Who is good at Test cricket?

Cricket fans often debate who is the best player, and these arguments are pretty hard to settle as matches take so long, have so many contributing factors, are pretty infrequent and involve a range of skills. When rating football players at Football Radar we encounter many of the same problems.

Below I use a similar approach to the one we currently use for football to try and see which players are good at Test cricket.

Wait, what is 'Test cricket'?

Cricket is a game with a well-deserved reputation for baffling terminology, especially in its 5-day 'Test' format. For our purposes the following description will more or less suffice:

- The game consists of lots of balls, arranged into up to 4 inningses (2 per team).
- Each ball (mostly) involves two players: batter vs. bowler.
- The batter aims to score runs and not concede a wicket (in this case they are out).
- The bowler aims to take wickets and not concede runs.

Data

I downloaded data recording the outcomes of 809592 balls from 402 male Test matches from the website cricsheet, and condensed it into a table indicating how many runs, balls and wickets happened for each bolwer/batter/innings combination.

Model

I used the following generalised linear models to describe the total number of runs and wickets for a given combination c of bowler, batter and innings

$$\begin{aligned} runs_c &\sim NegativeBinomial(\lambda_c, \phi) \\ wickets_c &\sim Binomial(balls_c, \eta_c) \end{aligned}$$

where

$$\begin{aligned} \log(\lambda_c) = \log(&balls_c) \\ &+ BaseRunRate_{innings_c} \\ &+ RunAbilityBat_{batter_c} \\ &- RunAbilityBowl_{bowler_c} \end{aligned}$$

$$\begin{aligned} logit(\eta_c) = &BaseWicketRate_{innings_c} \\ &+ WicketAbilityBat_{batter_c} \\ &- WicketAbilityBowl_{bowler_c} \end{aligned}$$

The binomial distribution for wickets in a combination implies a logistic regression at the level of balls. The negative binomial distribution allows the variance of the run distribution to differ from the mean. I chose this method to take into account the possibility of runs arriving irregularly in clumps rather than at a constant rate.

Bowling and batting abilities have normal priors centered at zero, with hierarchical standard deviations:

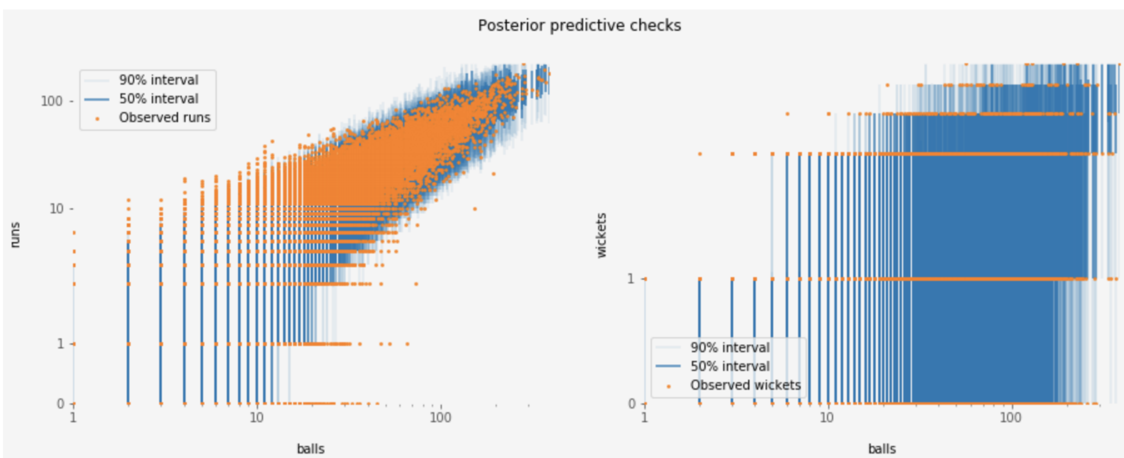
$$\begin{aligned}
RunAbilityBat &\sim Normal(0, \sigma_{RunBat}) \\
WicketAbilityBat &\sim Normal(0, \sigma_{WicketBat}) \\
RunAbilityBowl &\sim Normal(0, \sigma_{RunBowl}) \\
WicketAbilityBowl &\sim Normal(0, \sigma_{WicketBowl})
\end{aligned}$$

Other parameters have weakly informative prior distributions.

This model specification implies that there is no systematic correlation between the two dimensions of batting and bowling ability. This choice is motivated by simplicity and the final results, which suggest that the two dimensions are more or less uncorrelated for both bowlers and batters.

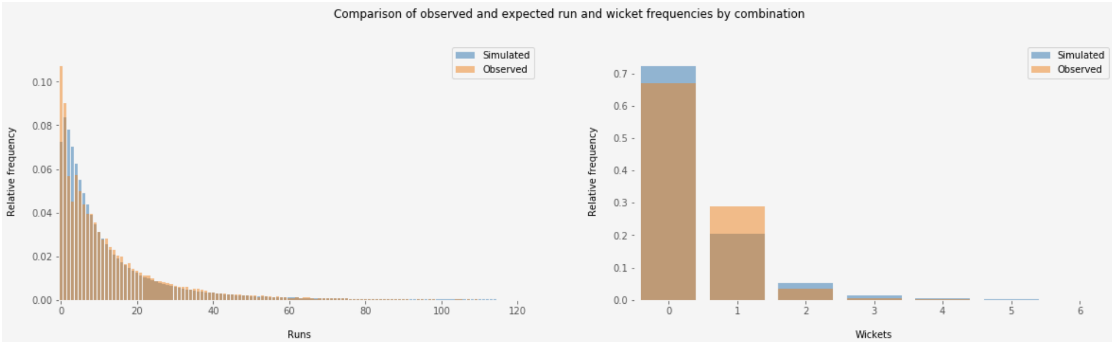
Model checking

I generated simulated runs and wickets for each bowler/batter/innings combination and compared these with the observed values, with the following results:



Roughly the right amount of observed values lie outside the model's 90% probable intervals. However, there is a pattern to the discrepancies between observed and simulated runs - the points outside the probable intervals occur almost exclusively for combinations with lower numbers of balls. This makes intuitive sense, as the model does not know that runs in cricket are mostly scored in increments of 1, 2, 4 and occasionally 6. The negative binomial likelihood is likely a reasonable approximation to the truth when the number of balls is high, but not when it is low.

