

# Summary of This Course

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# Outline

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- ▶ Basics about Signal & Systems
- ▶ Bayesian inference
  - ▶ PCVM
- ▶ Hidden Markov Model
- ▶ Kalman filter
- ▶ Extended Kalman filter
- ▶ Particle filter
- ▶ Bayesian Networks
- ▶ Nonlinear Dynamic Systems
  - ▶ Echo State Networks



# Signal & System

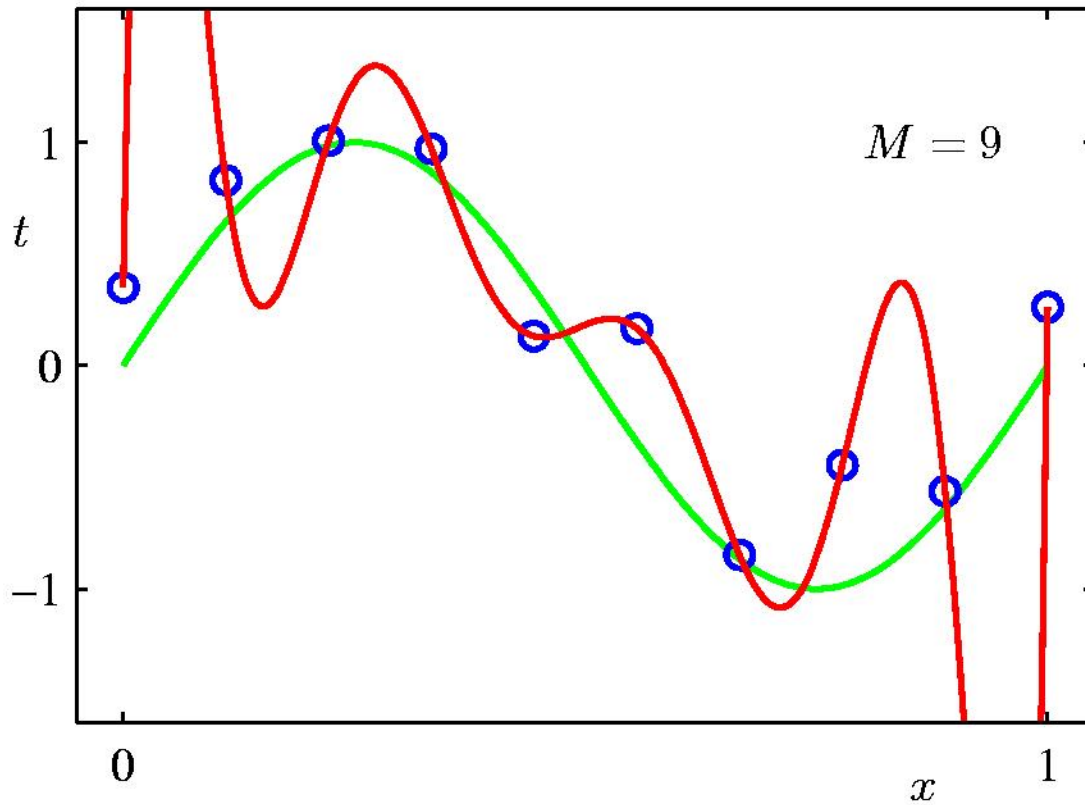
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- ▶ Time Domain
  - ▶ Signal properties
- ▶ Frequency Domain
  - ▶ Fourier transform
  - ▶ Z-transform
  - ▶ Laplace transform
- ▶ System
  - ▶ State space model



# Machine learning & Bayesians

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# Sparse Bayesian Learning

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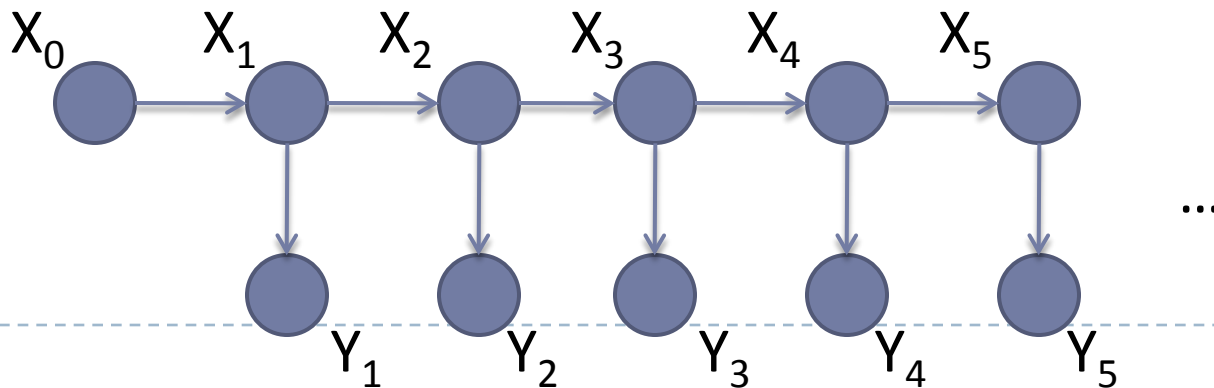
- ▶ What's Bayesian?
- ▶ Why Bayesian?
- ▶ How to use Bayesian?



