UWDS2-Wk8-ImprovedLrmcModel-jms206

Jim Stearns, NetID=jms206

Due 10 Mar 2015

Improving the LRMC model for NCAA Basketball Ranking

(Assignment language is in *italics*)

Overview

This week we will combine the new feature you evaluated previously with the LRMC (Logistic Regression/Markov Chain) model to see if the combined approach can improve the base model. Please write a summary of your approach for combining the two models as well as a statement about comparing the combined model's performance to the basic model on the 2012 and 2013 data.

My approach was to follow the course suggested by the supplied NCAA_2014.R script, namely: * Use the LRMC model as the base model to predict the results of the 2014 NCAA tournament. * Try the RPI model by itself. * Try a range of blends of the two models.

I wasn't able to target the models to the data for years 2012 and 2013. Reason: the RPI values are on the Rankings page, and I couldn't find one for earlier years. http://www.cbssports.com/collegebasketball/rankings/rpi/index1 gives the current year. So I'm actually using 2015 rankings, aren't I?

Are there URLs to the CBS Sports website with rankings for previous years?

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## [1] "==== verify URLs: Start ===="
## [1] "==== verify URLs: End ===="


## Warning: NAs introduced by coercion


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## [1] "NCAA>>>>>> "  "kentucky"      "kansas-state"
## [1] "NCAA>>>>>> "    "kentucky"       "wichita-state"
## [1] "NCAA>>>>>> " "kentucky"    "louisville"
## [1] "NCAA>>>>>> " "kentucky"    "michigan"
## [1] "NCAA>>>>>> " "kentucky"    "wisconsin"
## [1] "NCAA>>>>>> " "kentucky"    "connecticut"


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## [1] "NCAA>>>>>> "      "kansas"              "eastern-kentucky"
## [1] "NCAA>>>>>> " "kansas"       "stanford"
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## [1] "NCAA>>>>>> " "villanova"   "milwaukee"
## [1] "NCAA>>>>>> " "villanova"   "connecticut"

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## [1] "NCAA>>>>>> " "wisconsin"   "american"
## [1] "NCAA>>>>>> " "wisconsin"   "oregon"
## [1] "NCAA>>>>>> " "wisconsin"   "baylor"
## [1] "NCAA>>>>>> " "wisconsin"   "arizona"

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## [1] "NCAA>>>>>> " "duke"        "mercer"

## Warning: NAs introduced by coercion

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## [1] "NCAA>>>>>> "     "virginia"          "coastal-carolina"
## [1] "NCAA>>>>>> " "virginia"    "memphis"
## [1] "NCAA>>>>>> "    "virginia"        "michigan-state"

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## [1] "NCAA>>>>>> " "arizona"     "weber-state"
## [1] "NCAA>>>>>> " "arizona"     "gonzaga"
## [1] "NCAA>>>>>> "     "arizona"          "san-diego-state"

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## [1] "NCAA>>>>>> "     "gonzaga"          "oklahoma-state"

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## [1] "NCAA>>>>>> " "baylor"       "nebraska"
## [1] "NCAA>>>>>> " "baylor"       "creighton"

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## [1] "NCAA>>>>>> "              "iowa-state"
## [3] "north-carolina-central"
## [1] "NCAA>>>>>> "    "iowa-state"     "north-carolina"
## [1] "NCAA>>>>>> " "iowa-state"  "connecticut"

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## [1] "NCAA>>>>>> "           "oklahoma"              "north-dakota-state"

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## [1] "NCAA>>>>>> "    "north-carolina" "providence"


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## [1] "NCAA>>>>>> " "louisville"  "manhattan"
## [1] "NCAA>>>>>> " "louisville"  "saint-louis"


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## [1] "NCAA>>>>>> "    "wichita-state" "cal-poly"


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## [1] "NCAA>>>>>> "      "vcu"                "stephen-f-austin"


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## [1] "NCAA>>>>>> "    "michigan-state" "delaware"
## [1] "NCAA>>>>>> "    "michigan-state" "harvard"
## [1] "NCAA>>>>>> "    "michigan-state" "connecticut"

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## [1] "NCAA>>>>>> "      "san-diego-state"  "new-mexico-state"
## [1] "NCAA>>>>>> "       "san-diego-state"    "north-dakota-state"

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## [1] "NCAA>>>>>> "    "oregon"        "brigham-young"
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## [1] "NCAA>>>>>> " "dayton"       "ohio-state"
## [1] "NCAA>>>>>> " "dayton"       "syracuse"
## [1] "NCAA>>>>>> " "dayton"       "stanford"
## [1] "NCAA>>>>>> " "dayton"       "florida"
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## [1] "NCAA>>>>>> "          "xavier"                   "north-carolina-state"

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## [1] "NCAA>>>>>> " "iowa"          "tennessee"

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## [1] "NCAA>>>>>> "    "texas"          "arizona-state"
## [1] "NCAA>>>>>> " "texas"          "michigan"

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## [1] "NCAA>>>>>> "       "stephen-f-austin" "ucla"

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## [1] "NCAA>>>>>> "           "north-carolina-state" "saint-louis"

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## [1] "NCAA>>>>>> " "tulsa"          "ucla"

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## [1] "NCAA>>>>>> " "wofford"        "michigan"
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## [1] "NCAA>>>>>> " "ucla"         "florida"

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## [1] "NCAA>>>>>> " "stanford"     "new-mexico"

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## [1] "NCAA>>>>>> " "pittsburgh"  "colorado"
## [1] "NCAA>>>>>> " "pittsburgh"  "florida"

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## [1] "NCAA>>>>>> "      "syracuse"          "western-michigan"

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## [1] "NCAA>>>>>> "   "massachusetts" "tennessee"

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## [1] "NCAA>>>>>> " "florida"      "albany-ny"
## [1] "NCAA>>>>>> " "florida"      "connecticut"
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## [1] "NCAA>>>>>> "        "george-washington" "memphis"

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## [1] "NCAA>>>>>> " "michigan"    "tennessee"

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## [1] "NCAA>>>>>> " "tennessee"    "mercer"

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## [1] "NCAA>>>>>> "    "albany-ny"      "mount-st-marys"

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## [1] "NCAA>>>>>> "    "texas-southern" "cal-poly"

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## [1] "NCAA>>>>>> "          "creighton"            "louisiana-lafayette"

