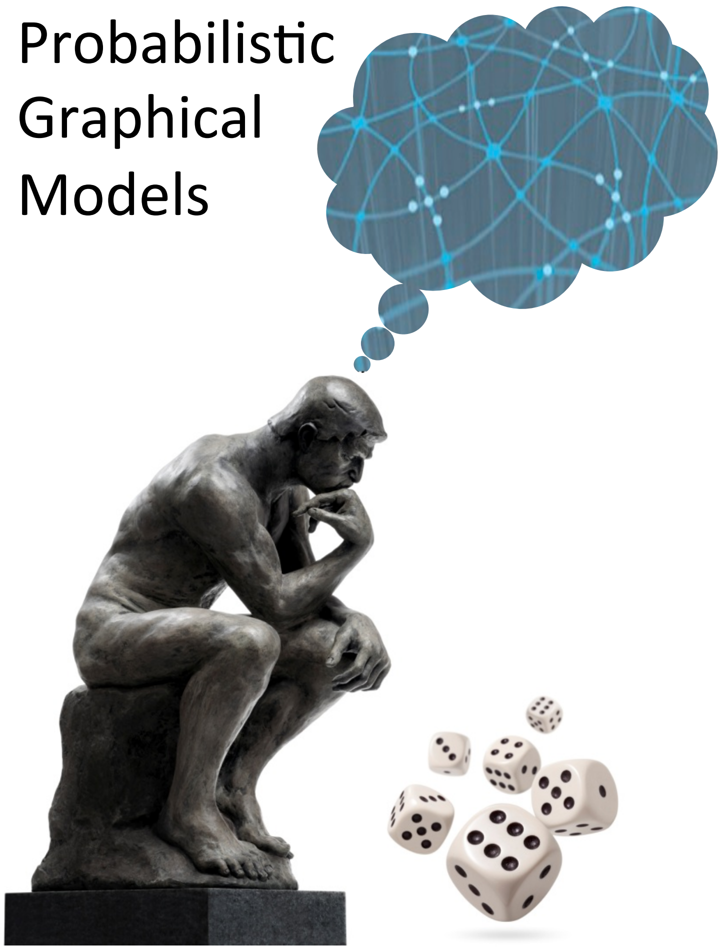
Probabilistic
Graphical
Models

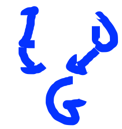


Representation

Local Structure

Overview

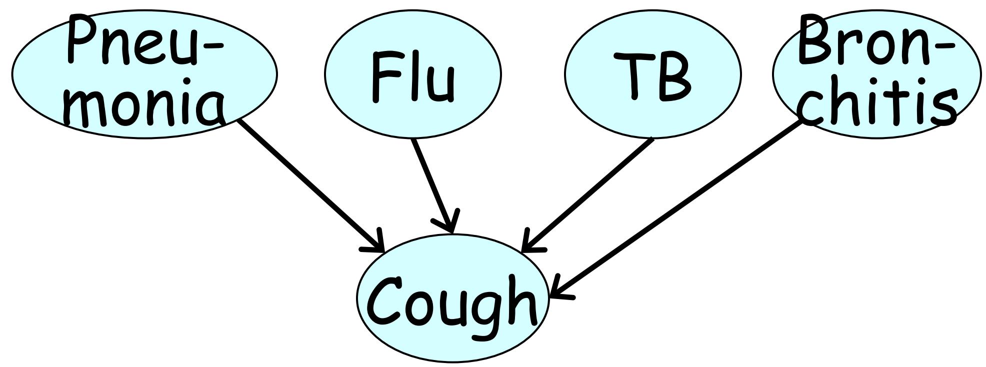
Tabular Representations



	g^1	g^2	g^3
i^0,d^0	0.3	0.4	0.3
i^0,d^1	0.05	0.25	0.7
i^1,d^0	0.9	0.08	0.02
i^1,d^1	0.5	0.3	0.2

k parents

$O(2^k)$ entries



General CPD

- CPD $P(X \mid Y_1, \ldots, Y_k)$ specifies distribution over X for each assignment $y_1, \ldots, y_k$
- Can use any function to specify a factor $\phi(X, Y_1, \ldots, Y_k)$ such that

$$\sum_x \phi(x, y_1, \ldots, y_k) = 1 \text{ for all } y_1, \ldots, y_k$$

Many Models

- Deterministic CPDs
- Tree-structured CPDs
- Logistic CPDs & generalizations
- Noisy OR / AND
- Linear Gaussians & generalizations

Context-Specific Independence

$$P \models (X \perp_c Y \mid Z, c)$$

assignment to C

$$P(X, Y \mid Z, c) = P(X \mid Z, c) P(y \mid Z, c)$$

$$P(X \mid Y, Z, c) = P(X \mid Z, c)$$

$$P(Y \mid X, Z, c) = P(Y \mid Z, c)$$