

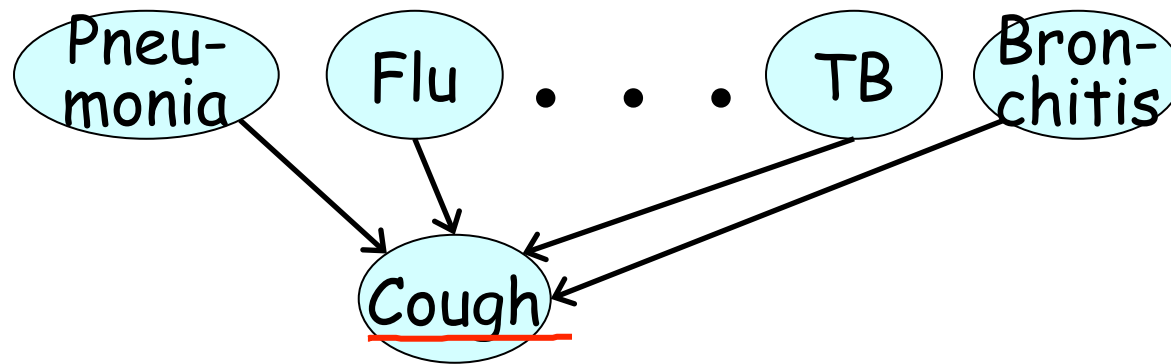
Probabilistic
Graphical
Models



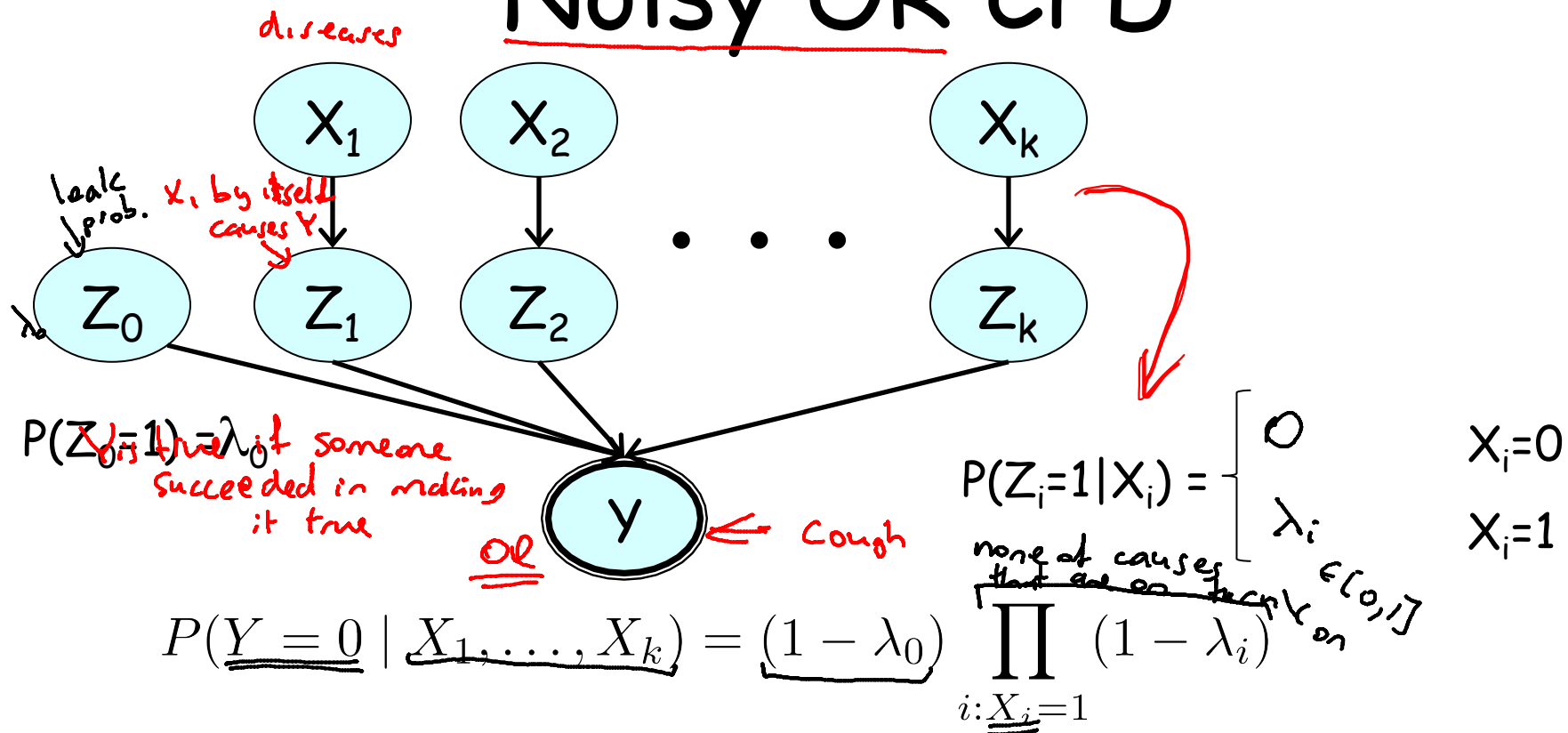
Representation

Local Structure

Independence
of Causal