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## [1] 1.639617e-09
## [1] 2.09447e-13
## [1] 2.94903e-17
## [1] 0
## [1] 0
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## [1] 0
## [1] 0
## [1] 0
## [1] "* kentucky vs. kansas-state"
## [1] "* kentucky vs. wichita-state"
## [1] "X kentucky vs. louisville"
## [1] "* kentucky vs. michigan"
## [1] "X kentucky vs. wisconsin"
## [1] "X kentucky vs. connecticut"
## [1] "* kansas vs. eastern-kentucky"
## [1] "X kansas vs. stanford"
## [1] "* villanova vs. milwaukee"
## [1] "X villanova vs. connecticut"
## [1] "* wisconsin vs. american"
## [1] "* wisconsin vs. oregon"
## [1] "* wisconsin vs. baylor"
## [1] "X wisconsin vs. arizona"
## [1] "X duke vs. mercer"
## [1] "* virginia vs. coastal-carolina"
## [1] "* virginia vs. memphis"
## [1] "* virginia vs. michigan-state"
## [1] "* arizona vs. weber-state"
## [1] "* arizona vs. gonzaga"
## [1] "* arizona vs. san-diego-state"
## [1] "X gonzaga vs. oklahoma-state"
## [1] "* baylor vs. nebraska"
## [1] "X baylor vs. creighton"
## [1] "* iowa-state vs. north-carolina-central"
## [1] "* iowa-state vs. north-carolina"
## [1] "* iowa-state vs. connecticut"
## [1] "X oklahoma vs. north-dakota-state"
## [1] "* north-carolina vs. providence"
## [1] "* louisville vs. manhattan"
## [1] "* louisville vs. saint-louis"
```

```
## [1] "* wichita-state vs. cal-poly"
## [1] "X vcu vs. stephen-f-austin"
## [1] "* michigan-state vs. delaware"
## [1] "* michigan-state vs. harvard"
## [1] "X michigan-state vs. connecticut"
## [1] "* san-diego-state vs. new-mexico-state"
## [1] "* san-diego-state vs. north-dakota-state"
## [1] "* oregon vs. brigham-young"
## [1] "X dayton vs. ohio-state"
## [1] "X dayton vs. syracuse"
## [1] "X dayton vs. stanford"
## [1] "* dayton vs. florida"
## [1] "X cincinnati vs. harvard"
## [1] "X xavier vs. north-carolina-state"
## [1] "X iowa vs. tennessee"
## [1] "* texas vs. arizona-state"
## [1] "* texas vs. michigan"
## [1] "* stephen-f-austin vs. ucla"
## [1] "X north-carolina-state vs. saint-louis"
## [1] "* tulsa vs. ucla"
## [1] "* wofford vs. michigan"
## [1] "* ucla vs. florida"
## [1] "* stanford vs. new-mexico"
## [1] "* pittsburgh vs. colorado"
## [1] "* pittsburgh vs. florida"
## [1] "* syracuse vs. western-michigan"
## [1] "* massachusetts vs. tennessee"
## [1] "* florida vs. albany-ny"
## [1] "X florida vs. connecticut"
## [1] "* george-washington vs. memphis"
## [1] "* connecticut vs. saint-josephs"
## [1] "* michigan vs. tennessee"
## [1] "* tennessee vs. mercer"
## [1] "* albany-ny vs. mount-st-marys"
## [1] "* texas-southern vs. cal-poly"
## [1] "* creighton vs. louisiana-lafayette"
## [1] "LRMC"
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "* kentucky vs. kansas-state"
## [1] "* kentucky vs. wichita-state"
## [1] "* kentucky vs. louisville"
## [1] "* kentucky vs. michigan"
## [1] "* kentucky vs. wisconsin"
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```

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## [1] "* wisconsin vs. american"
## [1] "* wisconsin vs. oregon"
## [1] "* wisconsin vs. baylor"
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## [1] "* baylor vs. creighton"
## [1] "* iowa-state vs. north-carolina-central"
## [1] "* iowa-state vs. north-carolina"
## [1] "X iowa-state vs. connecticut"
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## [1] "* north-carolina vs. providence"
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## [1] "* wichita-state vs. cal-poly"
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## [1] "* michigan-state vs. harvard"
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## [1] "* san-diego-state vs. new-mexico-state"
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## [1] "* oregon vs. brigham-young"
## [1] "* dayton vs. ohio-state"
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## [1] "X iowa vs. tennessee"
## [1] "* texas vs. arizona-state"
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## [1] "X wofford vs. michigan"
## [1] "X ucla vs. florida"
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## [1] "X massachusetts vs. tennessee"
## [1] "* florida vs. albany-ny"
## [1] "X florida vs. connecticut"
```

```
## [1] "X george-washington vs. memphis"
## [1] "* connecticut vs. saint-josephs"
## [1] "* michigan vs. tennessee"
## [1] "* tennessee vs. mercer"
## [1] "* albany-ny vs. mount-st-marys"
## [1] "X texas-southern vs. cal-poly"
## [1] "* creighton vs. louisiana-lafayette"
## [1] "RPI Prediction Results"
## [1] 43
## [1] 67
## [1] 0.641791
## [1] "LRMC & RPI"
## [1] 0
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.02
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.04
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.06
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.08
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.1
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.12
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.14
## [1] 47
## [1] 67
```

```
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.16
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.18
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.2
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.22
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.24
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.26
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.28
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.3
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.32
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.34
## [1] 47
## [1] 67
```

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## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.36
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.38
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.4
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.42
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.44
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.46
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.48
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.5
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.52
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.54
## [1] 47
## [1] 67
```

```
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.56
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.58
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.6
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.62
## [1] 48
## [1] 67
## [1] 0.7164179
## [1] "LRMC & RPI"
## [1] 0.64
## [1] 48
## [1] 67
## [1] 0.7164179
## [1] "LRMC & RPI"
## [1] 0.66
## [1] 48
## [1] 67
## [1] 0.7164179
## [1] "LRMC & RPI"
## [1] 0.68
## [1] 48
## [1] 67
## [1] 0.7164179
## [1] "LRMC & RPI"
## [1] 0.7
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.72
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.74
## [1] 47
## [1] 67
```

```
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.76
## [1] 49
## [1] 67
## [1] 0.7313433
## [1] "LRMC & RPI"
## [1] 0.78
## [1] 48
## [1] 67
## [1] 0.7164179
## [1] "LRMC & RPI"
## [1] 0.8
## [1] 48
## [1] 67
## [1] 0.7164179
## [1] "LRMC & RPI"
## [1] 0.82
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.84
## [1] 48
## [1] 67
## [1] 0.7164179
## [1] "LRMC & RPI"
## [1] 0.86
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.88
## [1] 47
## [1] 67
## [1] 0.7014925
## [1] "LRMC & RPI"
## [1] 0.9
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.92
## [1] 46
## [1] 67
## [1] 0.6865672
## [1] "LRMC & RPI"
## [1] 0.94
## [1] 44
## [1] 67
```

```
## [1] 0.6567164
## [1] "LRMC & RPI"
## [1] 0.96
## [1] 44
## [1] 67
## [1] 0.6567164
## [1] "LRMC & RPI"
## [1] 0.98
## [1] 44
## [1] 67
## [1] 0.6567164
## [1] "LRMC & RPI"
## [1] 1
## [1] 43
## [1] 67
## [1] 0.641791
```

