ROLE EXTRACTION BY MATRIX EQUATIONS

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The nodes in a network may be grouped into equivalence classes according to the role they play. The grouping is based upon their connections with nodes in either the same role or different roles [1]. Browet and Van Dooren introduced a node similarity matrix for solving this role extraction problem in directed graphs [2]. The sought matrix is the solution of the matrix equation

$$X - \beta^2(AXA^T + A^TXA) = AA^T + A^TA,$$

where A is the adjacency matrix of the network. In a later step, the similarity matrix allows grouping together nodes assigned to the same role. However, this procedure tacitly relies on the assumption that connections inside and between the different roles are fairly uniform, a condition rarely fulfilled in real-world networks. In this talk, I propose a variant of the Browet-Van Dooren method that operates on a suitable diagonal scaling of the adjacency matrix to compensate for the inhomogeneity of node connections.

References

[1] J. Reichardt and D. White, *Role models for complex networks*, Eur. Phys. J. B 60 (2007), pp. 217–224.

[2] A. Browet and P. Van Dooren, *Low-rank similarity measure for role model extraction*, in Proceedings of the 21st MTNS Symposium, 2014, pp. 1412–1418.