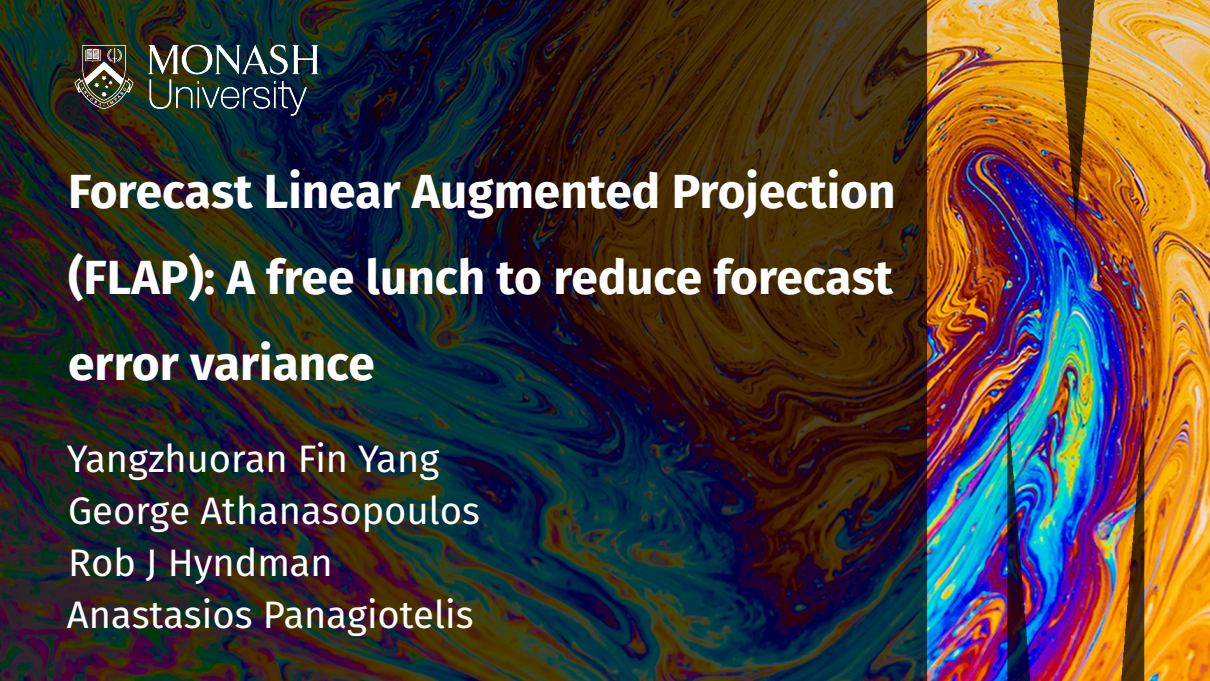

MONASH University

Forecast Linear Augmented Projection (FLAP): A free lunch to reduce forecast error variance

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Forecast Linear Augmented Projection (FLAP)

Forecasting multiple time series?

FLAP can imporve your forecasts

FLAP

- Model-independent forecast adjustment
- Uses common signal shared across series
- Reduces forecast error variance
- Doesn’t need additional data

How does FLAP work

We have time series $\boldsymbol{y}_t \in \mathbb{R}^m$

1. Form components
   $\boldsymbol{c}_t = \Phi \boldsymbol{y}_t \in \mathbb{R}^p$
2. Obtain base forecasts
   $\hat{\boldsymbol{z}}_{t+h} = [\hat{\boldsymbol{y}}'_{t+h}, \hat{\boldsymbol{c}}'_{t+h}]'$
3. Project: $\tilde{\boldsymbol{z}}_{t+h} = \boldsymbol{M}\hat{\boldsymbol{z}}_{t+h}$

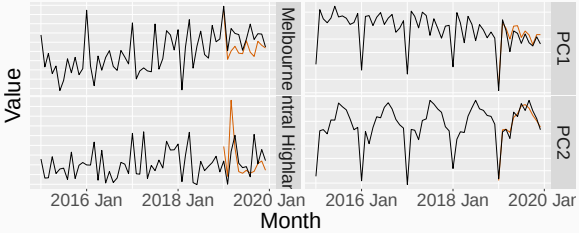
$$\boldsymbol{M} = \boldsymbol{I}_{m+p} - \boldsymbol{W}_h \boldsymbol{C}'(\boldsymbol{C}\boldsymbol{W}_h\boldsymbol{C}')^{-1}\boldsymbol{C}$$

$$\boldsymbol{C} = \begin{bmatrix} -\Phi & \boldsymbol{I}_p \end{bmatrix}$$

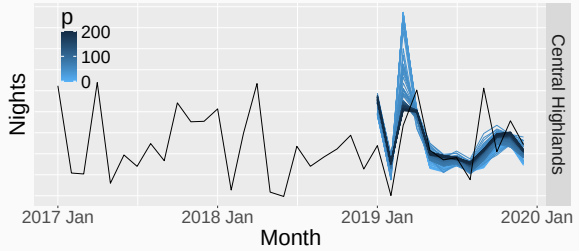
$$\boldsymbol{W}_h = \text{Var}(\boldsymbol{z}_{t+h} - \hat{\boldsymbol{z}}_{t+h})$$

History and Base Forecast

LEFT: Visitor nights; RIGHT: Principal Components



FLAP forecasts with number of components p



Why should you consider it

Theoretically, the forecast error variance of each series

1. is **reduced** with FLAP.
2. **monotonically** decreases with increasing number of components.
3. is **optimally** minimised among linear projections.