

On Friday November 14, 2014 1:55 PM EST Ithaca, NY, USA (3)

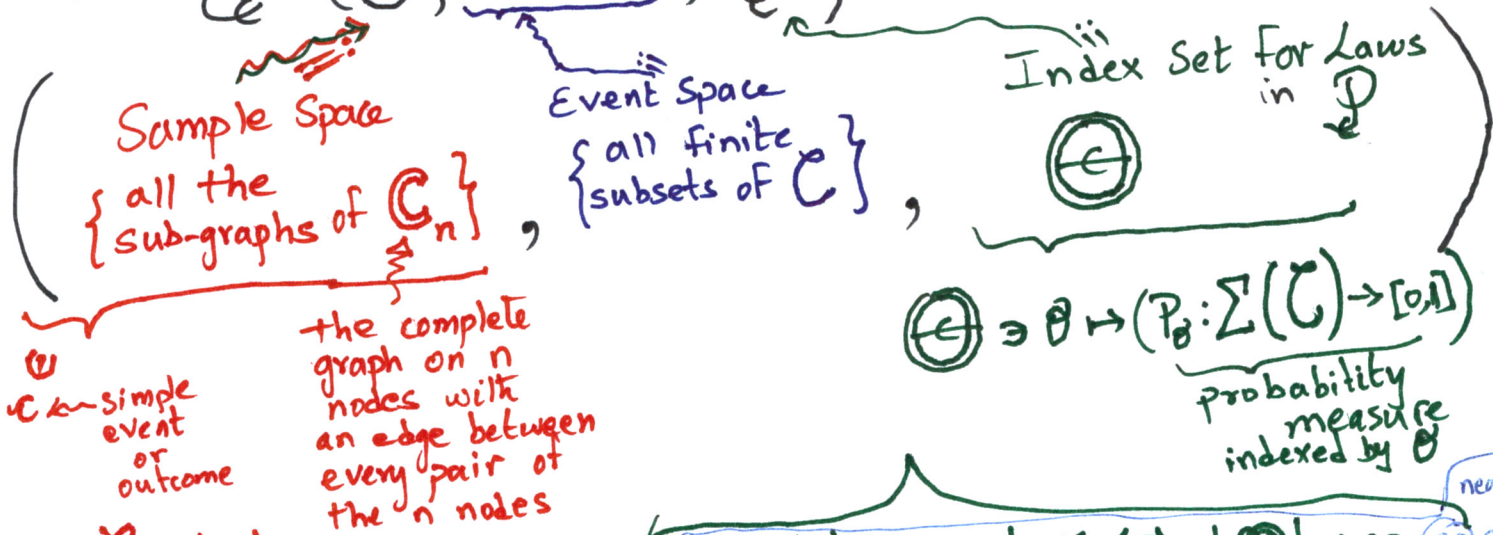
Experiments in Phylogenetic Epidemiology

Lecture-Discussion #9: BTRY 6940, Cornell, Fall 2014

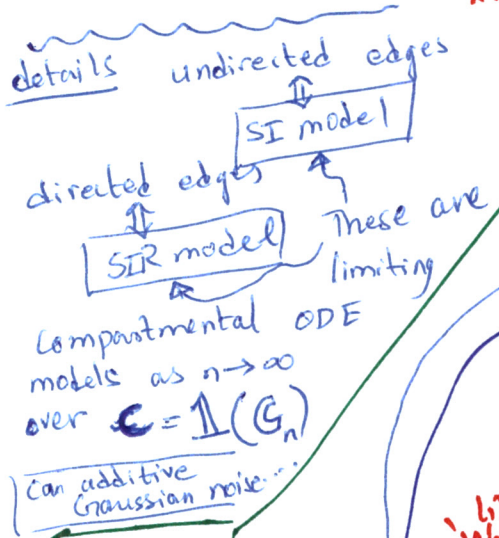
By Raazesh Sainudiin.

Dfn 1: Contact Graph Experiment

is $\mathcal{E} := (\mathcal{C}, \Sigma(\mathcal{C}), \mathcal{P})$ is a triple, s.t.,



$\mathcal{C} \sim \mathcal{C}$ -valued R.V. (i.e., a Random Graph R.G.)



- ① Finitely many laws $\Leftrightarrow |\mathcal{C}| < \infty$
 - ② Parametric family of laws $\Leftrightarrow \dim(\mathcal{C}) < \infty$
- examples of ②

of type A: Algorithmic/constructive models of random graphs (RGs).

- (i) Erdős-Rényi with parameter $p \in [0,1]$
- (ii) preferential attachment model with power law parameter $\theta = (\gamma, \dots)$

(iii) Pedigree (ancestral) contact graphs for genealogical parasites: like 'Wobahia' in *Drosophila* species

of type E: Existential Models

- (i) Exponential family of RGs

The RG $\mathcal{C} \sim \exp(-[S(\mathcal{C}) - \delta]^2)$

③ Non-parametric family of Laws.

$\mathcal{H} \xrightarrow{1-1} \mathcal{P}$ & $\dim(\mathcal{H}) \neq \infty$

egs. $\left\{ \begin{array}{l} \text{average connections per node} \\ \text{\# of triangular edges, ...} \end{array} \right\}$ some measurable map of \mathcal{C} .