NCAA Predictions: RPI*alpha + LRMC*(1−alpha)
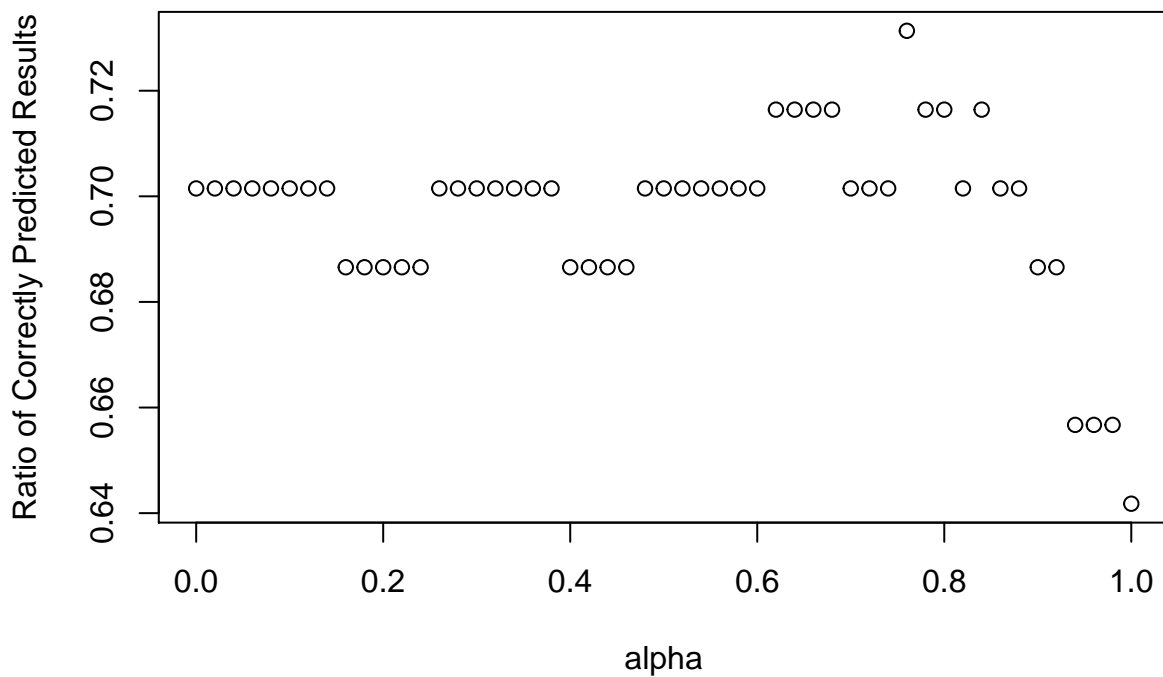

```
## [1] "Best prediction ratio of 0.731 achieved with alpha=0.76 (alpha*RPI + (1-alpha)*LRMC)"
```

Results: LRMC Model by Itself

```
print("LRMC")
```

```
## [1] "LRMC"
```

```
print(lmrcPredictions$correct)
```

[1] 47

```
print(lmrcPredictions$total)
```

[1] 67

```
print(lmrcPredictions$correct/lmrcPredictions$total)
```

[1] 0.7014925

Results: RPI Model by Itself

```
print("RPI Prediction Results")
```

[1] "RPI Prediction Results"

```
print(rpiPredictions$correct)
```

[1] 43

```
print(rpiPredictions$total)
```

[1] 67

```
print(rpiPredictions$correct / rpiPredictions$total)
```

[1] 0.641791

Combining Models

You may combine the new information with the base model in any way you like, however, here are two approaches that you may find useful…

1. *Combine final scores*

Suppose that the new factor you chose allows you to produce a ranking model independent of the basic LRMC model. For example suppose you chose RPI score, which immediately allows you to create an ordered list of all teams. Let x be a team's LRMC score and y be its RPI score. The combined score could be a weighted average of these two, e.g., ax + (1-a)y where a is a number between 0 and 1. For numerical stability, it will also be helpful in this case to make sure that the two scores have similar magnitude (i.e., both have similar minimum and maximum values). If they do not, then rescale one of them as necessary (consider the R function "scale").

Scaling was used so that RPI and LRMC have similar ranges (0..1).

2. *Modify the probability matrix*

*The LRMC model works by first constructing a probability matrix (the value in row i and column j is the probability that team i is better than team j). If you have a method for updating this probability based on your feature, then the matrix can be modified and then the regular LRMC ranking process can be applied. Again, a weighted average of the form a*x + (1-a)*y might be useful.*

Evaluation of New Model

To judge the quality of each model we will use a relatively simple measurement: the number of head-to-head predictions it correctly makes for the games played during the 2014 NCAA tournament (you might also be interested in previous years, though this requires some tedious adjustments to the part of the LRMC code that collects the data). Only data available before the beginning of the tournament may be used to make predictions. If you have used an approach similar to the weighted average described above, you can now use this measurement to search for an optimal value of the weighting parameter.

```
plot(seq(0,1,0.02), ratioCorrect, main="NCAA Predictions: RPI*alpha + LRMC*(1-alpha)",
     xlab="alpha", ylab="Ratio of Correctly Predicted Results")
```


NCAA Predictions: RPI*alpha + LRMC*(1−alpha)
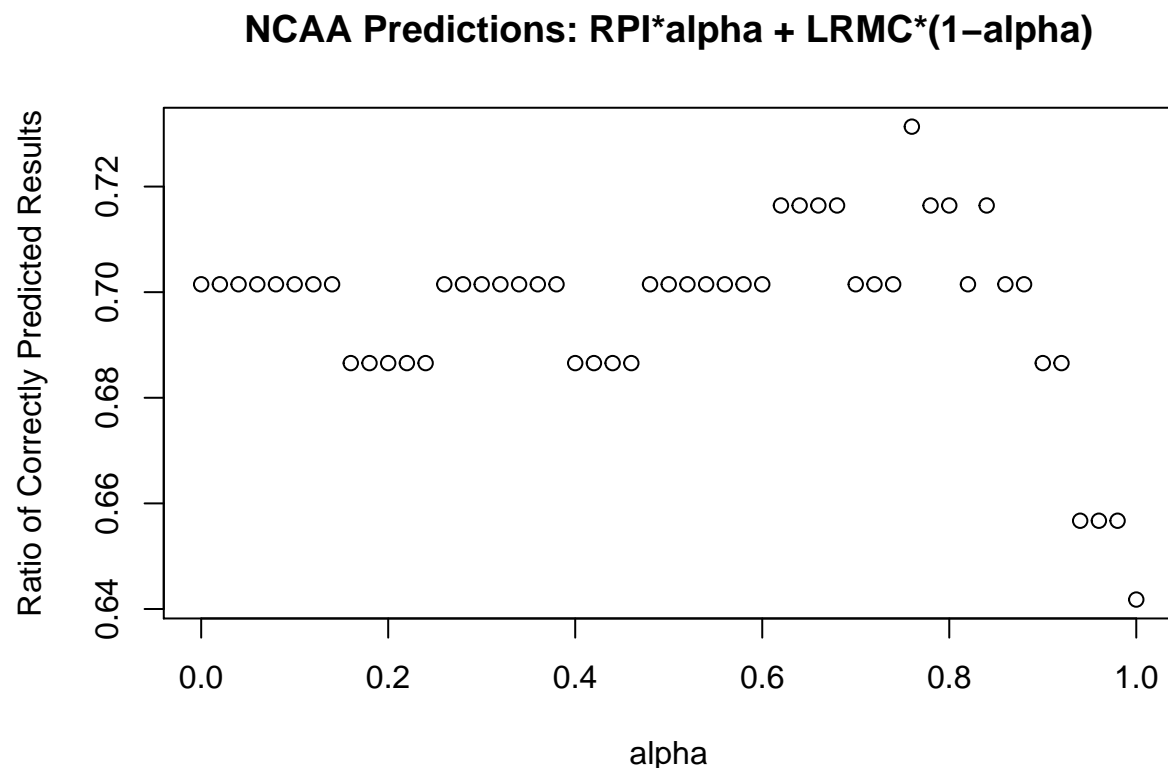
```
print(sprintf("Best prediction ratio of %0.3f achieved with alpha=%s (alpha*RPI + (1-alpha)*LRMC)",
              bestAlphaRatio, bestAlpha))
```