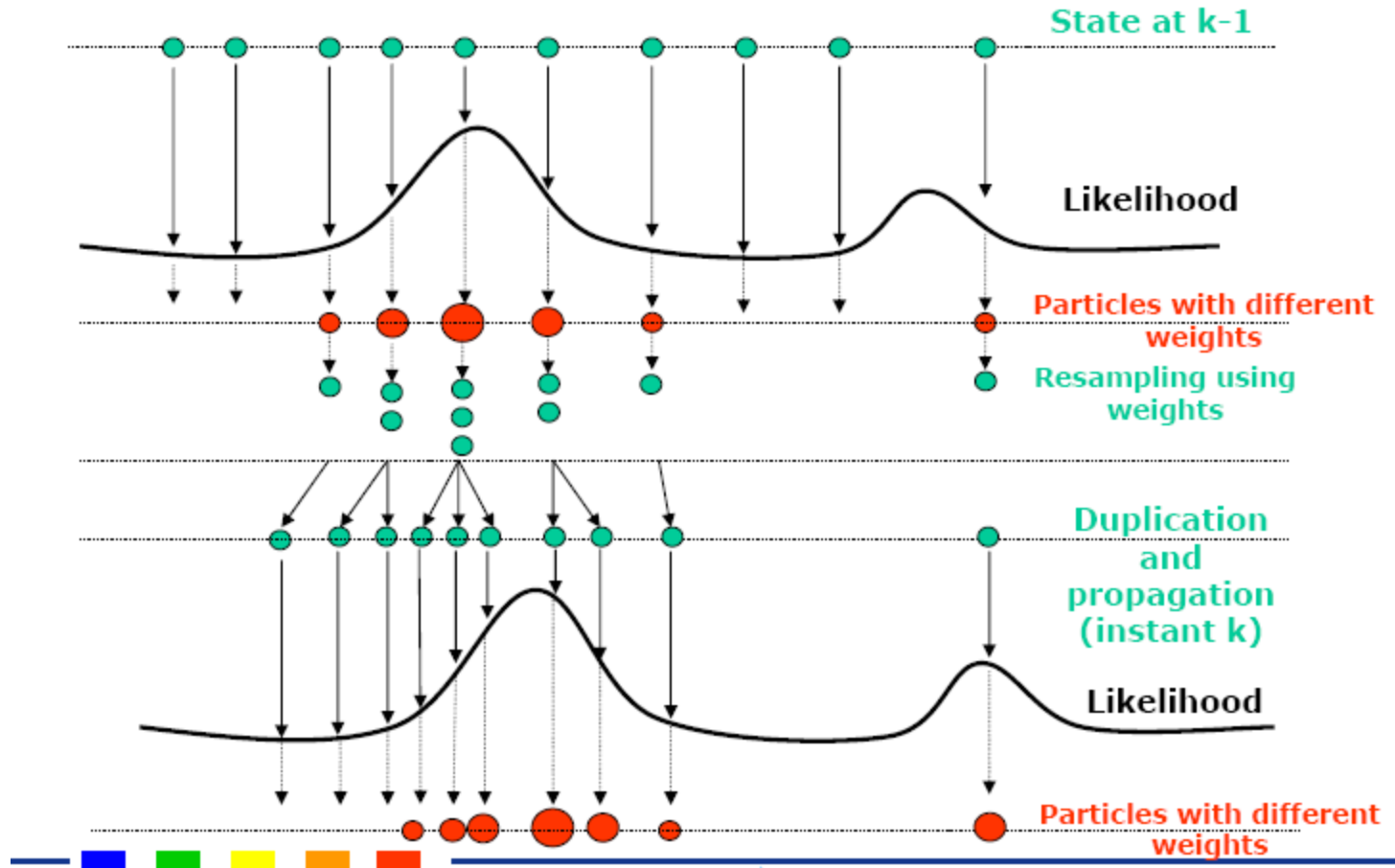
# Kalman filtering : Recursive update of state

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- ▶ Kalman filtering algorithm: repeat...
  - ▶ Time update:  
from  $X_{t|t}$ , compute a **priori** distribution  $X_{t+1|t}$
  - ▶ Measurement update:  
from  $X_{t+1|t}$  (and given  $\mathbf{y}_{t+1}$ ), compute a **posteriori** distribution  $X_{t+1|t+1}$



# Particle filter







# Echo State Networks

