

The double link between network science and artificial intelligence: a key to scalable learning solutions?

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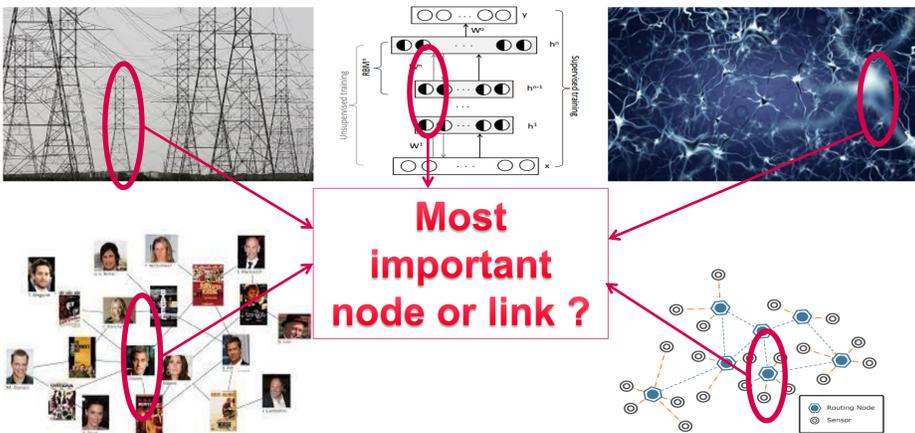
interoperability of heterogeneous IOT platforms

The double link between network science and artificial intelligence. A key to scalable learning solutions?

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Artificial Intelligence → Network Science

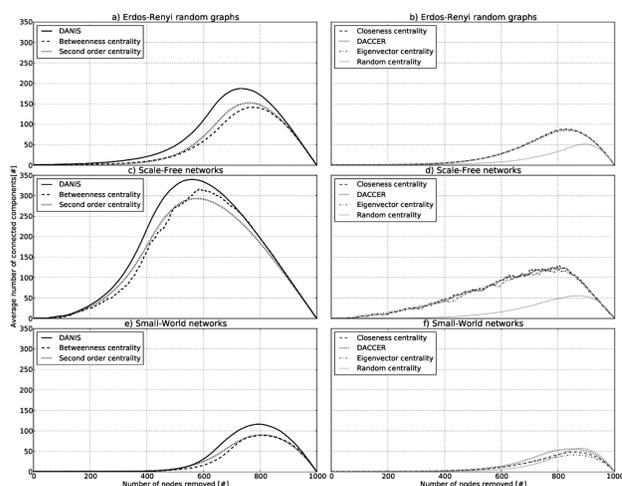
Problems:



Solution: DANIS [1]

- A novel decentralized algorithm to assess node's centrality in networks.
- Inspired by the collaborative behavior of decentralized and self-organized swarms.
- Its parallel time complexity is on the polylogarithmic scale with respect to the number of nodes in the network.

Results:

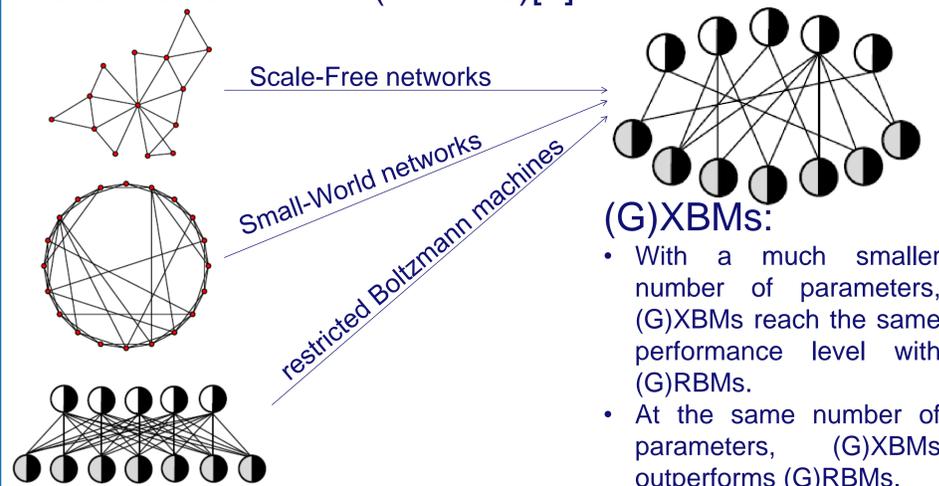


Network Science → Artificial Intelligence

Problems:

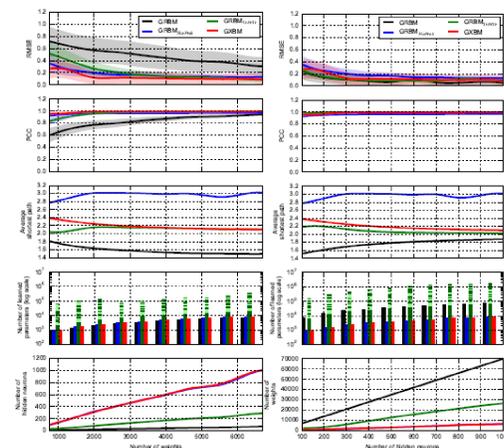
- High dimensional data (e.g. images have millions of pixels).
- Too many parameters in machine learning models (e.g. deep artificial neural networks have at least millions of parameters).
- The above involve large, or even impracticable, computational time.

Solution: complex Boltzmann Machines (XBMs) and Gaussian XBMs (GXBM)s[2]



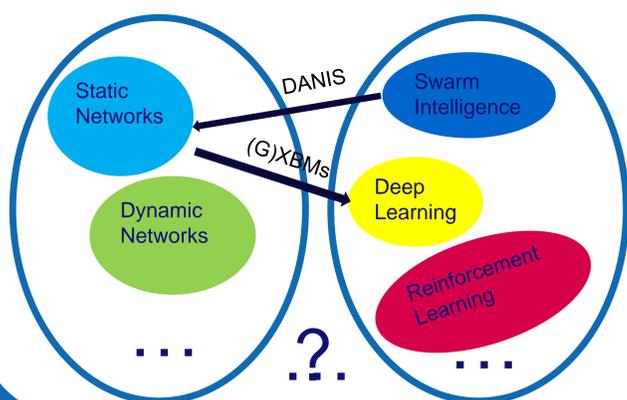
- (G)XBMs:**
- With a much smaller number of parameters, (G)XBMs reach the same performance level with (G)RBMs.
 - At the same number of parameters, (G)XBMs outperforms (G)RBMs.

Results:



The double link [3]

Network Science Artificial Intelligence



Conclusion

- **DANIS outperforms all the others centralized or decentralized algorithms on Erdős–Rényi Random Graphs, Scale-Free networks, Small-World networks.**
- **(G)XBMs outperform fully connected (G)RBMs and sparse (G)RBMs derived models on 11 benchmark databases (e.g. MNIST digits, CalTech 101 Silhouettes, UCI evaluation suite).**
- **The double link between network science and artificial intelligence may be a good starting point to devise scalable learning solutions.**

References

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- [2] D.C. Mocanu, E. Mocanu, P. Nguyen, M. Gibescu, A. Liotta: "A topological insight into restricted Boltzmann machines", Machine Learning Journal, ECML PKDD 2016 special issue.
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