[1] "Best prediction ratio of 0.731 achieved with alpha=0.76 (alpha*RPI + (1-alpha)*LRMC)"

Appendix: R Source

The following source is a debugged version of the NOAA_2014.R script provided as part of this assignment with these changes:

46

- Activated URL checker, added a few special cases to the pairs in transformName1().
- Debugged and got it working.

  - Reports LRMC, RPI, and a blend of the two.
  - RPI doesn't help LRMC, so the blend as it stands is not a very interesting result.

- Stayed with LRMC base plus RPI, introducing scaling. Scaled both LRMC and RPI scores to range 0..1. At a weighting of 0.76 RPI (i.e. 0.24 weighting for LRMC), number of correctly predicted games improved from 47 (LRMC alone) to 49.
- Improved plot, added print of best alpha value (0.76 for year 2004).
- Refactor: Put prediction result calculators for RPI and LRMC into own functions.

```
##    [1] "# http://www.sports-reference.com/cbb/"
##    [2] ""
##    [3] "# Constants used in determining whether result beat the point spread."
##   [4] "h <- 4  # Used in games at a neutral court to adjust spread as if team1 played at home."
##    [5] "tau <- 4.26"
##    [6] "sig <- 11 "
##    [7] ""
##  [8] "# code to compute the probability that one team is better than another based on point spread, x."
##  [9] "# compute P(Z>0 | X=x) from eq. (12) pnorm(2*tau^2/(sig*sqrt((sig^2+2*tau^2)*(sig^2+4*tau^2)))
##   [10] "a <- 2*tau^2/(sig*sqrt((sig^2+2*tau^2)*(sig^2+4*tau^2)))"
##   [11] "b <- 2*tau^2*h/(sig*sqrt((sig^2+2*tau^2)*(sig^2+4*tau^2)))"
##   [12] ""
##   [13] "# include XML package to read data from HTML tables"
##   [14] "library(XML)"
##   [15] ""
##   [16] "# Set up teams list: include top 200 by RPI"
##  [17] "teamColumnNames = c(\"Rk.\", \"School\", \"W\", \"L\", \"RPI\", \"SOS Rank\", \"SOS\") "
##   [18] ""
##   [19] "# Get top 68 teams"
##   [20] "url <- \"http://www.cbssports.com/collegebasketball/rankings/rpi/index1\""
##   [21] "tables_top68 <- readHTMLTable(url)"
##   [22] ""
##   [23] "# get teams 1-34"
##   [24] "teams1 <- tables_top68[[4]]"
##   [25] "#names(teams) <- sapply(teams[1,], as.character)"
##   [26] "#teams <- teams[-1,]"
##   [27] "names(teams1) = teamColumnNames "
##   [28] ""
##   [29] "# get teams 35-68"
##   [30] "teams2 <- tables_top68[[5]]"
##   [31] "#names(teams2) <- sapply(teams2[1,], as.character)"
##   [32] "#teams2 <- teams2[-1,]"
##   [33] "names(teams2) = teamColumnNames "
##   [34] ""
##   [35] "# Get remaining teams"
##   [36] "url <- \"http://www.cbssports.com/collegebasketball/rankings/rpi/index2\""
##   [37] "tables_remaining <- readHTMLTable(url)"
##   [38] ""
```

```
## [39] "# skip first row for formatting reasons"
## [40] "teams3 <- tables_remaining[[4]]"
## [41] "#names(teams3) <- sapply(teams3[1,], as.character)"
## [42] "#teams3 <- teams3[2:nrow(teams3),]"
## [43] ""
## [44] "names(teams3) = teamColumnNames "
## [45] ""
## [46] "teams4 <- tables_remaining[[5]]"
## [47] "#names(teams4) <- sapply(teams4[1,], as.character)"
## [48] "#teams4 <- teams4[2:nrow(teams4),]"
## [49] ""
## [50] "names(teams4) = teamColumnNames "
## [51] ""
## [52] "teams <- rbind(teams1, teams2, teams3, teams4)"
## [53] ""
## [54] "# Grand Canyon university joind D1 in 2014, so remove it for 2013 testing"
## [55] "id = which(teams$School == \"Grand Canyon\")"
## [56] "teams$School[id]"
## [57] "#teams = teams[-id,]"
## [58] ""
## [59] "# Incarnate Word university joind D1 in 2014, so remove it for 2013 testing"
## [60] "id = which(teams$School == \"Incarnate Word\")"
## [61] "teams$School[id]"
## [62] "#teams = teams[-id,]"
## [63] ""
## [64] "# UMass-Lowell joind D1 in 2014, so remove it for 2013 testing"
## [65] "id = which(teams$School == \"UMass-Lowell\")"
## [66] "teams$School[id]"
## [67] "#teams = teams[-id,]"
## [68] ""
## [69] "# remove extra copies of the header row from the table"
## [70] "if (length(which(teams$School == \"School\"))) {"
## [71] "    teams = teams[-which(teams$School==\"School\"),]"
## [72] "}"
## [73] ""
## [74] "# regularize team names"
## [75] "# all lower case"
## [76] "# replace white space with '-'"
## [77] "for(i in 1:length(teams$School)) {"
## [78] "  name <- teams$School[i]"
## [79] "  url.name <- gsub(\"&\", \"\", gsub(\" \", \"-\", tolower(as.character(name))))"
## [80] "  teams$url.name[i] <- url.name"
## [81] "  url <- paste(\"http://www.sports-reference.com/cbb/schools/\",url.name, sep=\"\")"
## [82] "}"
## [83] ""
## [84] "# make some team url corrections by hand"
## [85] "transformName1 <- function(name) {"
## [86] "  pairs <- c("
## [87] "    \"Miami (Fla.)\",\"miami-fl\","
## [88] "    \"St. Mary's\",\"saint-marys-ca\","
```

```
