

技术指标的主成分分析

接第一个文档

考虑主成分分析降维，将多个技术指标合成为一个，最后得到少数几个有效指标；

得到的所有指标分别为（第一次拿着total_length作比较，下一次拿跑动比例）

who_to_serve total_length_1 total_length_2 p1_ace p2_ace p1_winner p2_winner
p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won
p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won
p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1
width_2 depth_1 depth_2 depth_return_1 depth_return_2

（大部分名称在题目给出的data_dictionary文档中能找到对应项，如第一个文档中所写的一样，使用当前1/2球员技术指标总做下的次数除以当前为止比赛中point的数量，在前中期尤其是前期会有所不稳定，后期大致稳定；后六项解释如下：

```
dict_1 = {'B': 1, 'BC': 2, 'BW': 3, 'C': 4, 'W': 5}  
dict_2 = {'CTL': 1, 'NCTL': 2}  
dict_3 = {'D': 1, 'ND': 2}
```

dict_1为serve_width在data_dictionary中对应五个情况，如果不是本方发球或NA则为0；

dict_2为serve_depth在data_dictionary中对应两个情况，如果不是本方发球或NA则为0；

dict_3为return_depth在data_dictionary中对应两个情况，如果不是本方发球或NA则为0。

采用Matlab中主成分分析程序，先标准化再计算协方差矩阵，得到29个变量两两间的相关系数矩阵；然后计算相关矩阵的相关系数和特征向量；

我们得到的特征值矩阵为

```
-9.31054507611992e-16 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 7.52072401324113e-16 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0.000117077085883979 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0.00856390936484261 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0.0199456785625035 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0.0247342619369006 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0.0547203542276636 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0.0570562706603560 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0.0787969010040726 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0.0848744064254536 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0.104710408995619 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0.109382246257408 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0.125037254936358 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0.165719440327940 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.208166552519924 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.220727036207082 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.250547863660093 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.276427407952792 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.309356787181245 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.394788011261464 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0.472268078995294 0 0 0 0 0 0 0 0 0 0 0 0 0
```

0 0.532251524132176 0 0 0 0 0 0 0
0 0.645598901895202 0 0 0 0 0 0 0
0 0.998332727666070 0 0 0 0 0 0 0
0 1.81454601539670 0 0 0 0 0 0 0
0 2.32674560346903 0 0 0 0 0 0 0
0 4.42135832147657 0 0 0 0 0 0 0
0 6.19552849646461 0 0 0 0 0 0 0
0 9.09969846193674 0 0 0 0 0 0 0

翻转后的29个特征值的贡献率累加（第x项为1到x贡献率的和）为

0.313782705584026
0.527421619255219
0.679882251030273
0.760114858046447
0.822685410301505
0.857110676772749
0.879372707872584
0.897726208704728
0.914011314876979
0.927624694575651
0.938292169995693
0.947824149580272
0.956463731085793
0.964075008196382
0.971253165179828
0.976967628639412
0.981279258119976
0.985051059715059
0.988661763473529
0.991588467143372
0.994305601660753
0.996273059269731
0.998159968036202
0.999012873620233
0.999700655639630
0.999995962859107
1
1
1

可以看到，从第九项开始，累计贡献率超过0.9；从第五项开始超过0.8，从第六项开始超过0.85；综合主成分数量和贡献值，认为应该选择8项主成分，即贡献率达到0.897726208704728，取对应的8个最大特征值及其对应的8个特征向量

（数据已经保存，准备在下一步中取用）

第二个是选择两位选手体力总/最近20球体力消耗的对比而非总里程对比，其他变量不变；29个变量名称分别为

who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值)
p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err
p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won
p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave
p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2

[illegible]

0.286746403662875
0.500402809141893
0.658162771202554
0.741330458534837
0.800902255119101
0.836666160367943
0.863131103947295
0.882247123181918
0.898633786251519
0.914221754813519
0.927008488232191
0.938280070344452
0.947808738764020
0.956375095261597
0.963420838949188
0.970269581128586
0.976221165440935
0.980531776965272
0.984141937289462

1
1
1

可以看到,从第五项开始,累计贡献率超过0.8;从第七项开始超过0.85,从第十项开始超过0.9;综合主成分数量和贡献值,认为应该选择9项主成分,即贡献率达到0.898633786251519时,取对应的9个最大特征值及其对应的9个特征向量

其结果分别在res1.mat和res2.mat中

接下来考虑对所有比赛的技术数据做分析，但2023-wimbledon-1310除外（该场的rally和speed_mph全部是无效值），采用刚刚的第二种方法，即选择两位选手体力总/最近20球体力消耗的对比而非总里程对比，其他变量不变；29个变量名称分别为

who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值)
p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err
p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won
p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave
p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2的数据

得到的特征值矩阵为：

[illegible]

-0.296088136691947 -0.195811116111507 0.0245263789421753 -0.150816273664820
0.00236325670915958 -0.287918134693845 -0.0399599708998147 0.0607889086844941
0.166740921052689 -0.321814885909870 0.0969692309021233 0.0408773774897447
-0.260097782450437 0.191258098500242 -0.330246162304214 0.0987736010900083
0.0161875920023649 -0.118308874350297 -0.202788923121261 -0.000265328267760522
0.178367652781900 0.403893534238054 -0.00945752405318500 -0.276820779358110
-0.242096256548904 -0.248895325117119 0.0756241716923923 -0.0356267328094715
-0.0164883505724906 -0.259465485935843 0.197664418034710 -0.159968498344928
0.117219505554276 -0.263815791136265 0.218357945384936 -0.0914260492612248
-0.220387155904422 0.160504877763416 -0.266278444416410 0.0412563406923998
0.0173597365094611 0.154468254326969 -0.108025056848539 0.0535146304661031
-0.00216774732325357 -0.0556648517381945 -0.0737093533243337 -0.340678932345409
0.387467583761200 -0.0303313410352964 -0.668080283367549 0.226776865124445
-0.00605143385332500 -0.00979043361544516 0.0442701939708298 0.247369468768519
0.191122719455776 -0.267381040591783 -0.216977377242077 -0.222161296651795
-0.00468419335343493 0.497130218360605 0.162949523253427 -0.297353857585642
0.0427815205631129 0.321159678717501 -0.267010297126794 -0.0653052378381299
-0.0674145216906045 -0.0827124888487182 -0.136091446080785 -0.0441013020665090
0.186290989530430 -0.0178775605121969 -0.134489369939735 -0.408906801777793
-0.0302641688835696 0.0809180849517260 0.334913573503671 0.153015916066881
0.0338855270241347 0.0333777444549435 -0.233719990973502 0.0469692725308445
0.0314735464214024 0.299208718904243 0.274850989226863 0.284664987608436
0.0350633193257008 -0.140300128736536 -0.411394894889703 -0.103314709208877
-0.0836792279683582 0.245597071709469 0.0777981178887494 0.110218615172866
-0.0352064952652762 0.432163802775736 -0.0644367830341430 0.0511863168986497
-0.0305690448258286 -0.0791856738553435 0.295960857221446 -0.349206307472825
-0.0305624893148977 0.196645244639609 0.244913179825506 -0.225266605971596
0.278636015565005 0.120770625303150 0.0886081596023830 -0.0627548856609156
0.0306754558676333 -0.169222753657044 -0.390154941623228 -0.0562643601568638
-0.117694358949946 0.305367053779961 0.0448140329250377 0.156052974602927
-0.0111407439431136 0.395287563136074 -0.0251795010490172 0.0823428704349047
-0.0211169427274091 -0.142721008311357 0.246151824256121 -0.400731518330509
-0.0685004543730050 0.126954308193445 0.229314304164439 -0.194915847775847
0.257666548476867 0.157898123566837 0.0371399272288958 -0.126729142544646
-0.0106757972158061 0.272104616526183 0.253567549805793 0.228553987004693
0.152426733615609 0.356969505811209 0.142445029120831 0.111893335227998
-0.111807366905077 0.135917904230565 -0.239275677809127 -0.0523093328099594
0.0141988604481235 0.415750874469373 -0.107561093240058 -0.262039026487895
0.0632189252411920 -0.135662150531927 0.169728479121105 -0.0860906310976942
-0.235744953162887 0.0728791837170984 0.0966601909791872 0.183091793756536
0.0211313552280199 0.216194619863822 0.0878343343676724 0.131121957877071
0.142558100635677 0.275804700477758 -0.239005335332452 -0.410030954385515
-0.0546088135749533 0.259008636077953 -0.0495301938807204 0.0328265407246532
-0.00871990132588596 0.327517220106977 -0.0345840271239344 -0.231022461606857
-0.00726403077048977 -0.155696477856015 0.157609204398652 0.0485834624355338
-0.232808484456222 0.130674455973310 -0.0249873976833270 -0.491803134682128
-0.0251883923433794 0.193791853911864 0.248066827421179 0.192745649245293
0.0958197802306265 0.258874436177623 0.310581422976771 0.375966576948835
-0.0999523954732043 0.00712262593644445 -0.253890980645224 -0.0814274377698259
0.0228777259578747 0.373958205251992 -0.122210242267987 -0.223210702924026
0.0858370844189223 -0.0972356701209770 0.140531629158868 -0.136535778692685
-0.188136408995054 0.0283570764743428 0.138290277367968 0.487610329513875

