Mixed Algorithms

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Proposed models

Mixing the algorithms

Criteria

1. The total potential energy, which both algorithms aim to minimize:

$$\sum_{i \neq j} \frac{q(\mathbf{x}_i)q(\mathbf{x}_j)}{d(\mathbf{x}_i, \mathbf{x}_j)}$$

2. One-at-a-Time Algorithm criterion tries to minimize:

$$\left\{ \sum_{i \neq j} \left(\frac{q(\mathbf{x}_i)q(\mathbf{x}_j)}{d(\mathbf{x}_i, \mathbf{x}_j)} \right)^k \right\}^{1/k}$$

3. Fast Algorithm Algorithm tries to minimize:

$$\max_{i \neq j} \frac{q(\mathbf{x}_i)q(\mathbf{x}_j)}{d(\mathbf{x}_i, \mathbf{x}_j)}$$

or, taking into account the simulated annealing at each step k, tries to minimize

$$\max_{i \neq j} \frac{q^{\gamma_s}(\mathbf{x}_i)q^{\gamma_s}(\mathbf{x})}{d(\mathbf{x}_i, \mathbf{x})}$$

when producing the $(s+1)$th design.

Revisiting the mixed algorithms idea

- Mixing the two algorithms:
  - use the criterion of the one-at-a-time algorithm
  - with the method of the fast algorithm (re: annealing)
- One-at-a-Time Algorithm: greedily choose the next $(n+1)$th design point:

$$\mathbf{x}_{n+1} = \arg\min_{\mathbf{C}} \sum_{i=1}^{n} \left(\frac{q(\mathbf{x}_i) q(\mathbf{x})}{d(\mathbf{x}_i, \mathbf{x})} \right)^k$$

- Fast Algorithm: At design $s \in 2 : (S-1)$, choose the location of $\mathbf{x}_j$ in the $(s+1)$th stage's design:

$$\mathbf{x}_j^{s+1} = \arg\min_{\mathbf{x} \in \mathbf{C}_{s+1}^{j}} \max_{i=1:(j-1)} \frac{q^{\gamma_s}(\mathbf{x}_i) q^{\gamma_s}(\mathbf{x})}{d^{(}\mathbf{x}_i, \mathbf{x})}$$

one-at-a-time method with fast criterion (mix1)

This is just fast algorithm with k = 1, but using max instead of sum over the design points:

$$\mathbf{x}_{n+1} = \arg\min_{\mathbf{C}} \max_{i=1:n} \frac{q(\mathbf{x}_i)q(\mathbf{x})}{d(\mathbf{x}_i, \mathbf{x})}$$

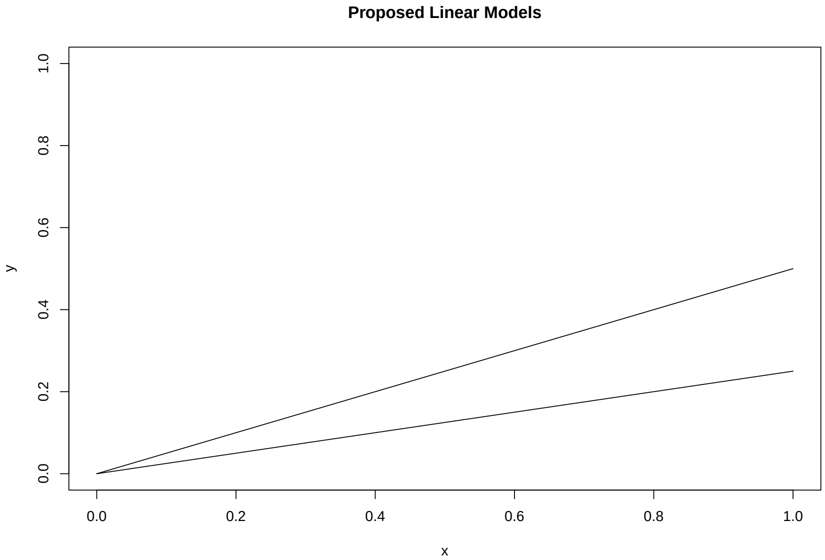
fast method with one-at-a-time criterion (mix2)

Have points converge to those which minimize the one-at-a-time algorithm's criterion (summation raised to k = 4 power) over S stages. At design for stage $s \in 2:(S-1)$, choose the location of $\mathbf{x}_j$ in the $(s+1)$th design:

