Learning Nonlinear Dynamical Networks in Neural Systems

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Presentation Abstract Summary Learning high-dimensional dynamic nonlinear systems from data is often computationally challenging. This work proposes a framework, called Dynamic Nonlinear Networks (DyNNets), for modeling such systems as a network of low-dimensional linear dynamical subsystems, with scalar memoryless nonlinearities in feedback, and linear inerteraction between subsystems. DyNNets
can encompass a wide range of complex phenomena and is particularly well-suited for modeling neuronal systems. The posterior density of the hidden states given the parameters of a DyNNet admits a factorable structure that separates the linear dynamics, memoryless nonlinearities, and linear interactions. This factorization enables efficient implementation of maximum a posteriori (MAP) state estimation and system identification via the alternating direction method of multipliers (ADMM). The methodology is illustrated on estimation of neural mass models.

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