Learning interaction matrices through samples of Ising Model.

Abstract

Ising models are analogous to a lot of real world scenarios where there are a large number of correlated binary variables. In such cases, understanding how these observations influence each other can help us better understand such scenarios. Originally used to analyse spin states, it has found applications in many other fields like analysing economic volatilities, voter dynamics, relations between mental health diseases etc. Our goal is to analyse and develop algorithms that reduce the complexity of the sample size required to predict the interaction matrices accurately to a certain degree.

Work done

So far we have analysed 2 research papers(https://arxiv.org/abs/1410.7659 and https://arxiv.org/abs/1810.11905) that describe algorithms to predict the interaction matrices and implemented them in Python to check for their practical efficacy(primarily with d degreed graphs)(link to code). In relation to the first paper, we have assessed various approaches to reduce the complexity while maintaining accuracy. In relation to the second paper, we have derived a relation between the sample complexity and the divergence of the actual with the predicted interaction matrices. Our goal going forward is to predict structures that produce similar distributions efficiently as opposed to the paper's focus of predicting structures themselves.

All progress has been reviewed and approved by the project mentor, Dr. Sutanu Gayen.

Keywords

Ising Models, Graph learning, algorithms