0.0380003743223806 0.0535082425576870 -0.265409720812887 0.244621019002871
0.283706456967769 -0.0142781754822241 0.345151262828200 -0.0516039296250399
0.267502958169537 -0.0210999161389260 0.209155833861358 -0.0843474160381142
-0.0273846069047336 0.00849095482643490 -0.0952119117146461 0.271303794614161
0.247061122542673 -0.178776804241787 0.443991617330953 0.0167026725630383
0.351391642789799 0.0522799421874063 0.169958439942950 0.116340416909652
0.368383614008642 -0.0104504183617377 0.0212792617211186 0.00518065230348999
-0.0140611948353258 -0.00434308160895049 0.0331507366657449 -0.00758014141234859
0.00689015784115487 -0.00514161071164184 0.0101563068068108 -0.0249134197510357
-0.371818589604838 0.000452970141957221 -0.0324601707526191 -0.0146173023838781
0.0151413810762448 -0.0150176723715361 -0.00194359381962580 0.00460386239363347
-0.0155812993327449 0.0365208614597625 -0.00895216988256667 -0.0149808329844553
0.392034378148726 -0.00438802989546516 0.0374062184729980 0.00423821913891222
-0.0100329271192209 0.00267110962086102 0.00743347888111518 0.0110105502402063
-0.00201718137977905 -0.00376851287319191 0.0209251744265902 -0.00298229758277219
-0.390280680987625 0.0106320507559235 -0.0362405611188393 -0.0111481788403165
0.00512663579590815 0.0141702170387400 -0.00771565877060850 0.0107348576177521
0.00384546524836332 -0.00298199033899973 0.00570582466845359 0.0170405640319679
0.344934059838932 0.0113964745713770 0.0454515048063391 0.00523249110685403
-0.0333348778002335 -0.0103608738750773 0.00695398957793980 0.0443002640850555
0.00713197940871014 0.0122672466396259 0.0448466416324730 0.0358726156619891
-0.342667639473011 0.0356449094423526 -0.0348432281043083 0.000636846206073914
-0.0178794366854802 0.0283309214369924 -0.0201611305146415 0.0217644973357218
0.0458498275252218 -0.0431284847534066 0.0443604900478056 0.00641276775646849

得到的12项主成分为：

F1 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比
值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err
p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt
p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed
p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1
depth_return_2]'(这个是行向量，下面那个是列向量，乘号是矩阵乘法得到的结果) *

[-0.412890590049213
-0.0356324207170165
-0.0225997144141101
-0.00322678124611190
0.00236325670915958
0.0161875920023649
-0.0164883505724906
0.0173597365094611
-0.00605143385332500
0.0427815205631129
-0.0302641688835696
0.0350633193257008
-0.0305690448258286
0.0306754558676333
-0.0211169427274091
-0.0106757972158061
0.0141988604481235
0.0211313552280199
-0.00871990132588596

-0.0251883923433794
0.0228777259578747
0.0380003743223806
-0.0273846069047336
0.368383614008642
-0.371818589604838
0.392034378148726
-0.390280680987625
0.344934059838932
-0.342667639473011]

