Euro 2016 Predictions Using Team Rating Systems

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Introduction

There were two challenges within the Euro 2016 prediction competition

- the match prediction challenge and
- the tournament elimination challenge.

Estimated probabilities for the first challenge were used to generate predictions for the second one.

Match outcome prediction

via team rating systems

(Not only) my approach:

1. estimate team ratings based on historical match data and
2. use them to predict future match outcomes.

$$\textit{Data} \rightarrow \textit{Ratings} \rightarrow \textit{Predictions}$$

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The data used were:

- `http://laenderspiel.cmuck.de/` - special **thanks to Christian Muck** for cordially exporting the data
- betting odds from `http://betexplorer.com/`

Ordinal logistic regression model (1)

Under this model, match outcomes - H (home team win), D (draw) and A (away team win) - are linked to team ratings via the following equations

$$\begin{aligned}
\mathbb{P}(H) &= \frac{1}{1+e^{c-(r_i-r_j+h)}}, \\
\mathbb{P}(D) &= \frac{1}{1+e^{-c-(r_i-r_j+h)}} - \frac{1}{1+e^{c-(r_i-r_j+h)}}, \\
\mathbb{P}(A) &= 1 - \frac{1}{1+e^{-c-(r_i-r_j+h)}},
\end{aligned}$$

where $h > 0$ is a parameter accounting for the home team advantage and $c > 0$ in an intercept which governs the draw margin.

Ordinal logistic regression model (2)

Model fitting: the weighted maximum likelihood method with regularization was used:

$$-L(\mathcal{M}|\mathbf{r}, h, c) + \lambda \cdot \left(\frac{1}{2}(1-\gamma)\|\mathbf{r}\|_2^2 + \gamma\|\mathbf{r}\|_1 \right),$$

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$$L(\mathcal{M}|\mathbf{r}, h, c) = \frac{1}{|\mathcal{M}|} \sum_{m \in \mathcal{M}} \phi(m) \cdot \log \mathbb{P}(o_m),$$

where:

- $\mathbb{P}(o_m)$ equal to the probability of the actual outcome of a match m attributed by the model and
- $\phi(m)$ being a weighting function depending both on time and match type (e.g., friendly game or World Cup finals match).

Poisson model (1)

The assumption here is that the goals scored by a team can be modelled as a Poisson distributed variable.

Given the attacking and defensive skills (model's parameters) of teams i and j, a_i, a_j and d_i, d_j, respectively, the rates of Poisson variables for a home team i and visiting team j, λ and μ respectively, are modelled as:

$$\lambda = c + h + a_i - d_j,$$

$$\mu = c + a_j - d_i.$$

Poisson model (2)

Under this model, the probability of a score x to y is a product of two individual Poisson variables with rates λ and μ respectively and equal to

$$\frac{\lambda^x \cdot e^{-\lambda}}{x!} \cdot \frac{\mu^y \cdot e^{-\mu}}{y!}.$$

The model's parameters are estimated using the weighted maximum likelihood method with regularization.

Least squares model

The least squares model assumes that the difference $s_i - s_j$ in the scores produced by the teams corresponds to the difference in their ratings

$$s_i - s_j = r_i - r_j + h.$$

Again, h is a correction for the home team advantage.

Tuning the predictive power (1)

In the competition, the accuracy was evaluated using logarithmic loss (*logloss*)

$$\frac{1}{m}\sum_{i=1}^{m}\log \mathbb{P}(o_m).$$

The parameters of the ratings systems are optimized for

- World Cup finals held between 1994 and 2010 (5 tournaments),
- UEFA European Championships 1996-2008 (4) and
- Copa America finals 1999-2011 (5).

This amounts for a set of 562 matches.

Tuning the predictive power (2)

Finally, the predictions are evaluated against 2014 World Cup finals, 2012 UEFA European Championships and 2015 Copa America.

Table : Evaluation of the final test set (112 matches).

Method	**Logloss**	**Accuracy**
Bookmakers	0.9726	52%
Ensemble	0.9950	56%
Least squares	0.9985	55%
Poisson	0.9991	55%
Ordinal regression	1.0002	52%
FIFA Women World Rankings	1.0060	50%
EloRatings.net	1.0189	51%
Random guess	1.0986	33%

Challenge I - Match outcome prediction

The final submission was an ensemble of the three discussed models obtained by averaging. In the contest the solution yielded 1.0776 logloss and 41% accuracy.

The probabilities generated for the first challenge were used for simulating tournament outcome 1.000.000 times in a Monte Carlo experiment. Based on the simulations, the probabilities of advancing a given stage were estimated.

Challenge II - Tournament elimination

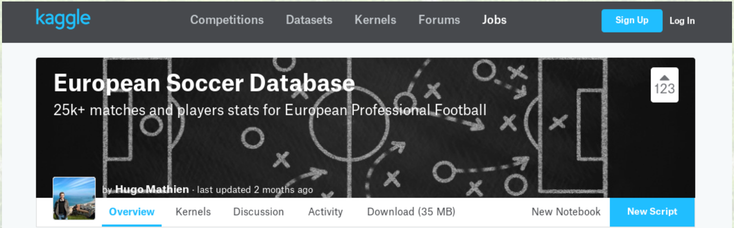
Table : Estimated probabilities of advancing past a given stage.

Team	Group stage	Quarterfinal	Semifinal	Final	Champions
France	98.01%	82.6%	67.71%	51.21%	37.55%
Spain	92.60%	72.24%	51.11%	33.95%	19.08%
Germany	94.71%	70.41%	45.99%	24.88%	13.21%
England	93.52%	67.5%	40.87%	22.25%	10.40%
Belgium	84.38%	48.2%	26.10%	11.51%	4.55%
Portugal	**91.37%**	**54.70%**	**26.31%**	**12.09%**	**4.42%**
Italy	72.43%	33.38%	14.83%	5.26%	1.55%
Ukraine	76.81%	37.05%	15.5%	5.53%	1.52%
Croatia	66.00%	31.92%	14.65%	5.27%	1.50%
Russia	75.34%	37.84%	13.07%	4.29%	1.14%
Turkey	61.90%	27.97%	12.07%	4.00%	1.05%
Switzerland	69.98%	30.49%	11.80%	3.97%	0.88%
Poland	67.40%	26.58%	9.35%	2.77%	0.60%
Sweden	57.89%	20.76%	7.45%	2.11%	0.47%
Romania	62.64%	23.82%	8.07%	2.35%	0.45%
Austria	71.63%	27.01%	7.46%	2.07%	0.43%
Slovakia	63.66%	25.57%	6.96%	1.79%	0.37%
Republic of Ireland	54.68%	18.64%	6.38%	1.72%	0.35%
Czech Republic	46.28%	16.19%	5.60%	1.44%	0.29%
Hungary	56.86%	16.08%	3.37%	0.69%	0.11%
Iceland	47.81%	11.32%	2.02%	0.36%	0.05%
Albania	31.46%	6.62%	1.26%	0.19%	0.02%
Wales	34.29%	7.98%	1.19%	0.16%	0.02%
Northern Ireland	28.32%	5.11%	0.88%	0.13%	0.01%

Can we do better?

How to obtain a model with a better predictive power?

- apply methods for improving a model efficacy, e.g., bagging
- use more data on, for example, the players and their skills
- ...



https://www.kaggle.com/hugomathien/soccer

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- and you for your attention!