1. Estimation using the Viterbi algorithm

- Basic idea: one-dimensional chaotic sequences can be seen as first order Markov chains which assume one of $N$ possible states at each time
- Domain $U$ is partitioned in $N_S$ intervals: $U_1, \ldots, U_{N_S}$
- State $q(n) = j$ if $s(n) \in U_j$
- Dedieu and Kisel (1999) uniform partition
- Problem: low estimation gain when using maps with nonuniform invariant density

2. Transition probability matrix – $f_T(\cdot)$

3. Transition probability matrix – $f_Q(\cdot)$

4. Viterbi algorithm – main steps

5. Numerical analysis

- Quantization error introduced
- It can be shown that

$$E[\text{SNR}_{\text{OUT}}] \leq 20 \log N_S$$

- Estimation gain is almost independent of the sequence length
- To achieve positive gain is necessary that

$$N_S \geq 10^{2\frac{\text{SNR}}{10}}$$

6. Estimation gain for map $f_T(\cdot)$ orbits

7. Modified partition improvement

8. MLE x Viterbi

9. Conclusions

- The Viterbi algorithm proposed by Dedieu and Kisel (1999) has acceptable performance only for maps with uniform invariant density
- The proposed generalization works for a broader class of maps
- Compared to MLE, the Viterbi algorithm achieves larger estimation gain over a considerable SNR range

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