F2 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2]' * [0.00616336352149703

0.0229500098225699
0.0160579968611315
-0.208515756020401
-0.287918134693845
-0.118308874350297
-0.259465485935843
0.154468254326969
-0.00979043361544516
0.321159678717501
0.0809180849517260
-0.140300128736536
-0.0791856738553435
-0.169222753657044
-0.142721008311357
0.272104616526183
0.415750874469373
0.216194619863822
0.327517220106977
0.193791853911864
0.373958205251992
0.0535082425576870
0.00849095482643490
-0.0104504183617377
0.000452970141957221
-0.00438802989546516
0.0106320507559235
0.0113964745713770
0.0356449094423526]

F3 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2]' * [-0.0340598456997410
0.0171930442778591

0.0148239627242198
-0.0391950881518821
-0.0399599708998147
-0.202788923121261
0.197664418034710
-0.108025056848539
0.0442701939708298
-0.267010297126794
0.334913573503671
-0.411394894889703
0.295960857221446
-0.390154941623228
0.246151824256121
0.253567549805793
-0.107561093240058
0.0878343343676724
-0.0345840271239344
0.248066827421179
-0.122210242267987
-0.265409720812887
-0.0952119117146461
0.0212792617211186
-0.0324601707526191
0.0374062184729980
-0.0362405611188393
0.0454515048063391
-0.0348432281043083]

F4 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2]' * [-0.00701020170693819

0.286871478336342
0.286015581410240
0.0785210127923912
0.0607889086844941
-0.000265328267760522
-0.159968498344928
0.0535146304661031
0.247369468768519
-0.0653052378381299
0.153015916066881
-0.103314709208877
-0.349206307472825
-0.0562643601568638
-0.400731518330509
0.228553987004693
-0.262039026487895
0.131121957877071
-0.231022461606857

0.192745649245293
-0.223210702924026
0.244621019002871
0.271303794614161
0.00518065230348999
-0.0146173023838781
0.00423821913891222
-0.0111481788403165
0.00523249110685403
0.000636846206073914]

F5 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2]' * [0.0128002837273604

-0.518090818021460
-0.529765993793632
0.317857000668428
0.166740921052689
0.178367652781900
0.117219505554276
-0.00216774732325357
0.191122719455776
-0.0674145216906045
0.0338855270241347
-0.0836792279683582
-0.0305624893148977
-0.117694358949946
-0.0685004543730050
0.152426733615609
0.0632189252411920
0.142558100635677
-0.00726403077048977
0.0958197802306265
0.0858370844189223
0.283706456967769
0.247061122542673
-0.0140611948353258
0.0151413810762448
-0.0100329271192209
0.00512663579590815
-0.0333348778002335
-0.0178794366854802]

F6 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2]' * [0.000522770883552350
-0.0176888523807150

-0.0517894519641341
0.116925721846789
-0.321814885909870
0.403893534238054
-0.263815791136265
-0.0556648517381945
-0.267381040591783
-0.0827124888487182
0.0333777444549435
0.245597071709469
0.196645244639609
0.305367053779961
0.126954308193445
0.356969505811209
-0.135662150531927
0.275804700477758
-0.155696477856015
0.258874436177623
-0.0972356701209770
-0.0142781754822241
-0.178776804241787
-0.00434308160895049
-0.0150176723715361
0.00267110962086102
0.0141702170387400
-0.0103608738750773
0.0283309214369924]

F7 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2]' * [-0.0140886870722550

0.236523835876292
0.243143162794850
0.126796529916022
0.0969692309021233
-0.00945752405318500
0.218357945384936
-0.0737093533243337
-0.216977377242077
-0.136091446080785
-0.233719990973502
0.0777981178887494
0.244913179825506
0.0448140329250377
0.229314304164439
0.142445029120831
0.169728479121105
-0.239005335332452
0.157609204398652

0.310581422976771
0.140531629158868
0.345151262828200
0.443991617330953
0.0331507366657449
-0.00194359381962580
0.00743347888111518
-0.00771565877060850
0.00695398957793980
-0.0201611305146415]

