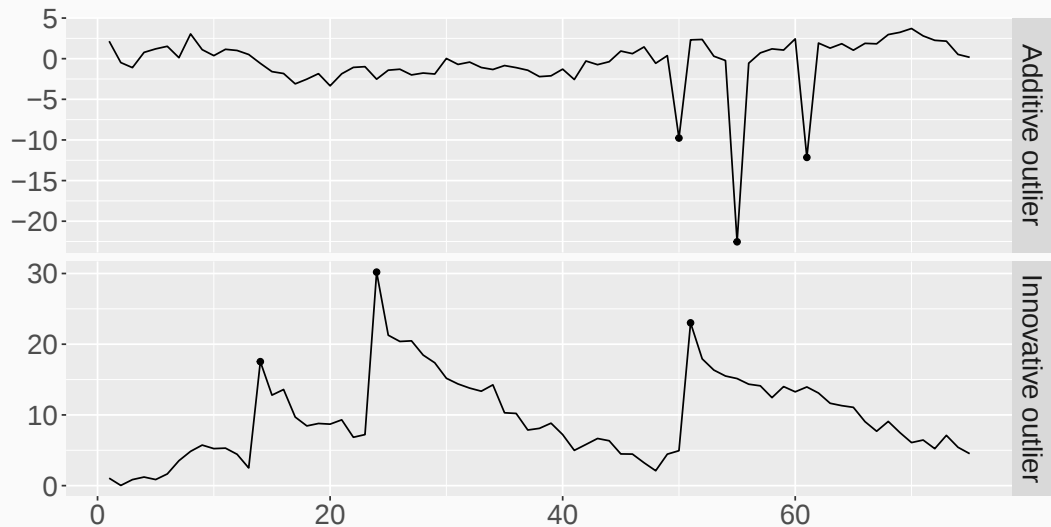


Time series outlier detection using penalised regression

Yangzhuoran Fin Yang
Ines Wilms
Jakob Raymaekers

Outliers in time series



Models

Additive outlier

$$y_t = \gamma_t + u_t$$

$$u_t = \varphi_1 u_{t-1} + \varphi_2 u_{t-2} + \cdots + \varphi_p u_{t-p} + \varepsilon_t$$

Innovative outlier

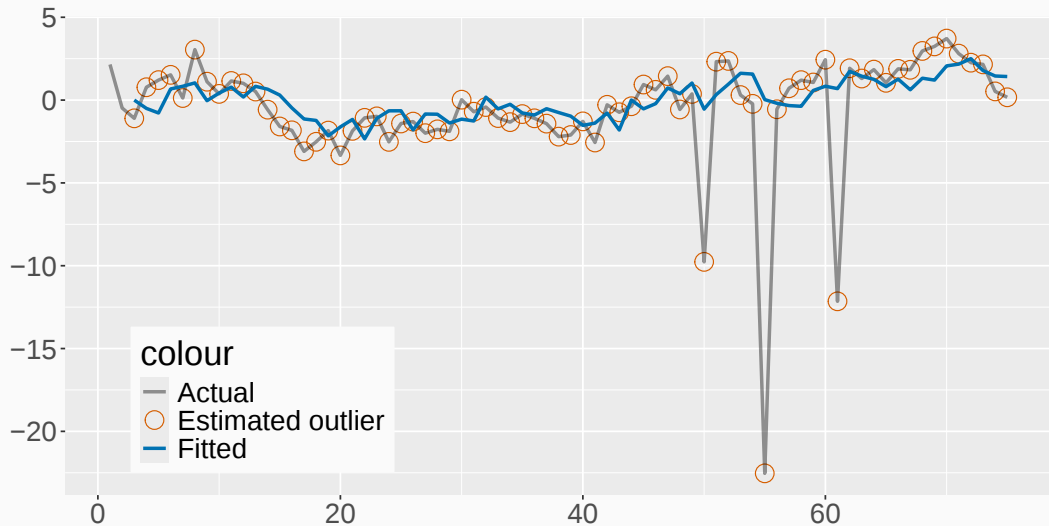
$$y_t = \gamma_t + \varphi_1 y_{t-1} + \cdots + \varphi_p y_{t-p} + \varepsilon_t$$