##  [89] "     \"Southern Miss\",\"southern-mississippi\","
##  [90] "     \"Ole Miss\",\"mississippi\","
##  [91] "     \"Stephen F. Austin\",\"stephen-f-austin\","
##  [92] "     \"Detroit\",\"detroit-mercy\","
##  [93] "     \"Saint Joseph's\",\"saint-josephs\","
##  [94] "     \"Mount St. Mary's\",\"mount-st-marys\","
##  [95] "     \"St. John's\",\"st-johns-ny\","
##  [96] "     \"Loyola-Maryland\",\"loyola-md\","
##  [97] "     \"St. Bonaventure\",\"st-bonaventure\","
##  [98] "     \"Albany\",\"albany-ny\","
##  [99] "     \"Bryant University\",\"bryant\","
## [100] "     \"LIU-Brooklyn\",\"long-island-university\","
## [101] "     \"St. Francis (N.Y.)\",\"st-francis-ny\","
## [102] "     \"NC-Asheville\",\"north-carolina-asheville\","
## [103] "     \"Loyola-Chicago\",\"loyola-il\","
## [104] "     \"Northridge\",\"cal-state-northridge\","
## [105] "     \"Santa Barbara\",\"california-santa-barbara\","
## [106] "     \"Bowling Green\",\"bowling-green-state\","
## [107] "     \"William & Mary\",\"william-mary\","
## [108] "     \"Miami (Ohio)\",\"miami-oh\","
## [109] "     \"E. Tennessee State\",\"east-tennessee-state\","
## [110] "     \"Texas State-San Marcos\",\"texas-state\","
## [111] "     \"St. Peter's\",\"saint-peters\","
## [112] "     \"New Jersey Tech\",\"njit\","
## [113] "     \"NC-Wilmington\",\"north-carolina-wilmington\","
## [114] "     \"SIU-Edwardsville\",\"southern-illinois-edwardsville\","
## [115] "     \"Wisconsin-Milwaukee\",\"milwaukee\","
## [116] "     \"St. Francis (Pa.)\",\"saint-francis-pa\","
## [117] "     \"Prairie View A&M\",\"prairie-view\","
## [118] "     \"NC-Greensboro\",\"north-carolina-greensboro\","
## [119] "     \"The Citadel\",\"citadel\",  "
## [120] "     \"UMass Lowell\", \"massachusetts-lowell\","
## [121] "     \"UT Martin\", \"tennessee-martin\","
## [122] "     \"NC State\", \"north-carolina-state\","
## [123] "     \"UC Davis\", \"california-davis\","
## [124] "     \"UC Irvine\", \"california-irvine\","
## [125] "     \"UL Lafayette\", \"louisiana-lafayette\""
## [126] "  )"
## [127] "  "
## [128] "  n <- length(pairs)"
## [129] "  full.name <- pairs[seq(1,n,2)]"
## [130] "  url.name  <- pairs[seq(2,n,2)]"
## [131] "  "
## [132] "  idx <- which(full.name == name)"
## [133] "  if(length(idx) > 0) {"
## [134] "    return(url.name[idx])"
## [135] "  } else {"
## [136] "    return(\"\")"
## [137] "  }"
## [138] "}"
```

```
## [139] ""
## [140] "# some team url corrections"
## [141] "transformName2 <- function(name) {"
## [142] "    "
## [143] "  pairs <- c(     "
## [144] "    \"Albany (NY)\", \"albany-ny\","
## [145] "    \"Missouri-Kansas City\", \"missouri-kansas-city\","
## [146] "    \"Alabama-Birmingham\", \"uab\",          "
## [147] "    \"Nevada-Las Vegas\", \"unlv\",            "
## [148] "    \"Miami (FL)\", \"miami-fl\",                 "
## [149] "    \"Loyola (IL)\", \"loyola-il\",                "
## [150] "    \"Lafayette\", \"lafayette\",             "
## [151] "    \"Texas A&M\", \"texas-am\",                "
## [152] "    \"Louisiana State\", \"lsu\",       "
## [153] "    \"West Virginia\", \"west-virginia\",     "
## [154] "    \"Texas Christian\", \"tcu\","
## [155] "    \"St. John's (NY)\", \"st-johns-ny\",            "
## [156] "    \"Alabama A&M\", \"alabama-am\",              "
## [157] "    \"Miami (OH)\", \"miami-oh\",   "
## [158] "    \"Central Florida\", \"central-florida\",     "
## [159] "    \"Loyola (MD)\", \"loyola-md\",            "
## [160] "    \"Saint Mary's (CA)\", \"saint-marys-ca\", "
## [161] "    \"North Carolina A&T\", \"north-carolina-at\","
## [162] "    \"Saint Francis (PA)\", \"saint-francis-pa\","
## [163] "    \"Saint Peter's\", \"saint-peters\","
## [164] "    \"Grambling\", \"grambling\","
## [165] "    \"Virginia Military Institute\", \"vmi\","
## [166] "    \"Texas A&M-Corpus Christi\", \"texas-am-corpus-christi\",    "
## [167] "    \"St. Francis (NY)\", \"st-francis-ny\","
## [168] "    \"Florida A&M\", \"florida-am\","
## [169] "    \"William & Mary\",\"william-mary\","
## [170] "    \"Stephen F. Austin\",\"stephen-f-austin\","
## [171] "    \"St. Bonaventure\",\"st-bonaventure\","
## [172] "    \"Saint Joseph's\",\"saint-josephs\","
## [173] "    \"Mount St. Mary's\",\"mount-st-marys\","
## [174] "    \"Central Florida\", \"ucf\""
## [175] "    )"
## [176] "  "
## [177] "  n <- length(pairs)"
## [178] "  full.name <- pairs[seq(1,n,2)]"
## [179] "  url.name  <- pairs[seq(2,n,2)]"
## [180] "  "
## [181] "  idx <- which(full.name == name)"
## [182] "  if(length(idx) > 0) {"
## [183] "    return(url.name[idx])"
## [184] "  } else {"
## [185] "    return(\"\")"
## [186] "  }"
## [187] "}"
## [188] ""
```

```
## [189] ""
## [190] "n <- nrow(teams)"
## [191] ""
## [192] "for(i in 1:n) {"
## [193] "   name <- teams$School[i]"
## [194] "   url.name <- transformName1(name)"
## [195] "   if(url.name != \"\") {"
## [196] "   #print(sprintf(\"TransformName1: URL name from '%s' to '%s'\", teams$url.name[i], url.name)
## [197] "      teams$url.name[i] <- url.name"
## [198] "   }"
## [199] "}"
## [200] ""
## [201] "t <- matrix(0,n,n)"
## [202] "teams$ngames <- array(0, n)"
## [203] ""
## [204] "print(\"==== verify URLs: Start ====\")"
## [205] "# test code for verifying urls"
## [206] "# loop through all teams on the teams list"
## [207] "bad.teams <- c()"
## [208] "bad.home <- c()"
## [209] "for(teams.idx in 1:n){"
## [210] "   "
## [211] "   # read in team game results"
## [212] "   team1.name <- teams$url.name[teams.idx]"
## [213] "  url <- paste(\"http://www.sports-reference.com/cbb/schools/\",team1.name, sep=\"\")"
## [214] "   url <- paste(url, \"/2014-schedule.html\", sep=\"\")"
## [215] "   game_result_tables <- readHTMLTable(url)"
## [216] "   "
## [217] "   outcomes <- game_result_tables[[length(game_result_tables)]]"
## [218] "   if(ncol(outcomes) != 13) {"
## [219] "      print(sprintf(\"Verify URL: error for team '%s' (url name='%s'): ncols=%s\", "
## [220] "                  teams$School[teams.idx], team1.name, ncol(outcomes)))"
## [221] "      teams[teams.idx,]"
## [222] "      #next"
## [223] "      #break"
## [224] "      stop"
## [225] "   }"
## [226] "   "
## [227] "   for(games.idx in 1:nrow(outcomes)) {"
## [228] ""
## [229] "      # Skip header rows in the form:"
## [230] "   # \"32 G Date Type  Opponent Conf                         Tm Opp OT W L Streak\""
## [231] "      if (outcomes$Opponent[games.idx] == \"Opponent\") {"
## [232] "         next"
## [233] "      }"
## [234] "      "
## [235] "      # skip non D1 games"
## [236] "      if(outcomes$Conf[games.idx] == \"\") {"
## [237] "         next"
## [238] "      }"
```