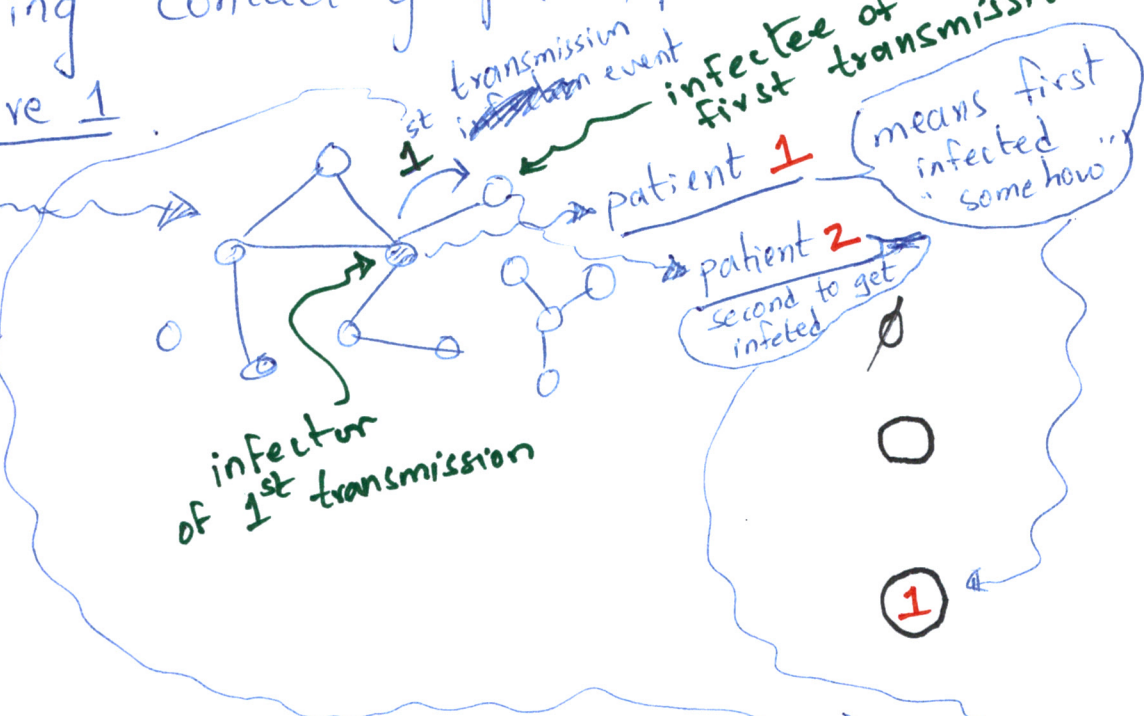
Dfn 2: A Transmission Experiment given an \mathcal{E} ^(2/3)
 is $\mathcal{E} := (\mathcal{T}, \Sigma(\mathcal{T}), \mathbb{P})$

Dfn 3: $\mathcal{T} := \left\{ \begin{array}{l} \text{all rooted, increasing, planar} \\ \text{binary trees with up to } n \text{ leaves} \end{array} \right\} \rightarrow \text{"ripb-trees"}$

Sample Space of Transmission trees that encode the transmission of a "disease" over the underlying contact graph experiment \mathcal{E} .

See Figure 1.

Let ω be a realization of the R.G.C

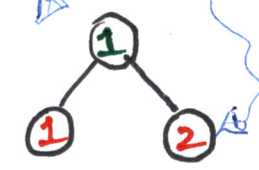


Dfn 3: Joint Experiment.

