

# Machine Learning applied to Economics and Finance

E. Benhamou

PhD Supervisors: Jamal Atif, Rida Laraki

Journée du LAMSADE  
April 18 2019



LAMSADE  
UMR CNRS 7243



# First work: Natural Gradient Method (NGM) for Dynamic Bayesian Networks (DBN)

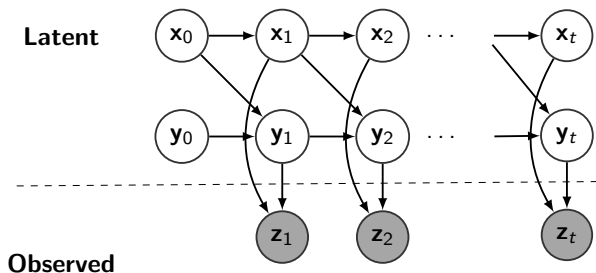


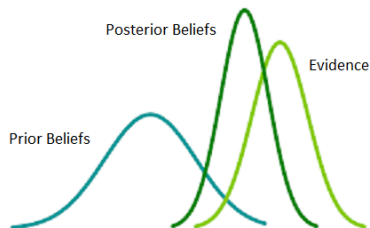
Figure 1: DBN combining Kalman filter & echo neural networks

- **Key idea:** Use NGM to learn DBN parameters. Strong alternative to EM method.
- **Arxiv:** <https://arxiv.org/abs/1811.11618>

## Second work: Bayesian version of CMA-ES

Assume **minimum distributed** according to  $\mathcal{N}(\hat{\mu}, \hat{\Sigma})$  and loop:

- Simulate Prior for  $\hat{\mu}, \hat{\Sigma}$
- Simulate k points  
 $\mathcal{X} = \{X_i\} = 1..n \sim \mathcal{N}(\hat{\mu}, \hat{\Sigma})$
- Look for candidates within  
 $\mathcal{X} = \{X_i\} = 1..n$
- Update Prior = Posterior



**Figure 2:** As we get more and more information, posterior becomes **more peak**

- **Key idea:** Use Bayesian interpretation of CMA-ES using conjugate prior (Normal Inverse Wishart or Normal Wishart)
- **Arxiv:** <https://arxiv.org/abs/1904.01401>