Adaptive Content Search Through Comparisons

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We study the problem of navigating through a database of similar objects using comparisons. This problem is known to be strongly related to the small-world network design problem. However, contrary to prior work, which focuses on cases where objects in the database are equally popular, we consider here the case where the demand for objects may be heterogeneous.
We show that, under heterogeneous demand, the small-world network design problem is NP-hard. Given the above negative result, we propose a novel mechanism for small-world design and provide an upper bound on its performance under heterogeneous demand. The above mechanism has a natural equivalent in the context of content search through comparisons, and we establish both an upper bound and a lower bound for the performance of this mechanism. These bounds are intuitively appealing, as they depend on the entropy of the demand as well as its doubling constant, a quantity capturing the topology of the set of target objects. Finally, based on these results, we propose an adaptive learning algorithm for content search that meets the performance guarantees achieved by the above mechanisms.

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