Influence



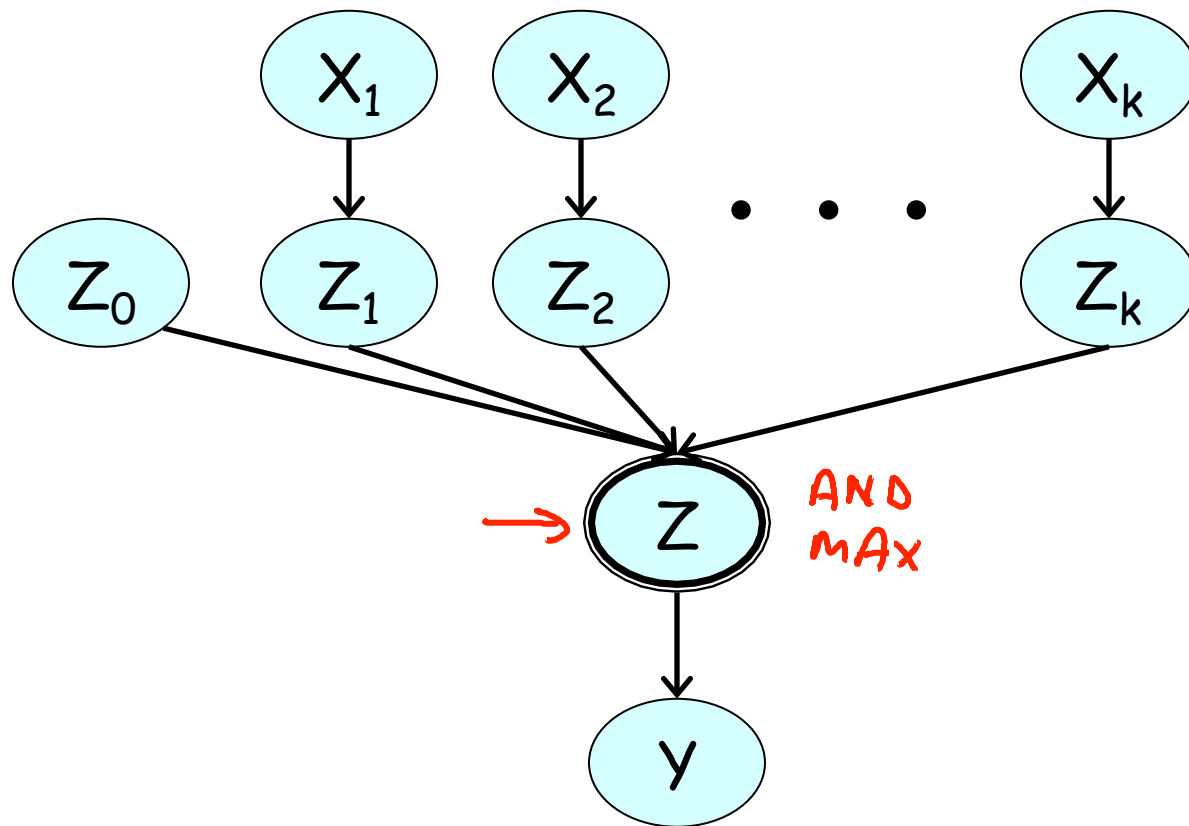
Noisy OR CPD



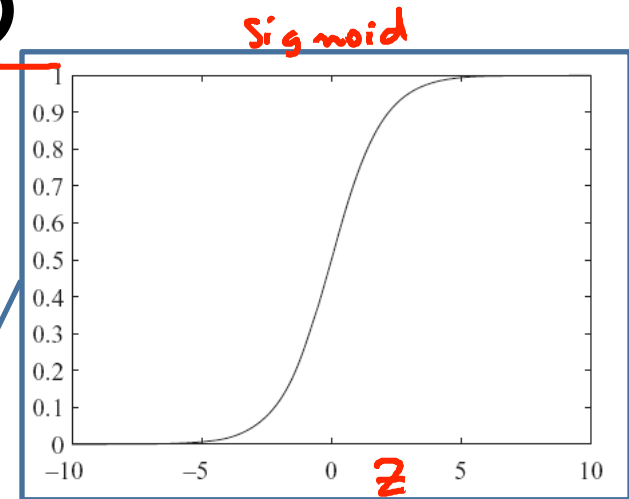
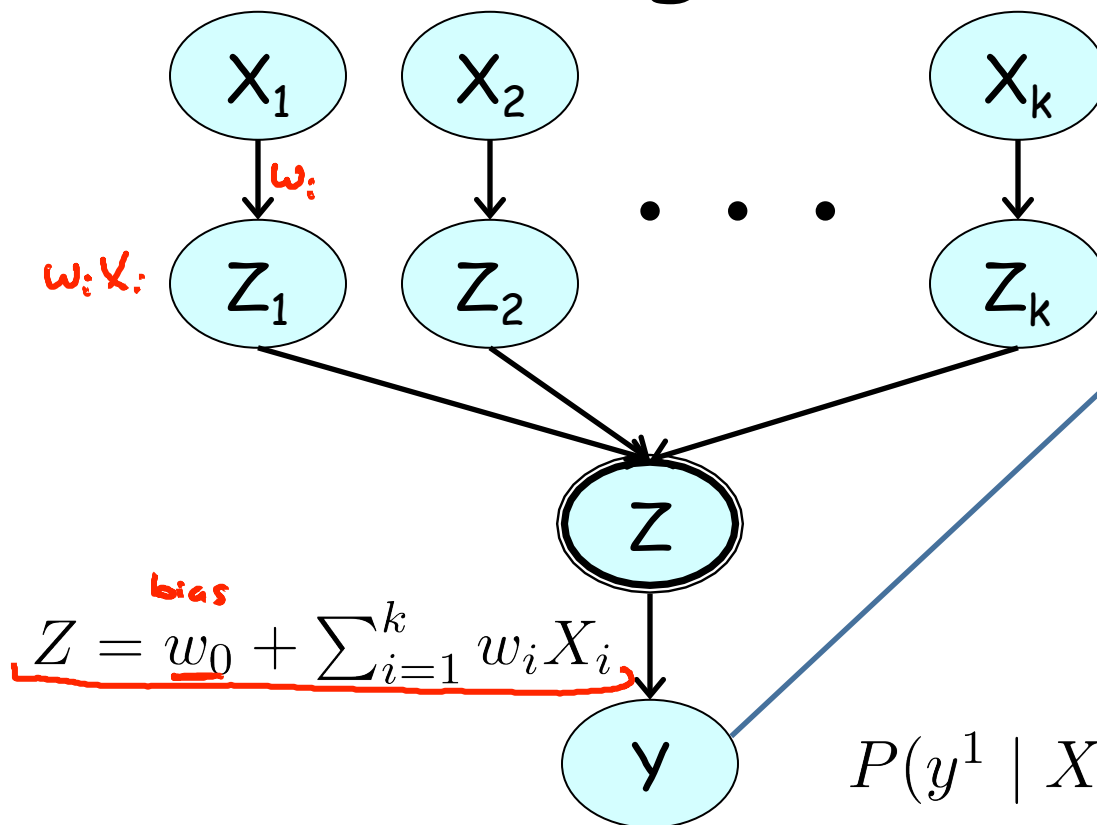
$$P(\underline{Y=0} \mid X_1, \dots, X_k) = (1 - \lambda_0) \prod_{i: \underline{X_i=1}} (1 - \lambda_i)$$

$$P(Y = 1 \mid X_1, \dots, X_k) = 1 - P(Y = \underline{0} \mid X_1, \dots, X_k)$$

