Entropy maximization of the nutrient-limited cloud join

Let $g_i(v)$ be the MaxEnt distribution constrained by the ith nutrient-limited network. We will define the cloud mixture density distribution as:

$$p(v) = \sum_i^n \alpha_i g_i(v) \tag{1}$$

where n is the number of nutrient-limited networks and α_i is the weight associated with network i. This distribution aim to containt all the information provided by the network cloud. The α weights must satisfy the normalization constraint $\sum_i^n \alpha_i = 1$ and we will select them so the entropy of $p(v)$ is maximized. Note that we have two levels of entropy maximization, one at network level and other at cloud level.

We can write the entropy as:

$$\begin{aligned} S_p &= -\int_{\{v\}} p(v) \log p(v) dv \\ S_p &= -\int_{\{v\}} \sum_i^n \alpha_i g_i(v) \log \sum_i^n \alpha_i g_i(v) dv \end{aligned} \tag{2}$$

0.1 Lower bound

0.2 Upper bound

There are not a close form for S_p and approximations are need it to represented. It can be prove that an upper bound of S_p is [huberEntropyApproximationGaussian2008]:

$$S_p^U = -\sum_i^n \alpha_i \log \alpha_i + \sum_i^n \alpha_i S_i \tag{3}$$

We can easily find the mixture α^* which maximized S_p^U:

$$\frac{\partial S_p^U}{\partial \alpha_k} = -\log \alpha_k^* - 1 + S_k = 0 \tag{4}$$

$$\alpha_k^* \sim \exp(S_k) \tag{5}$$