

The football model

Let p_{ij} the probability **per minute** that team i scores a goal against team j in a football match. We want to infer that probability from a record of football matches. Let us study different models. In all cases $p_{ij} \neq p_{ji}$. **Note:** Again, use ABC.

1. In the first model, we have only two matches: R. Madrid-Barcelona (2-1) and Barcelona-R. Madrid (3-0). We know that being the host of the match gives you a 10% increased probability (define $\gamma = 1.1$) of scoring a goal. Compute the posterior distribution for p . Test a couple of priors.
2. The problem with that model is that it does not help us learn from one match to another. So, in the second model, we want to infer the *intrinsic offensive ability* of each team, α_k , and the *intrinsic defensive ability*, β_k , so we can write

$$p_{ij} = \alpha_i \beta_j$$

Again, consider the same **home effect**, $\gamma = 1.1$. Use the same *dataset* with just two matches.

3. Finally, we want to learn the home effect parameter, γ . Try different priors for this parameter as well.
4. Now you can try your model using a large dataset of results from a season of La Liga. Using your model, compute the posterior distribution for the ranking of each team in that season.
5. **Exploiting the posterior:** Simulate a new scoring system where teams scoring 4 or more goals get an extra point for that match.
6. **Exploiting the posterior:** What's the probability that a team do not receive any goal in N matches in a row?