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Comments on

Large-Scale Dynamic Predictive Regressions

by Daniele Bianchi & Kenichiro McAlinn

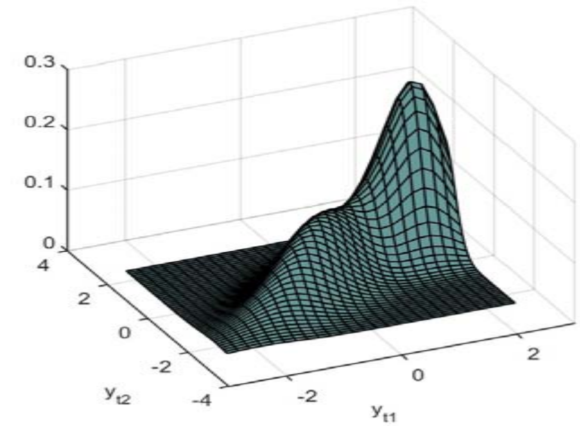
Mike West

Forecast future time *t* : Vector outcome $\mathbf{y}_t$

$\mathcal{M}_1$ $\mathcal{M}_2$ $\cdots$ $\mathcal{M}_j$ $\cdots$

Model set: $\mathcal{M}_{1:J}$

Predictions: $h_{tj}(\mathbf{y}_t)$



Information:
$$\mathcal{H}_t = h_{t,1:J}(\cdot)$$

Predictive synthesis: $p(\mathbf{y}_t | \mathcal{H}_t, \mathcal{I}_t)$

Past/prior information

$$p(\mathbf{y}_t|\mathcal{H}_t,\mathcal{I}_t) = \int_{\mathbf{x}_{t,1:J}} \alpha_t(\mathbf{y}_t|\mathbf{x}_{t,1:J}) \ \prod_{j=1:J} h_{tj}(\mathbf{x}_{tj})d\mathbf{x}_{tj}$$

Synthesis model/pdf

(Dynamic) latent agent factors

- *Model-specific biases, calibration*
- *Relative expertise/accuracy*
- *Model inter-dependencies*
- *Incomplete model set: Includes ability to "ignore" & adapt*
- *Time-variation … in all the above*

- A subset of full Bayesian models (theory)
- Many choices of synthesis model/function

[Crosse & MW 1992; MW 1991,1992]

- Nice idea: Models to be synthesised = Subset regressions (dynamic)

MW1

- Uniform predictive improvements (over lasso, BMA, etc) – why?
  - “illusion of sparsity” (high collinearities- avoid big models)
  - don’t select : mix over small models … somehow
  - model set incompleteness: BPS “encompasses” and adapts
  - dynamics

- Forecast goals focus: Build models for a purpose
  - multi-step or path-ahead forecast goals
  - decision goals in other contexts

- Elucidates model/forecast interdependencies
  - … and their dynamics over time

Slide 4

MW1 prove
Mike West, 16/06/2018

- Aggregation of "weak learners":
  - BART: ("boosting") McCulloch et al, 2010 AAOS
  - Decision-guided SSS: MW et al 2004-10, JASA, JCGS
  - Lee & Clyde ("bagging") 2004 JMLR

- Emergent linked themes:
  - Shephard, Engle et al 2014 (bagging: "Composite likelihood" - CL)
  - Chan, Koop et al 2018 – CL for large TV-VARs
    - mixing large numbers of small intersecting models
    - structurally – a special subclass of SGDLMs

- Decouple/Recouple: Rethinking modelling for scale-up

  SGDLMs: - decoupled sets of small univariate dynamic models
  - recoupled via (dynamic) simultaneous equations
  - G = graphical model underpinnings

Vector outcome $\mathbf{y}_t = (y_{1t}, \ldots, y_{mt})'$

$$y_{jt} \leftarrow \text{DLM}(\mathbf{x}_{jt}, \mathbf{y}_{sp(j),t}, v_{jt})$$

Series *j* specific predictors

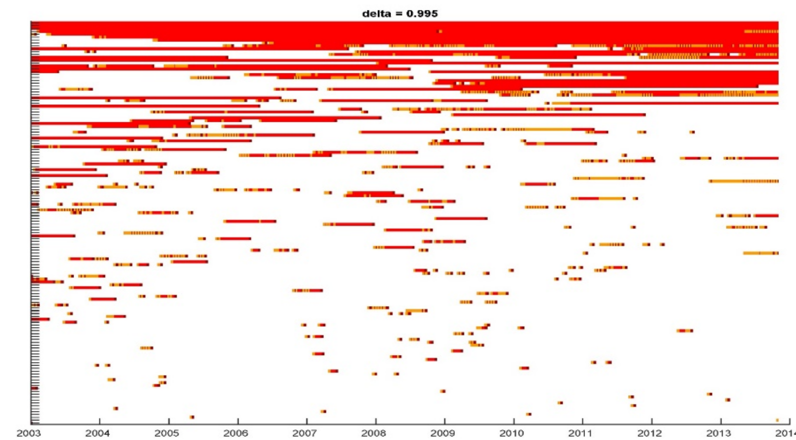
Simultaneous parental predictors

- *Contemporaneous & lagged directed graphical models*
- *Flexible, sparse multivariate volatility structure induced*
- *Efficient forward filtering & forecasting*
- *Scale-up with m: Decouple/recouple analysis - O(m)*
- *Examples: m ~ 400*
- *GPU implementation exemplar*