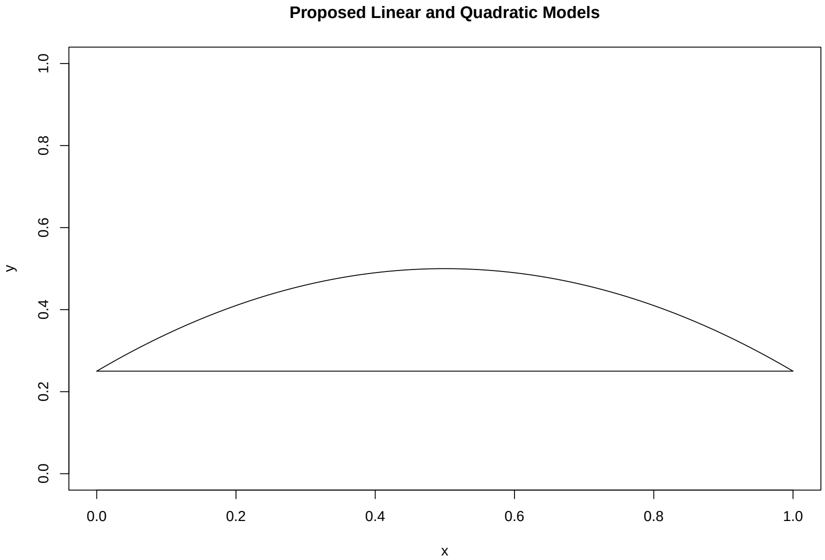
$$\mathbf{x}_j^{s+1} = \underset{\mathbf{x} \in \mathbf{C}_{s+1}^{j}}{\arg\min} \sum_{i=1}^{j-1} \left(\frac{q^{\gamma_s}(\mathbf{x}_i) q^{\gamma_s}(\mathbf{x})}{d(\mathbf{x}_i, \mathbf{x})} \right)^k$$

Proposed models

I. Proposed Models



VI. Proposed Models



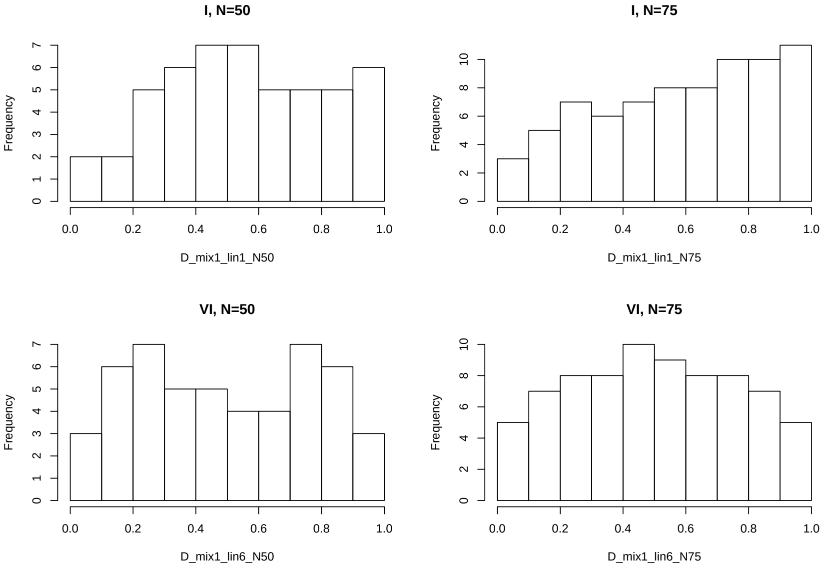
Mixing the algorithms

one-at-a-time method with fast criterion (mix1)

This is just fast algorithm with k = 1, but using max instead of sum over the design points:

$$\mathbf{x}_{n+1} = \arg\min_{\mathbf{C}} \max_{i=1:n} \frac{q(\mathbf{x}_i)q(\mathbf{x})}{d(\mathbf{x}_i, \mathbf{x})}$$

Design Points

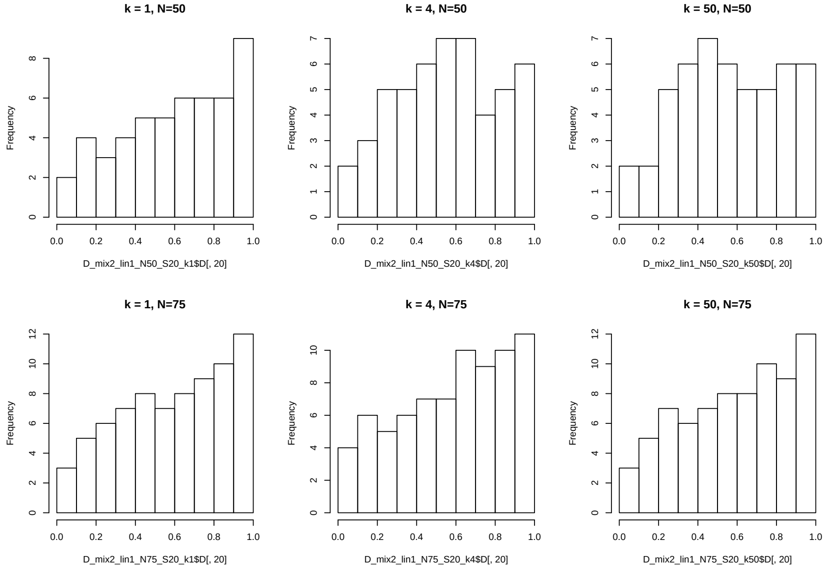


fast method with one-at-a-time criterion (mix2)

Have points converge to those which minimize the one-at-a-time algorithm's criterion (summation raised to k = 4 power) over S stages. At design for stage $s \in 2 : (S-1)$, choose the location of $\mathbf{x}_j$ in the $(s+1)$th design:

$$\mathbf{x}_j^{s+1} = \arg\min_{\mathbf{x} \in \mathbf{C}_{s+1}^j} \sum_{i=1}^{j-1} \left(\frac{q^{\gamma_s}(\mathbf{x}_i) q^{\gamma_s}(\mathbf{x})}{d(\mathbf{x}_i, \mathbf{x})} \right)^k$$

Design Points, I



Design Points, VI