Objective function

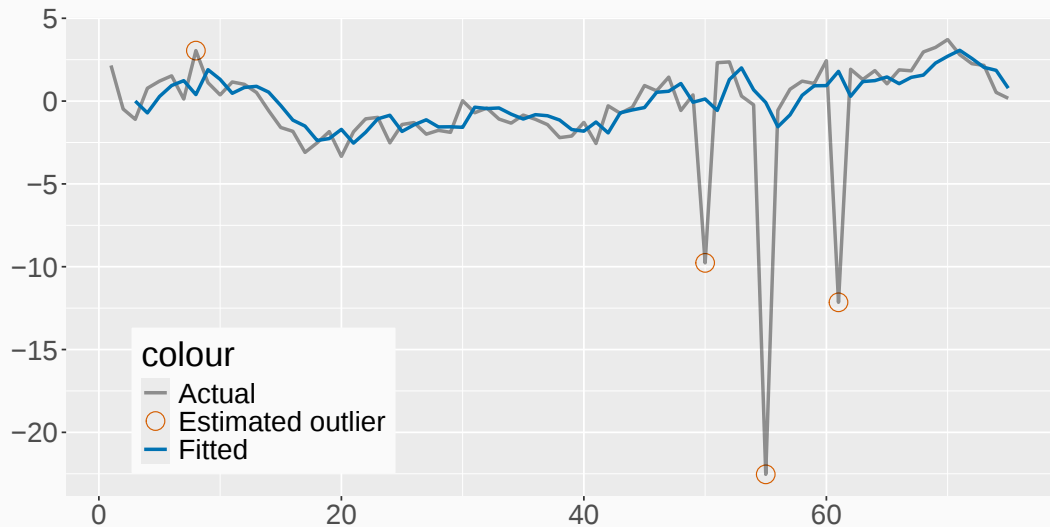
$$\min_{\varphi, \gamma} SSR(\phi, \gamma) + p(\gamma; \lambda)$$

γ_t is nonzero when observation t is an outlier.

