

# INFINITE FACTORIAL DYNAMICAL MODEL

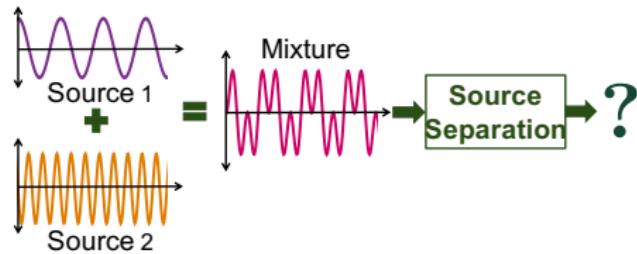
Isabel Valera,\* Francisco J. R. Ruiz,\*  
Lennart Svensson, Fernando Perez-Cruz



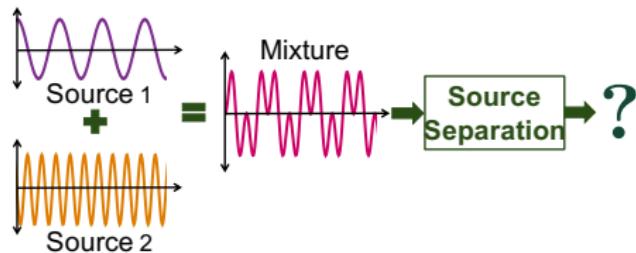
Alcatel-Lucent  
Bell Labs

March 4th, 2016

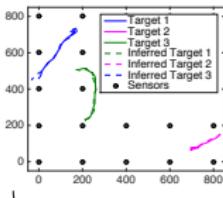
# MOTIVATION



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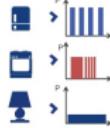
Multi-target tracking



Cocktail party



Power disaggregation



Multi-user detection



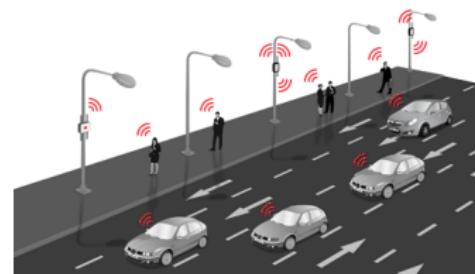
Sources with continuous states

Sources with discrete states

# MOTIVATION

Internet of Things.

- Discrete signals (messages).
- Transmitters enter & leave the system.
- Receiver needs to infer #sources.



# CONTRIBUTIONS

## INFINITE FACTORIAL DYNAMICAL MODEL

- ① A general Bayesian non parametric model for source separation.
  - Infers #sources from data.
  - Valid for a wide range of applications.
- ② Efficient inference.
  - Valid for many likelihood and dynamical models.
- ③ Comprehensive set of experiments.

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Multipath propagation

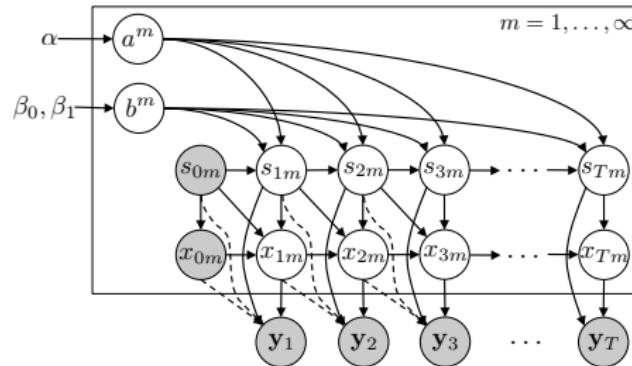
# MODEL AND INFERENCE

## ① Model

- Infinite #parallel chains (based on Markov IBP).
- Finite number of *active* sources for any finite dataset.

## ② Inference

- Infers #active sources, their states, and other parameters.
- Slice sampling & Particle Gibbs with ancestor sampling.



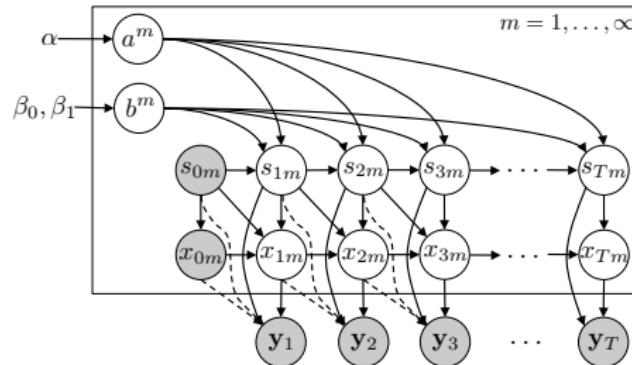
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Can accommodate:

- Any transition probabilities  $p(x_{tm} | x_{(t-1)m}, s_{(t-1)m}, s_{tm})$ .
- Any likelihood  $p(\mathbf{y}_t | \{x_{tm}, x_{(t-1)m}, \dots, x_{(t-L+1)m}\}_{m=1}^M)$ .

# EXPERIMENTS

Experiments on 4 applications:

- Multi-target tracking.
- Cocktail party.
- Power disaggregation.
- Multi-user detection.

