1164-05-175 **Zachary M Boyd***, zachboyd@email.unc.edu, and **Nicolas Fraiman**, **Jeremy L Marzuola**, **Peter J Mucha**, **Braxton Osting** and **Jonathan Weare**. *A metric on directed graphs and Markov chains based on hitting probabilities.*

The shortest-path, commute time, and diffusion distances on undirected graphs have been widely used. Increasingly, there is interest in using asymmetric structure of data derived from Markov chains and directed graphs, but few metrics are adapted to this task. We introduce a metric on the state space of any ergodic, finite-state, time-homogeneous Markov chain and, in particular, on Markov chains derived from a directed graph. Our construction is based on hitting probabilities, with nearness in the metric space related to the transfer of random walkers from one node to another at stationarity. Notably, our metric is insensitive to shortest and average walk distances, thus giving new information compared to existing metrics. We use possible degeneracies in the metric to develop an interesting structural theory of directed graphs and explore a related quotienting procedure. Our metric can be computed in $O(n^3)$, and in examples we scale up to $n = 10,000$ nodes and $\approx 38M$ edges on a desktop computer. In examples, we explore the metric, compare it to alternatives, and demonstrate its utility for weak recovery of community structure in dense graphs, visualization, structure recovering, dynamics exploration, and multiscale cluster detection. (Received January 18, 2021)