

# Highlights

,

- 
- 
-

★

$a,*,1$  ,  $b,2$

$a$  , , , , ,  
 $b$  , , , , ,

---

ARTICLE INFO

*Keywords:*

---

ABSTRACT

Here goes the abstract



---

1.

---

\*

\*Corresponding author

 ( ) ; ( )  
 ( ) ; ( )

ORCID(s):  
1

Figure 1:

Table 1

---

---

---

## 2.

### CRediT authorship contribution statement

: : : .

### References

- Blondel, V.D., Guillaume, J.L., Lambiotte, R., Lefebvre, E., 2008. Fast unfolding of communities in large networks. *J. Stat. Mech.-Theory Exp.* 2008, P10008.
- Chen, Q., Wu, T.T., Fang, M., 2013. Detecting local community structure in complex networks based on local degree central nodes. *Physica A.* 392, 529–537.
- Clauset, A., Newman, M.E.J., Moore, C., 2004. Finding community structure in very large networks. *Phys. Rev. E.* 70, 066111.
- Danon, L., Diaz-Guilera, A., Duch, J., Arenas, A., 2005. Comparing community structure identification. *J. Stat. Mech.-Theory Exp.* , P09008.
- Fabio, D.R., Fabio, D., Carlo, P., 2013. Profiling core-periphery network structure by random walkers. *Sci. Rep.* 3, 1467.
- Fabricio, B., Liang, Z., 2013. Fuzzy community structure detection by particle competition and cooperation. *Soft Comput.* 17, 659–673.
- Fortunato, S., 2010. Community detection in graphs. *Phys. Rep.-Rev. Sec. Phys. Lett.* 486, 75–174.
- Fortunato, S., Barthelemy, M., 2007. Resolution limit in community detection. *Proc. Natl. Acad. Sci. U. S. A.* 104, 36–41.
- Gregory, S., 2011. Fuzzy overlapping communities in networks. *J. Stat. Mech.-Theory Exp.* , P02017.
- Havens, T.C., Bezdek, J.C., Leckie, C., Ramamohanarao, K., Palaniswami, M., 2013. A soft modularity function for detecting fuzzy communities in social networks. *IEEE Trans. Fuzzy Syst.* 21, 1170–1175.
- Hullermeier, E., Rifqi, M., 2009. A fuzzy variant of the rand index for comparing clustering structures, in: in *Proc. IFSA/EUSFLAT Conf.*, pp. 1294–1298.
- Lancichinetti, A., Fortunato, S., 2009. Benchmarks for testing community detection algorithms on directed and weighted graphs with overlapping communities. *Phys. Rev. E.* 80, 016118.
- Lancichinetti, A., Fortunato, S., Radicchi, F., 2008. Benchmark graphs for testing community detection algorithms. *Phys. Rev. E.* 78, 046110.
- Li, J., Wang, X., Eustace, J., 2013. Detecting overlapping communities by seed community in weighted complex networks. *Physica A.* 392, 6125–6134.
- Liu, J., 2010. Fuzzy modularity and fuzzy community structure in networks. *Eur. Phys. J. B.* 77, 547–557.
- Liu, W., Pellegrini, M., Wang, X., 2014. Detecting communities based on network topology. *Sci. Rep.* 4, 5739.
- Lou, H., Li, S., Zhao, Y., 2013. Detecting community structure using label propagation with weighted coherent neighborhood propinquity. *Physica A.* 392, 3095–3105.
- Nepusz, T., Petróczy, A., Négyessy, L., Bazsó, F., 2008. Fuzzy communities and the concept of bridgeness in complex networks. *Phys. Rev. E.* 77, 016107.
- Newman, M.E.J., 2013. Network data. <http://www-personal.umich.edu/~mejn/netdata/>.
- Newman, M.E.J., Girvan, M., 2004. Finding and evaluating community structure in networks. *Phys. Rev. E.* 69, 026113.
- Psorakis, I., Roberts, S., Ebden, M., Sheldon, B., 2011. Overlapping community detection using bayesian non-negative matrix factorization. *Phys. Rev. E.* 83, 066114.
- Raghavan, U., Albert, R., Kumara, S., 2007. Near linear time algorithm to detect community structures in large-scale networks. *Phys. Rev. E.* 76, 036106.
- Sobolevsky, S., Campari, R., 2014. General optimization technique for high-quality community detection in complex networks. *Phys. Rev. E.* 90, 012811.
- Sun, P., Gao, L., Han, S., 2011. Identification of overlapping and non-overlapping community structure by fuzzy clustering in complex networks. *Inf. Sci.* 181, 1060–1071.
- Vehlow, C., Reinhardt, T., Weiskopf, D., 2013. Visualizing fuzzy overlapping communities in networks. *IEEE Trans. Vis. Comput. Graph.* 19, 2486–2495.
- Šubelj, L., Bajec, M., 2011a. Robust network community detection using balanced propagation. *Eur. Phys. J. B.* 81, 353–362.
- Šubelj, L., Bajec, M., 2011b. Unfolding communities in large complex networks: Combining defensive and offensive label propagation for core extraction. *Phys. Rev. E.* 83, 036103.
- Šubelj, L., Bajec, M., 2012. Ubiquitousness of link-density and link-pattern communities in real-world networks. *Eur. Phys. J. B.* 85, 1–11.
- Wang, W., Liu, D., Liu, X., Pan, L., 2013. Fuzzy overlapping community detection based on local random walk and multi-dimensional scaling. *Physica A.* 392, 6578–6586.
- Wang, X., Li, J., 2013. Detecting communities by the core-vertex and intimate degree in complex networks. *Physica A.* 392, 2555–2563.
- Zhang, S., Wang, R., Zhang, X., 2007. Identification of overlapping community structure in complex networks using fuzzy c-means clustering. *Physica A.* 374, 483–490.
- Zhang, Y., Yeung, D., 2012. Overlapping community detection via bounded nonnegative matrix tri-factorization, in: *In Proc. ACM SIGKDD Conf.*, pp. 606–614.