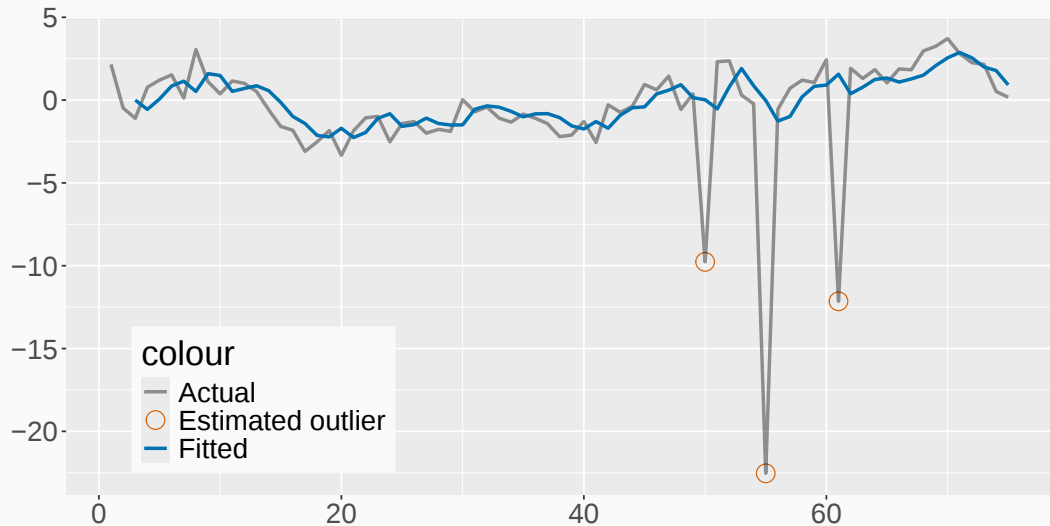
Optimisation: Iteration 0



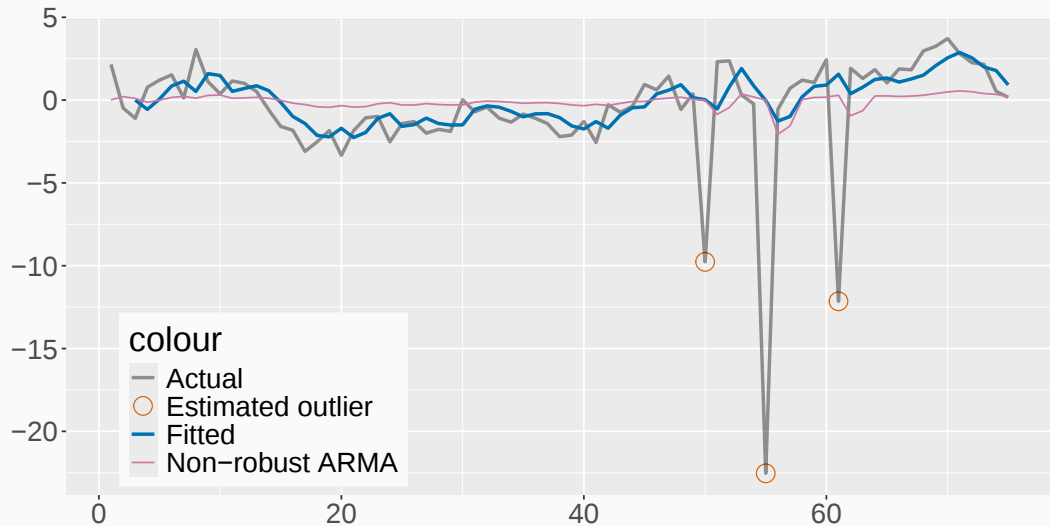
Optimisation: Iteration 1



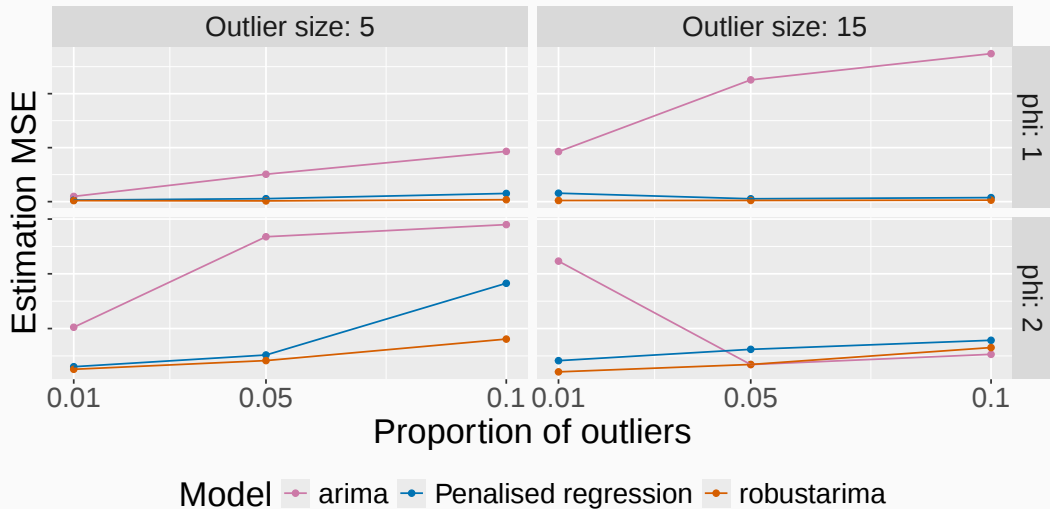
Optimisation: Iteration 6



Non-robust ARMA



Performance: Model estimation



Performance: Outlier identification

