Restricting exchangeable nonparametric distributions

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Indian buffet process

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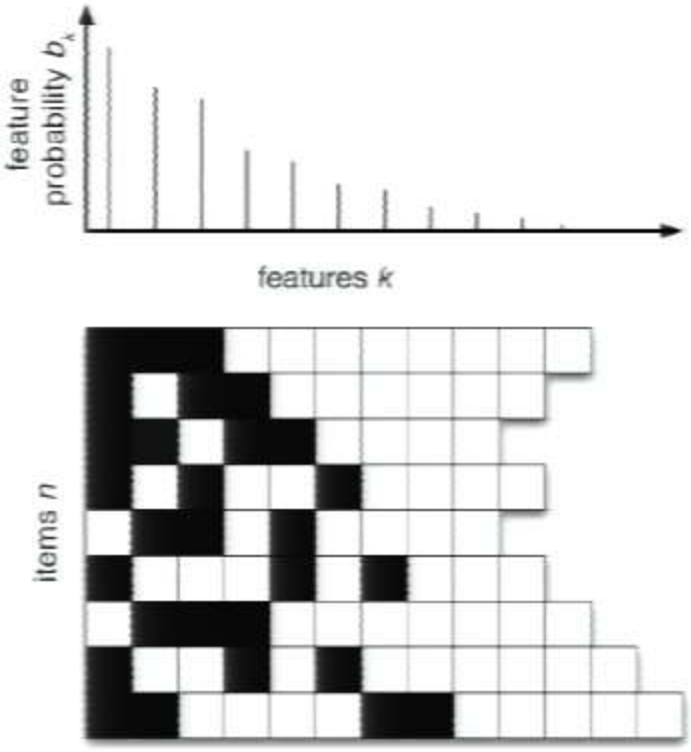
- Distribution over binary matrices with infinitely many columns and exchangeable rows.
- Idea: Rows = data points; columns = features.
- Feature probabilities distributed according to a *beta process*.
- Each row distributed according to a *Bernoulli process*.
- Number of ones per row marginally **Poisson**-distributed.



Restricting the number of features per data point

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- Poisson number of features per data point may not be appropriate:
  - We may know the number of features per data point – e.g. speakers in a dialogue, members of a team.
  - We may believe the number of features exhibits power-law behaviour.
- Poisson behaviour results from the beta process and the Bernoulli process being *completely random measures*.
- We can remove this behaviour by directly restricting the support of the Bernoulli process, e.g.
  - Bernoulli process restricted to have K non-zero entries $\rightarrow$ binary matrix with K non-zero entries/row.
  - Bernoulli process restricted to have a chosen distribution f over the number of non-zero entries $\rightarrow$ binary matrix with $n_i \sim f$ entries/row.
- Resulting matrix is still exchangeable.

More flexible distributions, more flexible models

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- More flexible distributions over matrices:

- When the number of features is known, IBP restricted to have K features recovers better representations than restricted IBP.
- In a classification task on text data, IBP restricted to have heavier-tailed marginals performs better than unrestricted IBP.
- For experimental details and more information, visit poster **Fri38**.