F8 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2]' * [0.00320536043760890

-0.254390681991558
-0.230282485325761
-0.380362097354718
0.0408773774897447
-0.276820779358110
-0.0914260492612248
-0.340678932345409
-0.222161296651795
-0.0441013020665090
0.0469692725308445
0.110218615172866
-0.225266605971596
0.156052974602927
-0.194915847775847
0.111893335227998
-0.0860906310976942
-0.410030954385515
0.0485834624355338
0.375966576948835
-0.136535778692685
-0.0516039296250399
0.0167026725630383
-0.00758014141234859
0.00460386239363347
0.0110105502402063
0.0107348576177521
0.0443002640850555
0.0217644973357218]

F9 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1 depth_return_2]' * [-0.00801660182964256
-0.146399641533242

-0.128921256256315
-0.296088136691947
-0.260097782450437
-0.242096256548904
-0.220387155904422
0.387467583761200
-0.00468419335343493
0.186290989530430
0.0314735464214024
-0.0352064952652762
0.278636015565005
-0.0111407439431136
0.257666548476867
-0.111807366905077
-0.235744953162887
-0.0546088135749533
-0.232808484456222
-0.0999523954732043
-0.188136408995054
0.267502958169537
0.351391642789799
0.00689015784115487
-0.0155812993327449
-0.00201718137977905
0.00384546524836332
0.00713197940871014
0.0458498275252218]

F10 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗
比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err
p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt
p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed
p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1
depth_return_2]' * [0.0123985107211015

0.0341542033173944
0.0153260070211153
-0.195811116111507
0.191258098500242
-0.248895325117119
0.160504877763416
-0.0303313410352964
0.497130218360605
-0.0178775605121969
0.299208718904243
0.432163802775736
0.120770625303150
0.395287563136074
0.157898123566837
0.135917904230565
0.0728791837170984
0.259008636077953
0.130674455973310

0.00712262593644445
0.0283570764743428
-0.0210999161389260
0.0522799421874063
-0.00514161071164184
0.0365208614597625
-0.00376851287319191
-0.00298199033899973
0.0122672466396259
-0.0431284847534066]

F11 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗
比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err
p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt
p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed
p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1
depth_return_2]' * [-0.00292831131238764

0.0318846617236787
0.0404108683597439
0.0245263789421753
-0.330246162304214
0.0756241716923923
-0.266278444416410
-0.668080283367549
0.162949523253427
-0.134489369939735
0.274850989226863
-0.0644367830341430
0.0886081596023830
-0.0251795010490172
0.0371399272288958
-0.239275677809127
0.0966601909791872
-0.0495301938807204
-0.0249873976833270
-0.253890980645224
0.138290277367968
0.209155833861358
0.169958439942950
0.0101563068068108
-0.00895216988256667
0.0209251744265902
0.00570582466845359
0.0448466416324730
0.0443604900478056]

F12 = [who_to_serve consumption_of_strength(最近20球消耗体力比值) consumption(总体力消耗
比值) p1_ace p2_ace p1_winner p2_winner p1_double_fault p2_double_fault p1_unf_err
p2_unf_err p1_net_pt p2_net_pt p1_net_pt_won p2_net_pt_won p1_break_pt p2_break_pt
p1_break_pt_won p2_break_pt_won p1_break_pt_missed p2_break_pt_missed
p1_serve_speed_ave p2_serve_speed_ave width_1 width_2 depth_1 depth_2 depth_return_1
depth_return_2]' * [0.00470731835586422
0.00406845007271258

-0.0167443572493979
-0.150816273664820
0.0987736010900083
-0.0356267328094715
0.0412563406923998
0.226776865124445
-0.297353857585642
-0.408906801777793
0.284664987608436
0.0511863168986497
-0.0627548856609156
0.0823428704349047
-0.126729142544646
-0.0523093328099594
0.183091793756536
0.0328265407246532
-0.491803134682128
-0.0814274377698259
0.487610329513875
-0.0843474160381142
0.116340416909652
-0.0249134197510357
-0.0149808329844553
-0.00298229758277219
0.0170405640319679
0.0358726156619891
0.00641276775646849]

当然，只取11或者10个主成分也是可行的