```
## [239] ""
## [240] "    team2 <- outcomes$Opponent[games.idx]"
## [241] "      "
## [242] "    team2.name <- transformName2(team2)"
## [243] "    # Kludge fix to get rid of warnings. But there should only be one team2.name."
## [244] "    if (length(team2.name) > 1) {"
## [245] "        team2.name = team2.name[1]"
## [246] "    }"
## [247] "    if(team2.name == \"\") {"
## [248] "      team2.name <- gsub(\" \", \"-\", tolower(as.character(team2)))"
## [249] "    }  "
## [250] "      "
## [251] "    team.index <- which(teams$url.name == team1.name)"
## [252] "    if (length(team.index) != 1) {"
## [253] "     print(sprintf(\"Unexpected # matches = %s for team1 '%s'\", length(team.index), team1.na
## [254] "        stop"
## [255] "    }"
## [256] "    opponent.index <- which(teams$url.name == team2.name)"
## [257] "    if(length(opponent.index) == 0) {"
## [258] "      bad.teams <- c(bad.teams, as.character(team2))"
## [259] "      bad.home <- c(bad.home, as.character(team1.name))"
## [260] "      ##"
## [261] "      ##outcomes[games.idx,]"
## [262] "    }"
## [263] "    if (length(opponent.index) > 1) {"
## [264] "        print(sprintf(\"Unexpected # matches = %s for opponent '%s'\","
## [265] "                      length(opponent.index), team2.name))"
## [266] "        stop"
## [267] "    }"
## [268] "  }"
## [269] "}"
## [270] "unique(bad.home)"
## [271] "unique(bad.teams)"
## [272] ""
## [273] "print(\"==== verify URLs: End ====\")"
## [274] ""
## [275] "ncaa.team1  <- c()"
## [276] "ncaa.team2  <- c()"
## [277] "ncaa.winner <- c()"
## [278] ""
## [279] "# loop through all teams on the teams list"
## [280] "for(teams.idx in 1:n) {"
## [281] "  "
## [282] "  # read in team game results"
## [283] "  team1.name <- teams$url.name[teams.idx]"
## [284] " url <- paste(\"http://www.sports-reference.com/cbb/schools/\",team1.name, sep=\"\")"
## [285] "  url <- paste(url, \"/2014-schedule.html\", sep=\"\")"
## [286] "  tables <- readHTMLTable(url)"
## [287] "  "
## [288] "  if (length(tables) == 0) {"
```

```
## [289] "        print(sprintf(\"Couldn't find game results for %s\", team1.name))"
## [290] "      next"
## [291] "   }"
## [292] "    "
## [293] "   ##print(c(teams.idx, team1.name))"
## [294] "    "
## [295] "   outcomes <- tables[[length(tables)]]"
## [296] "   if(ncol(outcomes) != 13) {"
## [297] "    print(sprintf(\"Error in game result lookup for team idx/name = %i/%s\", teams.idx, team1.na
## [298] "     break"
## [299] "   }"
## [300] "   outcomes$Tm <- as.numeric(as.character(outcomes$Tm))"
## [301] "   outcomes$Opp <- as.numeric(as.character(outcomes$Opp))   "
## [302] "    "
## [303] "   # note that the paper is inconsistent with the indexing convention"
## [304] "   # if game is held at home court i"
## [305] "   # observe i vs. j (i=home, j=away, margin is x_ij = home.points - away.points)"
## [306] "   # increment N_i by 1"
## [307] "   # increment N_j by 1"
## [308] "   # probability that home is better than away r_x(g(i,j)) = pnorm(a*spread-b)"
## [309] "   # intuition: if home wins big, r > 50% and votes prefer to go from j to i"
## [310] "   # probability of transfer from i to j increased by t_ij += 1 - r_x"
## [311] "   # probability of transfer from j to i increased by t_ji += r_x"
## [312] "   # probability of transfer from i to i increased by t_ii += r_x"
## [313] "   # probability of transfer from j to j increased by t_jj += 1 - r_x"
## [314] "   # "
## [315] "   # if game is held at neutral court, adjust spread by h"
## [316] "   # let team1 = i and team2 = j, adjust spread as if game were played at home by team1"
## [317] "  # observe i vs. j (i=team1, j=team2, margin is x_ij = team1.points - team2.points + h)"
## [318] "   # update as if team1 = home and team2 = away"
## [319] "    "
## [320] "   for(games.idx in 1:nrow(outcomes)) {"
## [321] "        "
## [322] "     # Skip header rows in the form:"
## [323] "    # \"32 G Date Type  Opponent Conf                          Tm Opp OT W L Streak\""
## [324] "     if (outcomes$Opponent[games.idx] == \"Opponent\") {"
## [325] "      next"
## [326] "     }"
## [327] "        "
## [328] "     # skip non D1 games"
## [329] "     if(outcomes$Conf[games.idx] == \"\") {"
## [330] "       next"
## [331] "     }"
## [332] "        "
## [333] "     team2 <- outcomes$Opponent[games.idx]"
## [334] "     team2.name <- transformName2(team2)"
## [335] "     if(team2.name == \"\") {"
## [336] "       team2.name <- gsub(\" \", \"-\", tolower(as.character(team2)))"
## [337] "     }  "
## [338] "        "
```

```
