Probabilistic forecasts for anomaly detection

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3 July 2024

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Outline

1. Australian PBS data
2. Probabilistic forecasts
3. Extreme log scores
4. Using the fable and weird packages
5. Online anomaly detection

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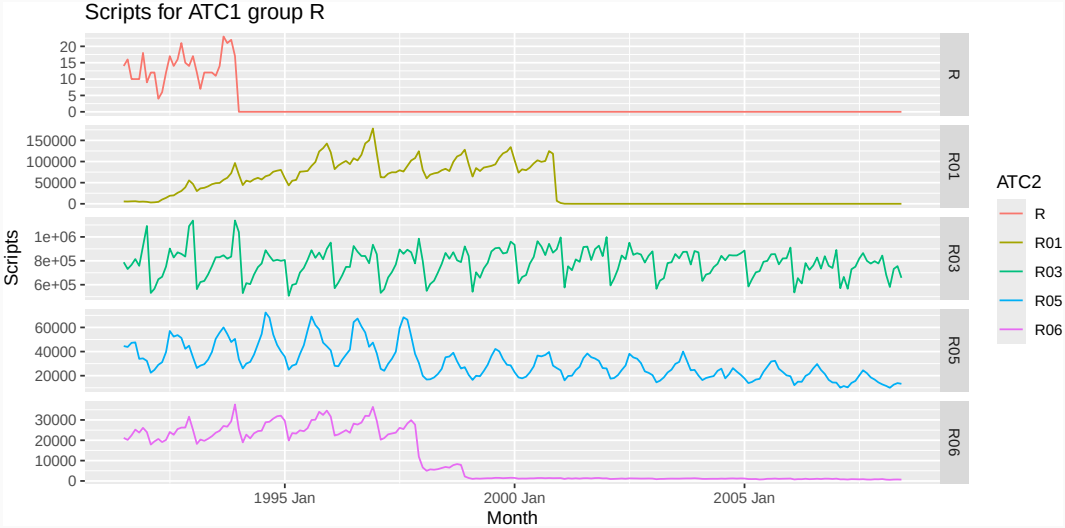
Australian PBS data

```
pbs
```

```
# A tsibble: 17,016 x 4 [1M]
# Key:       ATC1, ATC2 [84]
   ATC1  ATC2     Month Scripts
   <chr> <chr>    <mth>   <dbl>
 1 A     A01   1991 Jul   22615
 2 A     A01   1991 Aug   20443
 3 A     A01   1991 Sep   21389
 4 A     A01   1991 Oct   23746
 5 A     A01   1991 Nov   23477
 6 A     A01   1991 Dec   26316
 7 A     A01   1992 Jan   22041
 8 A     A01   1992 Feb   16393
 9 A     A01   1992 Mar   17207
10 A     A01   1992 Apr   18847
# i 17,006 more rows
```

Australian PBS data



Main idea

- Look at one-step forecast distributions and compute the anomaly score = $-$ log probability density of the next observation.
- High anomaly scores indicate potential anomalies.
- Fit a Generalized Pareto Distribution to the largest anomaly scores.
- Estimate the probability of each observation being an anomaly.

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Probabilistic forecasts

- Describe probabilistic forecasts

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Extreme log scores

- Explain log scores and EVT approach to finding anomalies ala lookout

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Using the fable and weird packages

- Demonstrate using weird package with (a) univariate models for tourism data; and (b) univariate models for age-specific time series from French mortality.

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Online anomaly detection

- Need to compute one-step forecast distributions using prior data. Approximately the same as N(y-hat, sigmaˆ2) using in-sample fit. More accurate using stretch tsibble with one-step forecasts.