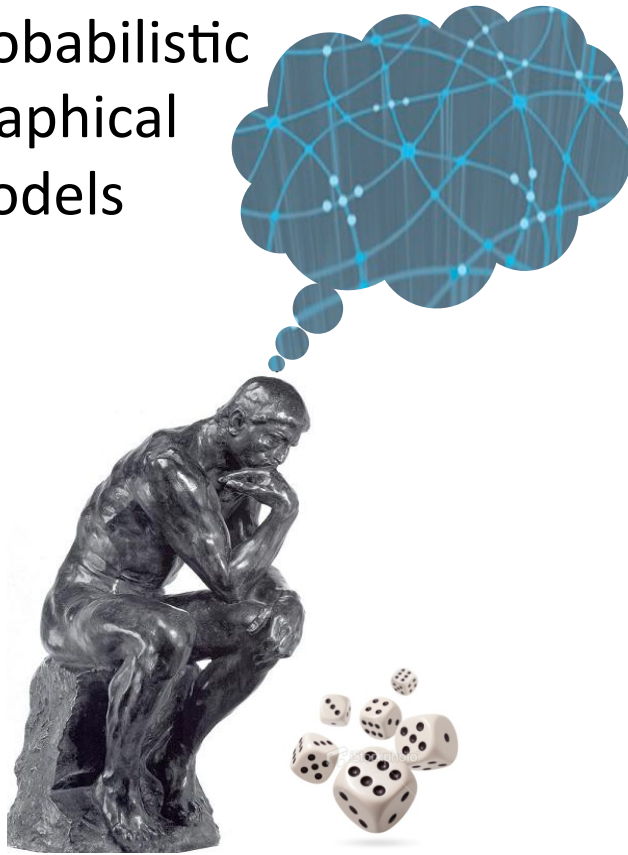Probabilistic Graphical Models

Representation

Wrapup

Knowledge Engineering

Important Distinctions

- Template based versus specific
- Directed versus undirected
- Generative versus discriminative

- Hybrids are also common

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Important Distinctions

Template-based

image segmentation

Specific

medical diagnosis

fault diagnosis

small number of variable types

large number of "unique" variables

features are not predictive

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Important Distinctions

Generative

task shifts

(easier to train in
certain regimes)

Discriminative
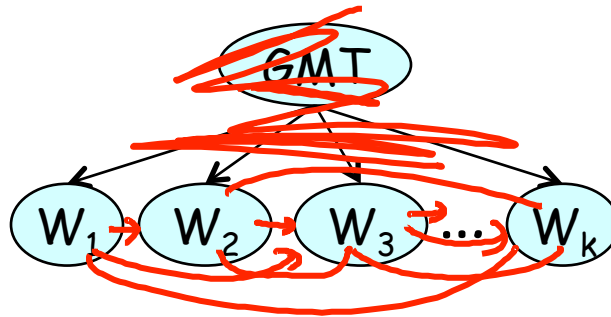
particular prediction task

richly expressive features
(avoid dealing w. correlations)
$\Rightarrow$ high performance

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Variable Types

- Target �))
- Observed ⬻
  - Including complex, constructed features
- Latent — simplify structure

  hidden

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Structure

$X \rightarrow Y$
$Y \rightarrow X$

generally sparser

- Causal versus non-causal ordering

more intuitive
easier to parameterize

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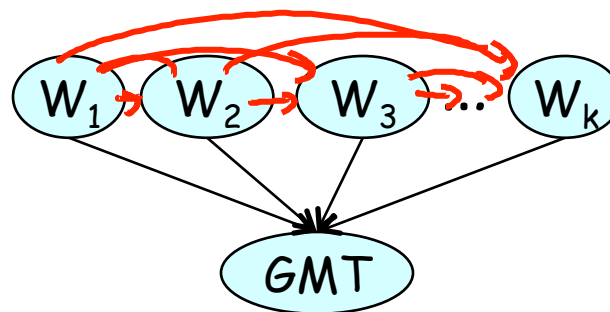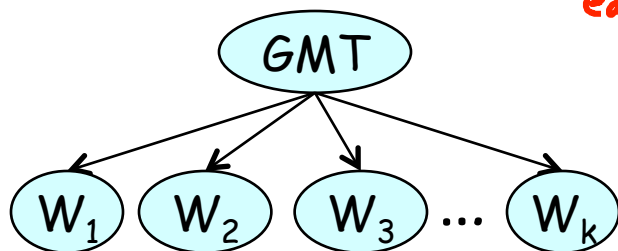
Extending the Conversation

reliably elicit
a CPD

Gender
County
Smoke
Age
Profession
Lung Cancer
Cough
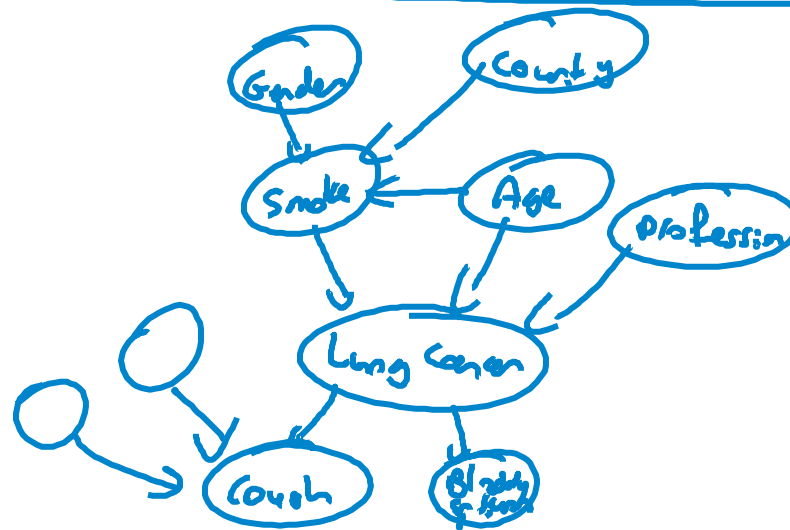
Parameters: Values

- What matters:
  - Zeros   early expert systems
  - Orders of magnitude
  - Relative values $P(y \mid x_1)$
  - $P(y \mid x_2)$
- Structured CPDs

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Parameters: Local Structure

- Table CPDs are the exception

$P(Y|X)$

multiple parents

	Context-specific	Aggregating
Y Discrete	tree (multiplexers)	noisy OR/AND... Sigmoid
Y Continuous	parameters can depend on a discrete parents regression tree	linear Gaussians

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Iterative Refinement

- Model testing
- Sensitivity analysis for parameters
- Error analysis
  - Add features
  - Add dependencies

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