(Much) better than lotto tickets: Analytics and NCAA tournament win probabilities

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Outline

Background

- Single elimination tournament with 64-68 teams.
- $2.5 billion wagered on the tournament in 2012 (Boudway 2014; Tsu 2014)
- Reminder: gambling is still illegal in most places

Scoring formats:

1. Traditional 1:2:4:8:16:32 (Yahoo, ESPN, etc)
   - Points for picking winners only, done before tournament
2. Kaggle "March Machine Learning Mania"
   - All games judged on predictive probabilities

Kaggle description

- $\sim$ 400 entries from 248 teams in 2014 (500 teams in 2015)
- Predict win probability for every *possible* game (2278 contests)
- Only 63 games actually played used in scoring
- Scoring function:

$$LogLoss = -y \times log(\hat{y}) + (1 - y) \times log(1 - \hat{y})$$

where $\hat{y}$ is the predicted probability of a win and y is the actual outcome (0 or 1).

- We* won this contest in 2014.
- I'll address a few main questions:
  - What did we do?
  - How lucky did we get?
  - Traditional NCAA pools
  - Lessons transferable to sports analytics

*Jointly with Gregory Matthews (Loyola-Chicago)

- Two sources of data:
  - Las Vegas point spread data (Model M_1)
  - Ken Pomeroy efficiency (Pomeroy 2012) ratings (Model M_2)
    - Why efficiency?
- Logistic regression: outcome variable of 1 for a win and 0 for a loss.
  - **Model** M_1: 1 predictor
    - Spread
  - **Model** M_2: 5 predictors
    - Offensive efficiency (home, away)
    - Defensive efficiency (home, away)
    - Neutral indicator

- Find w to minimize LogLoss of $w \times \hat{y}_{M_1} + (1 - w) \times (1 - \hat{y}_{M_2})$
- In-sample versus out-of-sample testing
- Our submissions:
  - $S_1 = 0.75\hat{y}_{m_1} + 0.25\hat{y}_{m_2}$
  - $S_2 = 0.25\hat{y}_{m_1} + 0.75\hat{y}_{m_2}$ (Winning entry)

How lucky were we?

- We simulated a the tournament 10,000 times with differing "true" underlying win probabilities:
  - S_1, S_2
  - Mean of top 10 entries.
  - Mean of all entires.
  - All games 0.5
- In each simulated tournament we scored all entries and counted how often we won.

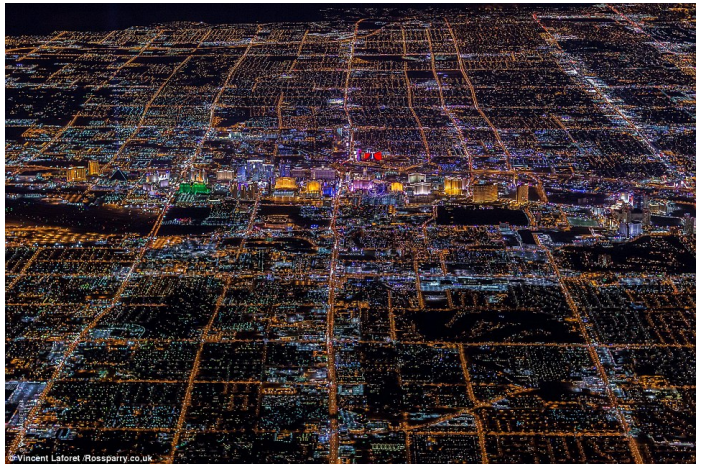
Results, Kaggle tournament

- Given our probabilities as true probabilities:
  - Each entry $\sim$ 15% of winning
  - Each entry $\sim$ 50% of top-10 finish
- We finished 4^{th} in 2015

Outline

Lessons, Kaggle tournament

1. You always need luck
2. 2 prediction models combined together outperform either alone
3. Better data $\geq$ complex models



Lessons, traditional pools

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   - Opponents picks known in expectation
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   - `kenpom.com`, `fivethirtyeight.com`
   - `http://www2.isye.gatech.edu/~jsokol/lrmc/`
   - 'Who picked whom'

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4. $P(Loss) > P(Win)$

Lessons, sports analytics

1. Research
2. Visualize
3. Practice
4. Share
5. Improve
6. Generalize

Sidebar: R-statistical software

Citations

- Lopez, M and Matthews, G.J. "Building an NCAA men's basketball predictive model and quantifying its success." *Journal of Quantitative Analysis in Sports*, 11:1 (2015): 5-12.
- Carlin, B. P. 1996. 'Improved NCAA Basketball Tournament Modeling Via Point Spread and Team Strength Information.' *The American Statistician* 50:3943.
- Pomeroy, K. 2012. Ratings Glossary. URL http://bit.ly/1LGb79q (accessed June 1, 2014).