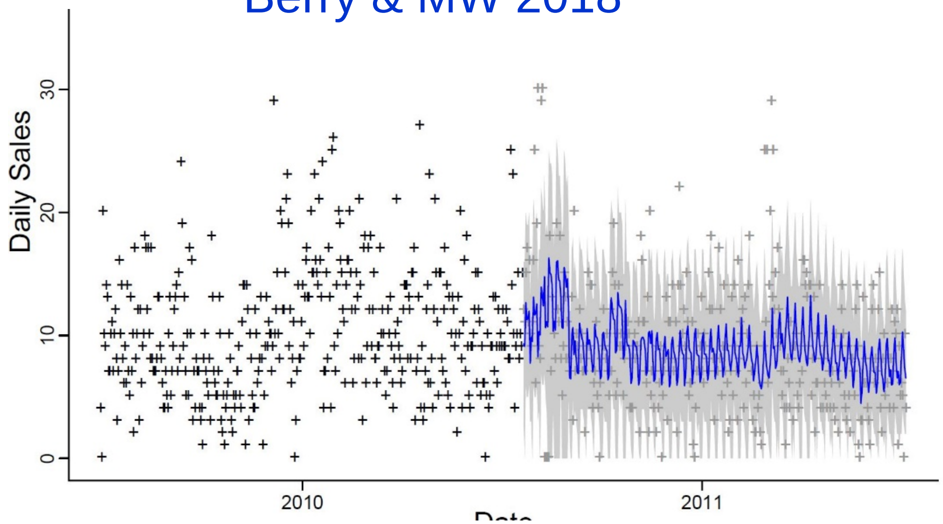
[Lutz Gruber & MW; BA 2016, EcoStat 2017, + …]

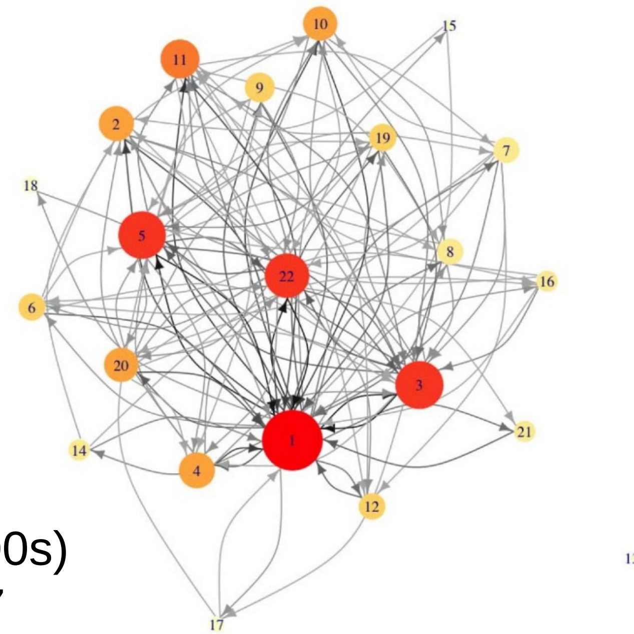
Decouple/Recouple for Large Time Series

SGDLMs - finance/macro econ (00s)



Multi-scale count series (000s)
Berry & MW 2018





Dynamic network flows (000s)
Xi, MW et al, JASA 2017

Bianchi & McAllin and DPR: A Few Questions

- Sum-to-one weights issue – irrelevant! (e.g., all ~ 0)

- How to choose small models?
  - theory/insights/economics
  - more details please
  - “overlay” with statistical ideas? Parsimony: “orthogonal” models?

- Go deeper with model interdependencies
  - changes over time: utility in informing interventions?
  - generating insights for model set refinements?

- Predictive improvements:
  - Time-varying BPS parameters: Role of dynamics

A Few More Questions

- Macro example (eg): 8 models to be synthesised
  - DLMs with "too many" predictors- stability? Sparser models
  - New thoughts: Hierarchical BPS …?

- Key issues: multi-step ahead predictions
  - Univariate models require future values of predictors
  - Predict the predictors offline? (no mention in draft ….)

- Impulse response analysis & multi-step forecasting (for decisions)
  - Need multivariate models
  - SGDLM-DPR models - Univariate DPRs coupled in SGDLM?