

Motif-based tests for bipartite networks

Abstract : Bipartite networks are a natural representation of the interactions between entities from two different types. The organization (or topology) of such networks gives insight to understand the systems they describe as a whole. Here, we rely on motifs which provide a meso-scale description of the topology. Moreover, we consider the bipartite expected degree distribution (B-EDD) model which accounts for both the density of the network and possible imbalances between the degrees of the nodes. Under the B-EDD model, we prove the asymptotic normality of the count of any given motif, considering sparsity conditions. We also provide closed-form expressions for the mean and the variance of this count. This allows to avoid computationally prohibitive resampling procedures. Based on these results, we define a goodness-of-fit test for the B-EDD model and propose a family of tests for network comparisons. We assess the asymptotic normality of the test statistics and the power of the proposed tests on synthetic experiments and illustrate their use on ecological data sets.