## [339] "     team.index <- which(teams$url.name == team1.name)"
## [340] "     opponent.index <- which(teams$url.name == team2.name)"
## [341] ""
## [342] "     if(outcomes$Type[games.idx] == \"NCAA\") {"
## [343] "       # if it's a tournament game, record the outcome"
## [344] "       if(length(opponent.index) > 0) {"
## [345] "         if(team.index < opponent.index) {"
## [346] "           ncaa.team1 <- c(ncaa.team1, as.character(teams$url.name[teams.idx]))"
## [347] "           ncaa.team2 <- c(ncaa.team2, as.character(team2.name))"
## [348] "           print(c(\"NCAA>>>>>> \", team1.name, team2.name))"
## [349] "           if(outcomes$Tm[games.idx] > outcomes$Opp[games.idx]) {"
## [350] "             ncaa.winner <- c(ncaa.winner, 1)"
## [351] "           } else {"
## [352] "             ncaa.winner <- c(ncaa.winner, 2)"
## [353] "           }"
## [354] "         }"
## [355] "       }"
## [356] "       "
## [357] "       # exclude the game from the rankings calculation"
## [358] "       next"
## [359] "     }"
## [360] "      "
## [361] "     if(length(opponent.index) > 0) {"
## [362] ""
## [363] "       # don't double count..."
## [364] "       if(opponent.index < team.index) {"
## [365] "         # in this case the game in question was already recorded when the other team was team1, so
## [366] "         # print(paste(\"skipping\",paste(team1.name,paste(\"vs.\",team2.name))))"
## [367] "         next"
## [368] "       }"
## [369] "       "
## [370] "       # compute margin of victory for the home team"
## [371] "       if(as.character(outcomes[games.idx,6]) == \"\") {"
## [372] "         team.home <- team1.name"
## [373] "         team.away <- team2.name"
## [374] "         i <- team.index"
## [375] "         j <- opponent.index"
## [376] "         if(outcomes$OT[games.idx] == \"OT\") {"
## [377] "           spread <- 0"
## [378] "         } else {"
## [379] "           spread <- outcomes$Tm[games.idx] - outcomes$Opp[games.idx]"
## [380] "         }"
## [381] "       } else if(as.character(outcomes[games.idx,6]) == \"@\") {"
## [382] "         team.home <- team2.name"
## [383] "         team.away <- team1.name"
## [384] "         i <- opponent.index"
## [385] "         j <- team.index"
## [386] "         if(outcomes$OT[games.idx] == \"OT\") {"
## [387] "           spread <- 0"
## [388] "         } else {"
```

```
## [389] "          spread <- outcomes$Opp[games.idx] - outcomes$Tm[games.idx]"
## [390] "        }"
## [391] "      } else {"
## [392] "        # neutral court, adjust spread as if team1 played at home"
## [393] "        team.home <- team1.name"
## [394] "        team.away <- team2.name"
## [395] "        i <- team.index"
## [396] "        j <- opponent.index"
## [397] "        if(outcomes$OT[games.idx] == \"OT\") {"
## [398] "          spread <- h"
## [399] "        } else {"
## [400] "          spread <- outcomes$Tm[games.idx] - outcomes$Opp[games.idx] + h"
## [401] "        }"
## [402] "      }"
## [403] "    "
## [404] "      if(is.na(spread)) {"
## [405] "        next # resolves problem when a game is listed online before a score is available"
## [406] "      }"
## [407] "    "
## [408] "      teams$ngames[i] <- teams$ngames[i] + 1"
## [409] "      teams$ngames[j] <- teams$ngames[j] + 1"
## [410] "  "
## [411] "    # update the probability matrix: t[i,j] = probability that i is a better team than j"
## [412] "      r <- pnorm(a*spread-b)"
## [413] "      t[i,j] <- t[i,j] + (1-r)"
## [414] "      t[j,i] <- t[j,i] + r"
## [415] "      t[i,i] <- t[i,i] + r"
## [416] "      t[j,j] <- t[j,j] + (1-r)"
## [417] "    "
## [418] "      ##print(paste(paste(paste(team.home,\"vs.\"), team.away),paste(spread,r)))"
## [419] "  "
## [420] "    } "
## [421] "  }"
## [422] ""
## [423] "}"
## [424] ""
## [425] "# normalize"
## [426] "for(i in 1:n) {"
## [427] "  if(teams$ngames[i]>0)"
## [428] "  t[i,] <- t[i,]/teams$ngames[i]"
## [429] "}"
## [430] ""
## [431] "#initialize ranking procedure"
## [432] "p <- matrix(1/n, 1, n)"
## [433] ""
## [434] "for(i in 1:n) {"
## [435] "  p[i] <- n-i+1"
## [436] "}"
## [437] ""
## [438] "p <- p/sum(p)"
```

```
## [439] ""
## [440] "# run ranking procedure"
## [441] "for(i in 1:1000) {"
## [442] "  p.next <- p %*% t"
## [443] "  if(i %% 100 == 0) {"
## [444] "    print(norm(p.next - p))"
## [445] "  }"
## [446] "  p <- p.next"
## [447] "}"
## [448] ""
## [449] "# add LRMC score to table and sort to get ranking"
## [450] "teams$LRMC.score <- t(p)"
## [451] ""
## [452] "teams <- teams[order(teams$LRMC.score, decreasing=TRUE),]"
## [453] ""
## [454] "teams.alpha <- teams[order(teams$School, decreasing=FALSE),]"
## [455] ""
## [456] "# for each matchup in the NCAA Tournament, compute the number of"
## [457] "# times the LRMC model predicted the winner."
## [458] "correct <- 0"
## [459] "total <- length(ncaa.team1)"
## [460] "for(i in 1:total) {"
## [461] "   "
## [462] "  score1 <- teams$LRMC.score[teams$url.name == ncaa.team1[i]]"
## [463] "  score2 <- teams$LRMC.score[teams$url.name == ncaa.team2[i]]"
## [464] "   "
## [465] "  symbol <- \"X\""
## [466] "   "
## [467] "  if(ncaa.winner[i] == 1 & score1 > score2) {"
## [468] "    correct <- correct + 1"
## [469] "    symbol <- \"*\""
## [470] "  }"
## [471] ""
## [472] "  if(ncaa.winner[i] == 2 & score2 > score1) {"
## [473] "    correct <- correct + 1"
## [474] "    symbol <- \"*\""
## [475] "  }"
## [476] "   "
## [477] "  print(paste(symbol,paste(paste(ncaa.team1[i],\"vs.\"),ncaa.team2[i])))"
## [478] "   "
## [479] "}"
## [480] ""
## [481] "#########  Wait until the regular season is final!"
## [482] ""
## [483] "# correct picks in the NCAA tournement based on LRMC"
## [484] "lmrcPredictions = list(correct=correct, total=total)"
## [485] "print(\"LRMC\")"
## [486] "print(lmrcPredictions$correct)"
## [487] "print(lmrcPredictions$total)"
## [488] "print(lmrcPredictions$correct/lmrcPredictions$total)"
```

