, we have analyzed eight years of Grand Slam tennis match statistics at the individual point level to shed light on whether a player should play consistently well on all points or purposefully conserve on unimportant points to be more successful on important points. Toward this end, we have empirically calculated point importances, seeing that there are specific points for which tanking is a recommended strategy. However, these points are scarce; although low importance points do contribute less to the final outcome, our examination comparing the winning rate of players on unimportant and important points reveals that following such an approach does not lead one to championships. The best players tend to have nearly equal winning rates on unimportant and important points, i.e., they do not take any points off, consistent with i.i.d. models of tennis [9, 7].

Table 3: Difference in Winning Rate Between Important and Unimportant Points

Event	Name	Difference
men	E. Schwank	0.098
men	L. Rosol	0.080
women	J. Groth	0.071
men	T. Gabashvili	0.067
men	S. Greul	0.064
men	B. Phau	0.063
men	D. Gimeno-Traver	0.062
women	L. Safarova	0.062

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