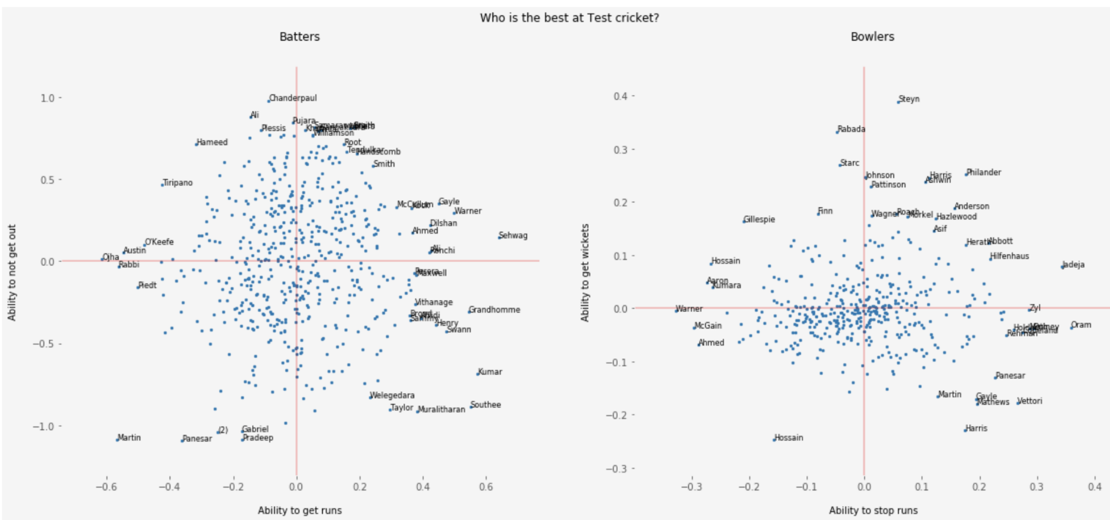
This impression is backed up by the following histograms of observed and simulated run and wicket counts:

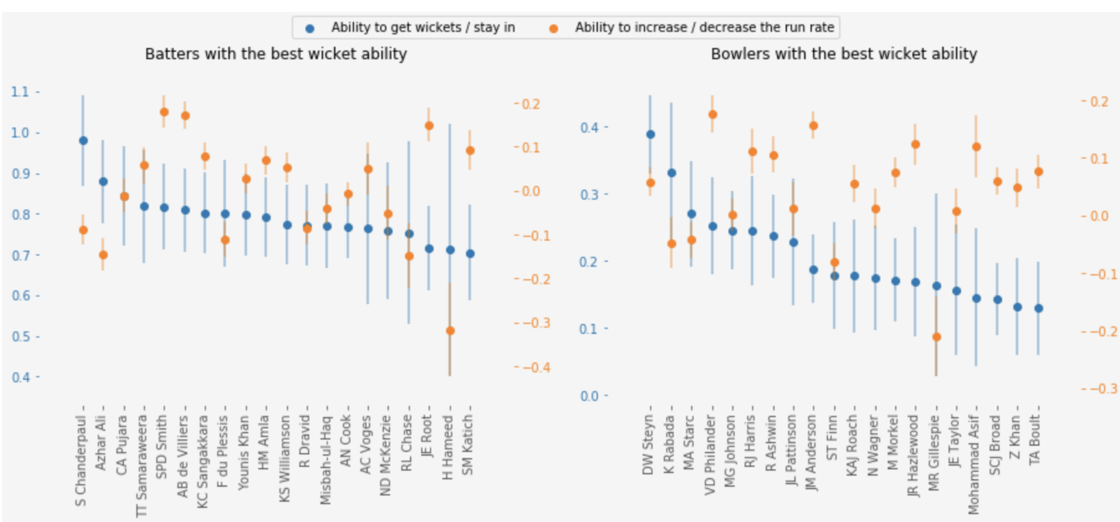


Overall there seems to be room for improvement, but the model fits the data well enough to make the results interesting.

Results

I made two charts - one plotting the posterior means of both abilities for all players, with unusual players highlighted, and another with a more detailed look at the players with the best wicket abilities.





The model seems to have picked out good players fairly well. My favourite players Mohammed Asif and Shivnarine Chanderpaul both make it into the top twenty, and most of the other top-rated players seem to be pretty good as well. I am slightly suspicious about the lack of slow bowlers in the top 20 - apart from Ashwin they are all fast bowlers who would probably do a lot of bowling when the ball is relatively new - this suggests a natural way to extend the model.

Limitations

I think this model works fairly well, but there are quite a few limitations and extensions that would be interesting to investigate:

- The model misses lots of important factors, including fielding, ball age, home advantage, change in ability over time, weather, stadium, game state or stamina.
- A ball can't usually involve both a wicket and a non-zero amount of runs, but in the model it can.
- There is probably a better way to describe the distribution of run errors.
- In order to say who is really the best player, run-rate ability needs to be weighed against wicket ability.