Motivating questions:
1. How to define interconnection for stochastic systems?
   - Interconnection as coupling
   - Modelling of probability distributions
2. What is the role of noise in biology?
   - Noise as an unavoidable nuisance
   - Synchronization
   - Robustness
   - Connecting different scales

Stochastic processes: a behavioral perspective

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Behavioral systems theory:
a framework for modelling open systems

Invariance properties in the space of LTI stochastic processes

Static case

Rw = e

\( e = n \text{-dim. Gaussian vector } N(\mu, \Sigma) \)

Equivalence class:

\[ U \in \mathbb{R}^{n \times n} \]

Unimodular invariance of covariance matrices

Dynamic case

\[ R(\sigma, e) w(t) = e(t) \]

\( e(t) = n \text{-dim. Gaussian process } \mathcal{GP}(\mu(t), \Sigma(t, x)) \)

Equivalence class:

\[ U \in \mathbb{R}^{n \times n} \]

Affine invariance of covariance matrices

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References:

Motivations

How to define interconnection for stochastic systems?

Interconnection as coupling
- Modelling of probability distributions

Interconnection as variable sharing
- Modelling of event spaces

Potential applications to neuroscience

Interconnection of neurons = interconnection of stochastic processes

Summary and future directions

Future research directions include the analysis of continuous-time stochastic processes and potential applications to interconnected biological systems affected by noise.

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References: