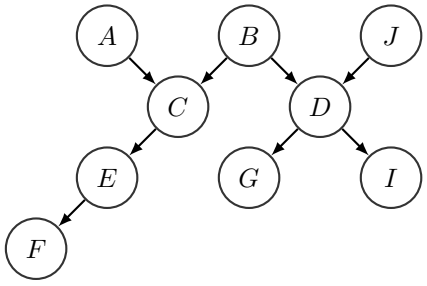
DD2434/FDD3434 Machine Learning, Advanced Course
Module 2 - additional exercise on dependencies

November 2024

Method-2 on v-structure

In Method-2, dependencies between nodes are determined based on the ancestral graph and the"moralize" step, which plays a critical role when dealing with v-structure. Let's say we are interested in such a structure: the dependency relation between A and B when they have a common child C.
1. If any descendant of C is observed, Method-2 will draw an ancestral graph, which includes the observed node and all of its ancestors, up to A and B. This setup will lead to a line between A and B during the "moralize" step, as they share a common child C in the ancestral graph. Consequently, we cannot say A and B are conditionally independent.
2. If none of the descendants of C is observed, the ancestral graph in the first step won't include any common child of A and B. As a result, A and B will remain unconnected during the"moralize" step, indicating that they are conditionally independent in this scenario.

For an example, consider the DGM below.



Q1: Are A and B conditionally independent, given F?
Q2: Are A and B conditionally independent, given I?

S1: They are not required to be conditionally independent, using method 2 as below:

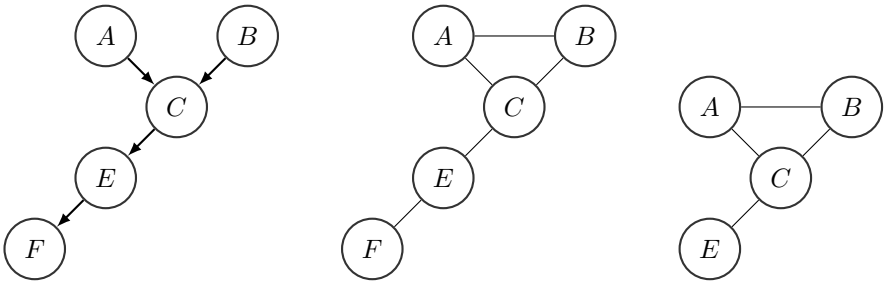


Figure 1: From left to right: 1. Draw ancestral graph 2. Moralize & Disorient 3. Delete givens

S2: They are conditionally independent, using method 2 as below:

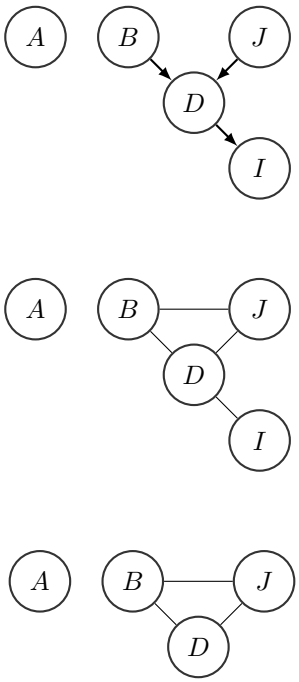


Figure 2: From top to bottom: 1. Draw ancestral graph 2. Moralize & Disorient 3. Delete givens