

## FID3018 Advanced Course in Data Mining and Analytics

### 2. Task 2

All research papers extend common tasks, such as clustering and Graph/Representation Representation Learning (GRL/NRL), in order that both lower-order and higher-order connections may be taken into account. Despite being different, they all share the key adjective *higher-order*. In general, a higher-order network is a network where the nodes are preserved, but at the same time, the edges are re-wired in order that specific properties may be emphasized. While [1] and [2] are research papers on graphs in the stricter sense of the noun, Chodrow and Mellor introduce annotated hypergraphs in order that directed graphs may be extended to polyadic connections. However, as noted by [3], there is a fine line between higher-order graphs and hypergraphs, since subgraphs can be thought of as hyperedges between 2+ nodes.

### References

- [1] A. R. Benson, D. F. Gleich, and J. Leskovec. **Higher-Order Organization of Complex Networks**. *Science*, 353, 2016.
- [2] R. A. Rossi, N. K. Ahmed, E. Koh, S. Kim, A. Rao, and Y. Abbasi-Yadkori. **A Structural Graph Representation Learning Framework**. In *Proceedings of the 13th International Conference on Web Search and Data Mining*, 2020.
- [3] P. Chodrow and A. Mellor. **Annotated Hypergraphs: Models and Applications**. *Applied Network Science*, 5, 2020.