Monitoring - July 2025

Qing Wang (37th cycle)

Economics Department

15 July 2025

4th Year

Activities

Attended Conferences / Workshops:

- Analysis and Probability in Infinite Dimensions, 22-25 April 2025, Germany (poster).
- 30th International Conference on Forecasting Financial Markets, 21-23 May 2025, Venice (chairing).
- Bayesian Inference in Stochastic Processes, 26-28 May 2025, Milan (poster).
- International Workshop on Functional and Operational Statistics, 25-27 June 2025, Novara (talk).

Seminars:

- Department and internal seminars.
- Review report for seminar given by Goeman.
- Pre-defense in internal seminar.

Research (1st Chapter)

- Topic: Markov Switching Multiple-equation Tensor Regression Model
- Original contributions: i) we extend the soft PARAFAC tensor regression to a MS framework to address structural breaks in the data. ii) We consider a multi-equation setting in which multiple tensor regression models are driven by a common latent process. iii) We propose an efficient Gibbs Sampler which reduces computational cost and improve scalability.
- Progress: 100 %
  - Casarin, R., Radu, C., Wang, Q. (2025), Markov Switching Multiple-equation Tensor Regressions, Journal of Multivariate Analysis, 208, 105427
  - Casarin, R., Craiu, R., Wang, Q. (2025). Markov Switching Tensor Regressions. In: Aneiros, G., Bongiorno, E.G., Goia, A., Hušková, M. (eds) New Trends in Functional Statistics and Related Fields. IWFOS 2025. Contributions to Statistics. Springer, Cham.

Research (2nd Chapter)

- Topic: Compressed Bayesian tensor regression
- Contributions:
  - We propose a new generalized tensor random projection (GTRP) method that embeds high-dimensional tensor-valued covariates into low-dimensional subspaces with minimal loss of information about the responses.
  - Strong theoretical support is provided for the concentration inequalities properties of the random projection and posterior consistency results of the Bayesian inference.
  - A Bayesian inference framework is provided featuring the use of hierarchical prior distribution and low-rank representation of the parameters (tensor coefficients).
- Progress: 100 % (finalizing for submission)

Research (2nd Chapter)

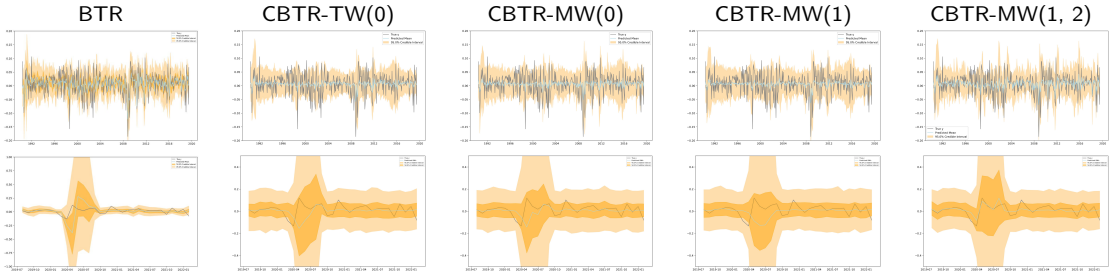

Figure: Fitting comparison between BTR and CBTR with different random projection methods. First row: in-sample fitting. Second row: out-of-sample prediction. True data are shown in gray solid line, predicted values are shown in blue solid line, light and dark orange colors represent 95% and 50% credible interval, respectively.

Table: RMSE of predictions of BTR and CBTR with different types of random projection methods.

	BTR	CBTR					
		TW	MW	MW(1)	MW(1, 2)	MW(1, 3)	MW(2, 3)
In-sample	0.0338	0.0355	0.0346	0.0356	0.0333	**0.0323**	0.0329
Out-of-sample	0.1148	0.0676	0.0623	0.0723	**0.0383**	0.0600	0.0508

Research (3rd Chapter)

- Topic: Bayesian tensor regression with stochastic volatility
- Contributions:
  - Introduce a novel Bayesian tensor regression model where the residual variances evolve according to a stochastic volatility (SV) process.
  - Allow for multi-way predictors (e.g., time $\times$ asset $\times$ feature) and incorporate SV to capture heteroskedasticity common in financial and macroeconomic data.
  - Propose a tailored MCMC sampler for the high-dimensional tensor-SV model that improves mixing and convergence.
  - Compare the performances of different competing SV models in predicting realized volatility on S&P 500.
- Progress: 90% (literature review, MCMC procedure are complete, programe is coded up, preliminary results available).

4th Year: Going forward...

- Finalizing the PhD thesis, prepare to submit to internal reviewers by end of July.
- Prepare to submit 2nd chapter to journals.
- Post-doc application and prepare for going to job market.
- Conferences
  - CMStatistics 2025.
  - FinEML Conference 2025.