Xidian 2023 English Summer Course – Prof. David Suter (d.suter@ecu.edu.au)

Title: Discrete Models: from statistical physics to social choice and community detection. A machine learning perspective.

Course web page (lecture slides)
https://ai-ecu.github.io/Xidian/2023/

Proposed schedule and content (NOTE – this will only be approximate at best!)

Lecture 1 & 2. Introduction to the main players: Boolean Cube, Graphs, Hypergraphs Simplicial Complexes and examples.

Lecture 3 & 4. Graph Classes and Abstract Graph problems (minimum vertex cover, maximum independent set, graph matching, travelling salesman etc.)

Lecture 5 & 6. Threshold graphs, split graphs, chordal graphs. Hypergraph analogues.

Lecture 7 & 8. Signal processing and machine learning versions of graph and hypergraph problems: planted clique, planted densely connected subset, etc.

Lecture 9 & 10. Maximum Consensus robust fitting as a hypergraph/simplicial complex problem.

Lecture 11 & 12. Boolean analysis – influence, noise sensitivity, applications to game theory, social choice etc.

Lecture 13 & 14. Graph and Hypergraph models of community detection.

Lecture 15 & 16. Introduction to quantum computing (of course, if time slips, this topic is likely to get a very brief mention at best!). Course Recap.