On Maximum Matching Width

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Abstract:

Tree-width and branch-width are connectivity parameters of importance in algorithm design. In 2012, Vatshelle introduced a graph parameter, maximum matching width, defined by a branch-decomposition over the vertex set of a graph G, using the symmetric submodular function obtained by taking the size of a maximum matching of the bipartite graph crossing the cut.

Tree-width and branch-width have alternative definitions through intersections of subtrees of a tree, where tree-width focuses on vertices and branch-width focuses on edges. We show that maximum matching width combines both aspects, focusing on vertices and on edges. Based on this we prove that given a graph G and a branch-decomposition of maximum matching width k, we can solve Dominating Set Problem in time $O^*(8^k)$. This runtime beats $O^*(3^{tw(G)})$-time algorithm for tree-width whenever $tw(G) > 1.893k$.