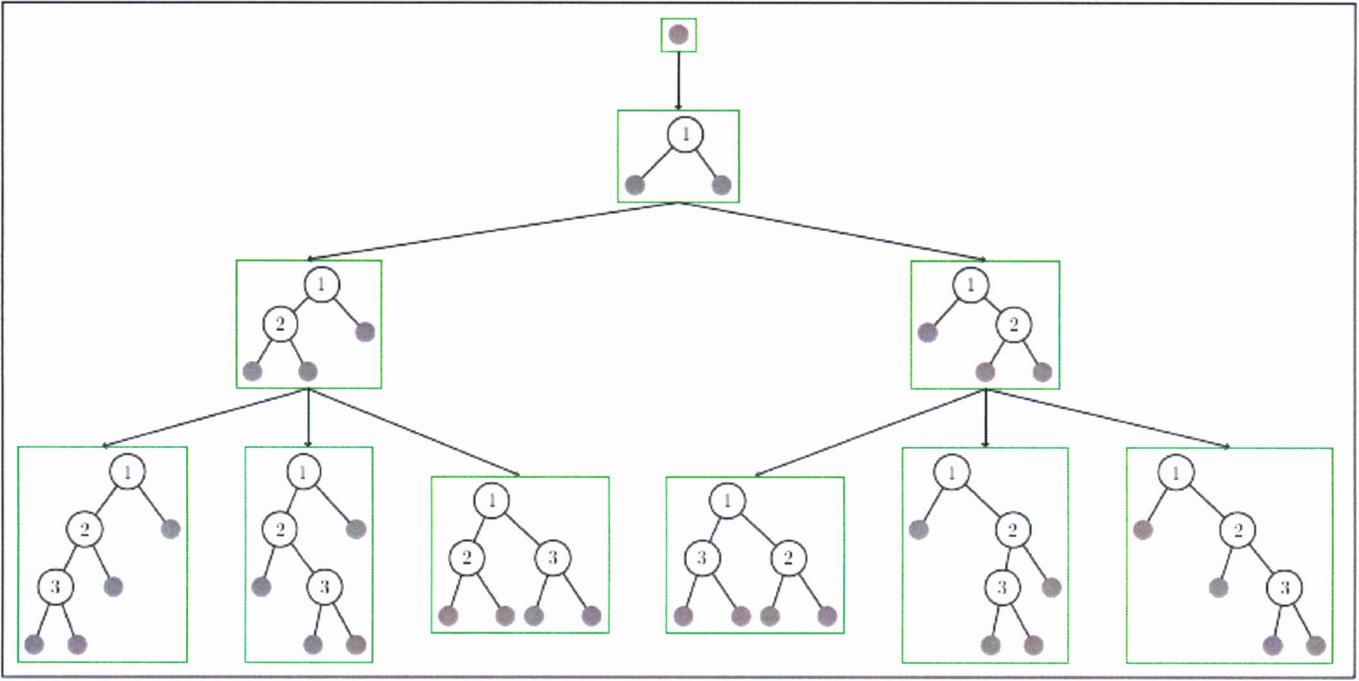
$\mathcal{E}_{\mathcal{E}\mathcal{T}}$ is natural by product Σ algebras.

Dfn 4: Wald's Decision theoretic Markov Kernels from $\mathcal{E}_{\mathcal{E}\mathcal{T}} \mapsto \mathcal{A}$

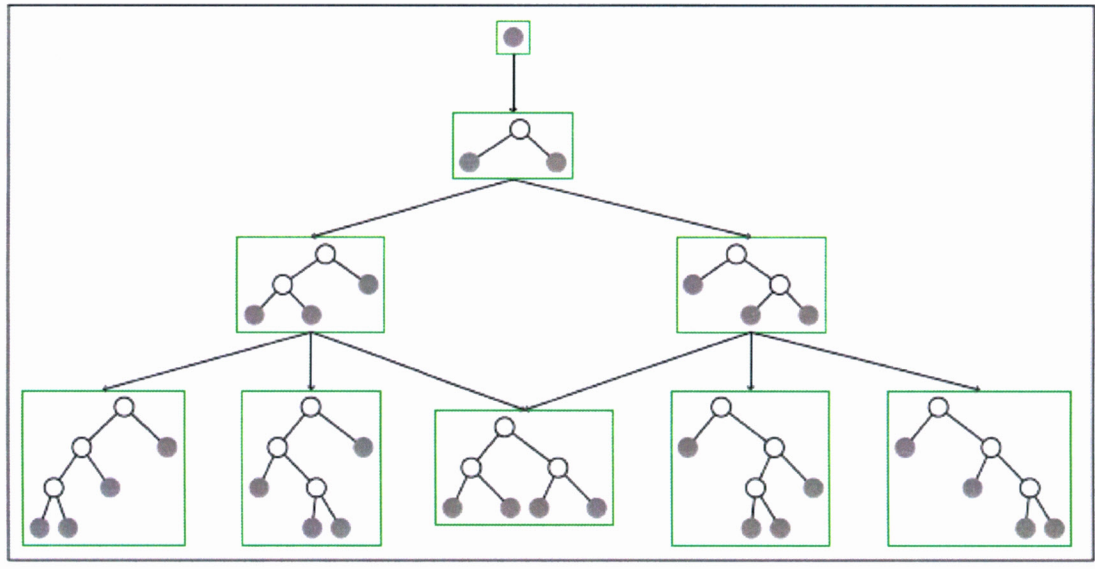
Control Action space or just param. estim.



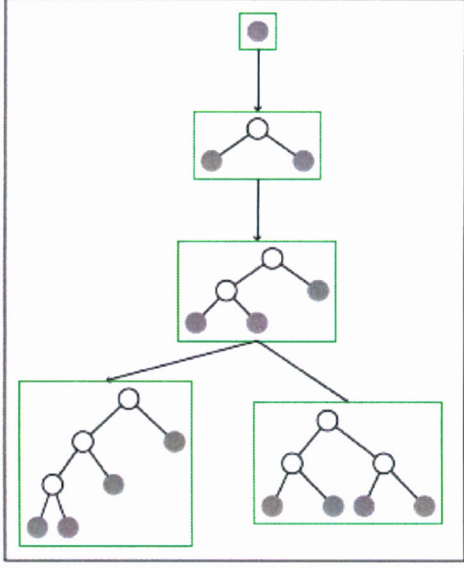
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(A) Hasse diagram of ripb-trees with up to 3 splits



(B) rdipb-trees



(C) rdinpb-trees