Independence of Causal Influence



Sigmoid CPD

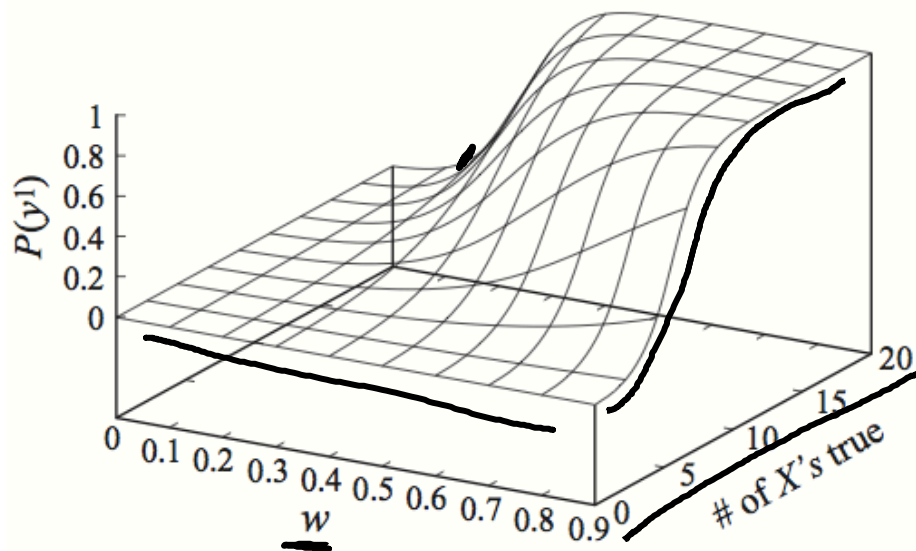


$$\text{sigmoid}(\underline{z}) = \frac{e^z}{1 + e^z} \quad \text{in } [0, 1]$$

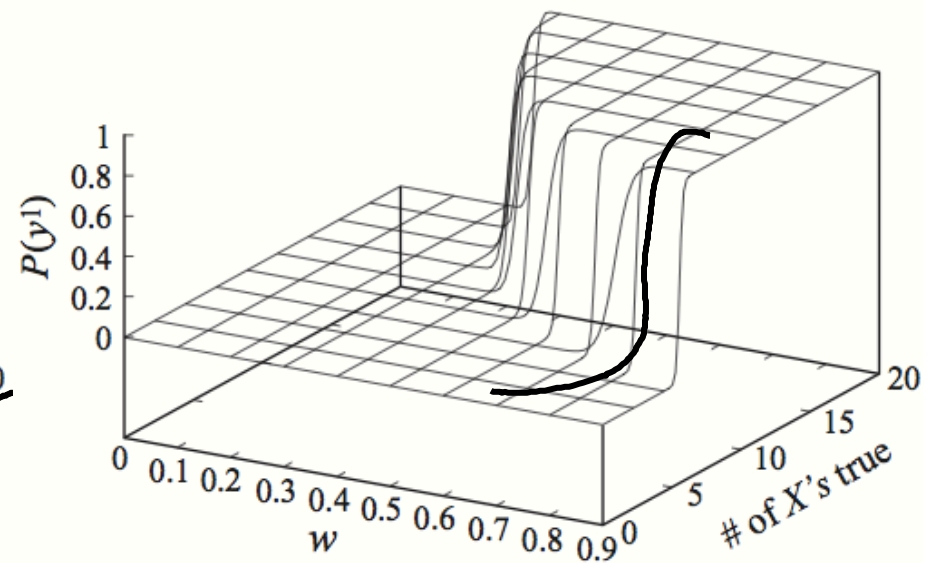
$$P(y^1 \mid X_1, \dots, X_k) = \text{sigmoid}(Z)$$

sigmoid = $\frac{e^b}{1 + e^b} \in [0, 1]$

Behavior of Sigmoid CPD



$w_0 = -5$



multiply w and w_0 by 10

CPCS

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G. Provan
B. Middleton
M. Henrion
UAI 1994

joint dist $\approx 4^{500}$
factorized ≈ 134 million
noisy max CPD ≈ 2000