```
## [489] ""
## [490] "calculateRpiPredictions = function(teams, ncaa.team1, ncaa.team2, ncaa.winner) {"
## [491] "    "
## [492] "    # for each matchup in the NCAA Tournament, compute the number of"
## [493] "    # times the widely used RPI model predicted the winner."
## [494] "    correct <- 0"
## [495] "    total <- length(ncaa.team1)"
## [496] "    for(i in 1:total) {"
## [497] "        "
## [498] "        score1 <- teams$RPI[teams$url.name == ncaa.team1[i]]"
## [499] "        score2 <- teams$RPI[teams$url.name == ncaa.team2[i]]"
## [500] "        "
## [501] "        score1 <- as.numeric(as.character(score1))"
## [502] "        score2 <- as.numeric(as.character(score2))"
## [503] "        "
## [504] "        symbol <- \"X\""
## [505] "        "
## [506] "        if(ncaa.winner[i] == 1 & score1 > score2) {"
## [507] "            correct <- correct + 1"
## [508] "            symbol <- \"*\""
## [509] "        }"
## [510] "        "
## [511] "        if(ncaa.winner[i] == 2 & score2 > score1) {"
## [512] "            correct <- correct + 1"
## [513] "            symbol <- \"*\""
## [514] "        }"
## [515] "        "
## [516] "        print(paste(symbol,paste(paste(ncaa.team1[i],\"vs.\"),ncaa.team2[i])))"
## [517] "        "
## [518] "    }"
## [519] "    returnList = list(correct=correct,total=total)"
## [520] "}"
## [521] ""
## [522] "rpiPredictions = calculateRpiPredictions(teams, ncaa.team1, ncaa.team2, ncaa.winner)"
## [523] "print(\"RPI Prediction Results\")"
## [524] "print(rpiPredictions$correct)"
## [525] "print(rpiPredictions$total)"
## [526] "print(rpiPredictions$correct / rpiPredictions$total)"
## [527] ""
## [528] "calculateWeightedRpiLrmcPredictions = function(teams, ncaa.team1, ncaa.team2, ncaa.winner, a]
## [529] "    minRPI = min(as.numeric(teams$RPI))"
## [530] "    maxRPI = max(as.numeric(teams$RPI))"
## [531] "    rngRPI = maxRPI = minRPI"
## [532] "    minLRMC = min(as.numeric(teams$LRMC.score))"
## [533] "    maxLRMC = max(as.numeric(teams$LRMC.score))"
## [534] "    rngLRMC = maxLRMC - minLRMC"
## [535] "    "
## [536] "    correct <- 0"
## [537] "    total <- length(ncaa.team1)"
## [538] "    for(i in 1:total) {"
```

```
## [539] "                  "
## [540] "        score1RPI = as.numeric(as.character(teams$RPI[teams$url.name == ncaa.team1[i]]))"
## [541] "        score1LRMC = teams$LRMC.score[teams$url.name == ncaa.team1[i]]"
## [542] "        score2RPI = as.numeric(as.character(teams$RPI[teams$url.name == ncaa.team2[i]]))"
## [543] "        score2LRMC = teams$LRMC.score[teams$url.name == ncaa.team2[i]]"
## [544] "                  "
## [545] "        score1RPIscaled = (score1RPI - minRPI) / rngRPI"
## [546] "        score1LRMCscaled = (score1LRMC - minLRMC) / rngLRMC"
## [547] "        score2RPIscaled = (score2RPI - minRPI) / rngRPI"
## [548] "        score2LRMCscaled = (score2LRMC - minLRMC) / rngLRMC"
## [549] "                  "
## [550] "        score1 <- alpha * score1RPIscaled + (1.0-alpha) * score1LRMCscaled"
## [551] "        score2 <- alpha * score2RPIscaled + (1.0-alpha) * score2LRMCscaled"
## [552] "                  "
## [553] "        symbol <- \"X\""
## [554] "                  "
## [555] "        if(ncaa.winner[i] == 1 & score1 > score2) {"
## [556] "            correct <- correct + 1"
## [557] "            symbol <- \"*\""
## [558] "        }"
## [559] "                  "
## [560] "        if(ncaa.winner[i] == 2 & score2 > score1) {"
## [561] "            correct <- correct + 1"
## [562] "            symbol <- \"*\""
## [563] "        }"
## [564] "                  "
## [565] "     #(Debug)#print(paste(symbol,paste(paste(ncaa.team1[i],\"vs.\"),ncaa.team2[i])))   "
## [566] "    }"
## [567] "    returnList = list(correct=correct,total=total)"
## [568] "    return(returnList)"
## [569] "}"
## [570] ""
## [571] "# for each matchup in the NCAA Tournament, compute the number of"
## [572] "# times the weighted average of LRMC and RPI predicted the winner."
## [573] "# Use scaled values for both LRMC and RPI."
## [574] ""
## [575] "ratioCorrect = c()"
## [576] "bestAlpha = 0"
## [577] "bestAlphaRatio = 0"
## [578] ""
## [579] "for(alpha in seq(0,1,0.02)) {"
## [580] ""
## [581] "  weightedRpiLrmcPredictions = calculateWeightedRpiLrmcPredictions(teams, ncaa.team1, ncaa.
## [582] "    correct <- weightedRpiLrmcPredictions$correct"
## [583] "    total <- weightedRpiLrmcPredictions$total"
## [584] "    "
## [585] "    # correct picks in the NCAA tournament based on RPI and LRMC"
## [586] "    print(\"LRMC & RPI\")"
## [587] "    print(alpha)"
## [588] "    print(correct)"
```

```
## [589] "       print(total)"
## [590] "       thisAlphaRatio = correct / total"
## [591] "       print(thisAlphaRatio)"
## [592] "       "
## [593] "       ratioCorrect = c(ratioCorrect, thisAlphaRatio)"
## [594] "       "
## [595] "       if (thisAlphaRatio > bestAlphaRatio) {"
## [596] "         bestAlphaRatio = thisAlphaRatio"
## [597] "         bestAlpha = alpha"
## [598] "       }"
## [599] "}"
## [600] ""
## [601] "plot(seq(0,1,0.02), ratioCorrect, main=\"NCAA Predictions: RPI*alpha + LRMC*(1-alpha)\", "
## [602] "       xlab=\"alpha\", ylab=\"Ratio of Correctly Predicted Results\")"
## [603] ""
## [604] "print(sprintf(\"Best prediction ratio of %0.3f achieved with alpha=%s (alpha*RPI + (1-alpha)*L"
## [605] "                    bestAlphaRatio, bestAlpha))"
```