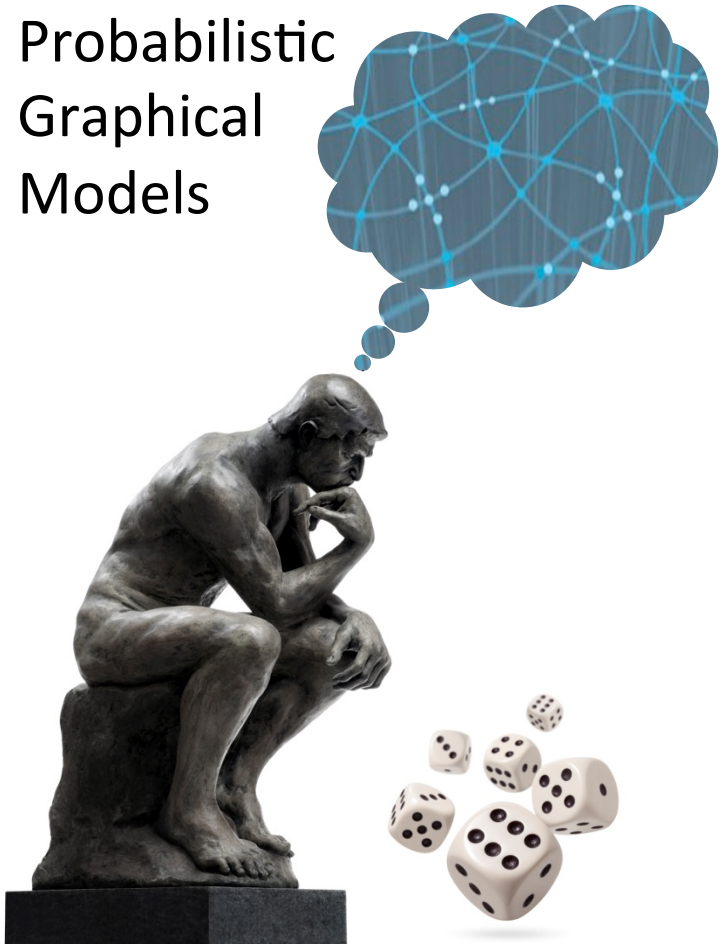
Probabilistic Graphical Models



Representation

Bayesian Networks

Application: Diagnosis

Medical Diagnosis: Pathfinder (1992)

病理学家 淋巴

- Help pathologist diagnose lymph node pathologies (60 different diseases)
- Pathfinder I: Rule-based system
- Pathfinder II used naïve Bayes and got superior performance

Heckerman et al.

Medical Diagnosis: Pathfinder (1992)

- Pathfinder III: Naïve Bayes with better knowledge engineering
- No incorrect zero probabilities
- Better calibration of conditional probabilities
  - P(finding | $disease_1$) to P(finding | $disease_2$)
  - Not P($finding_1$ | disease) to P($finding_2$ | disease)

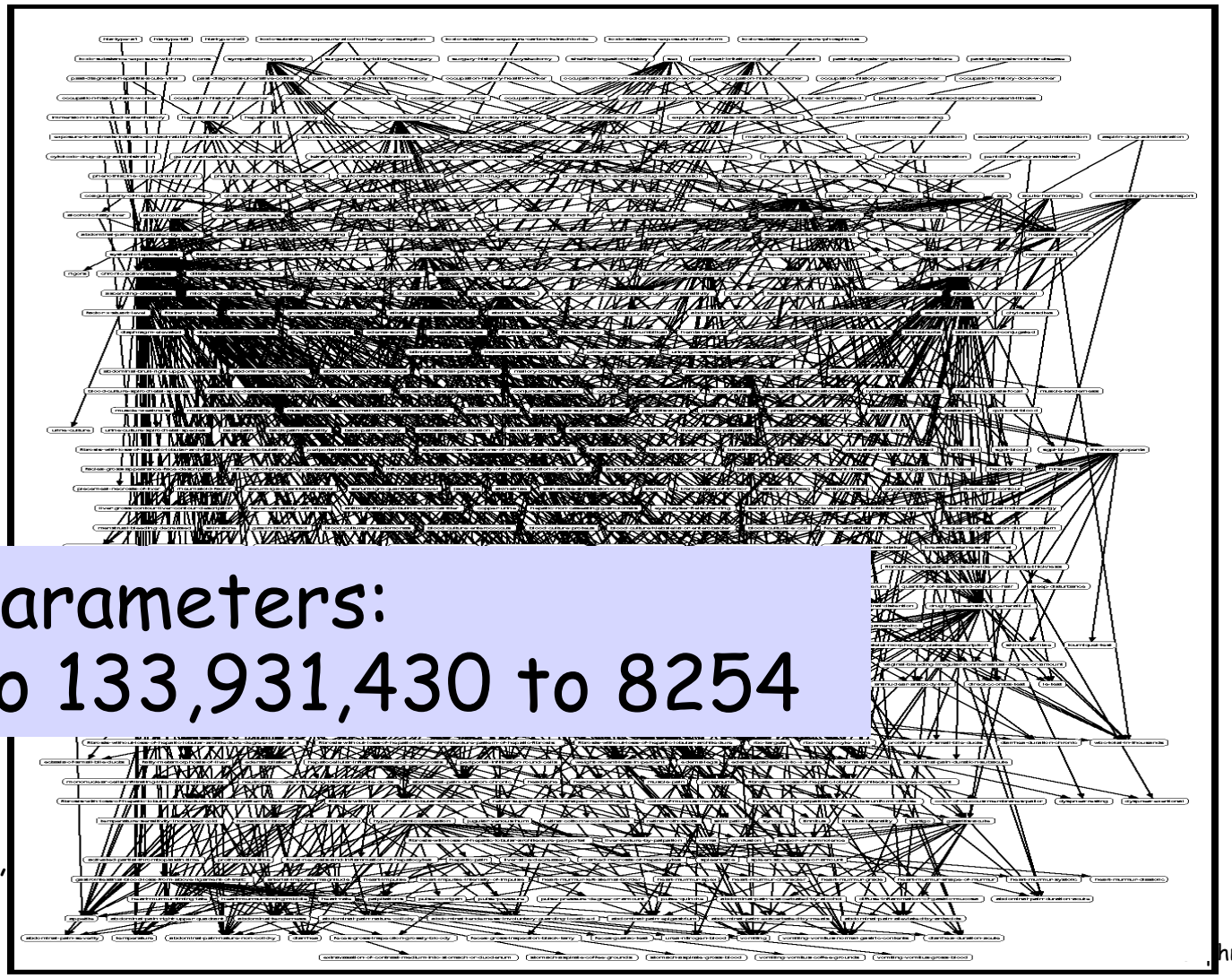
Heckerman et al.

Medical Diagnosis: Pathfinder (1992)

- Pathfinder IV: Full Bayesian network
  - Removed incorrect independencies
  - Additional parents led to more accurate estimation of probabilities
- BN model agreed with expert panel in 50/53 cases, vs 47/53 for naïve Bayes model
- Accuracy as high as expert that designed the model

Heckerman et al.

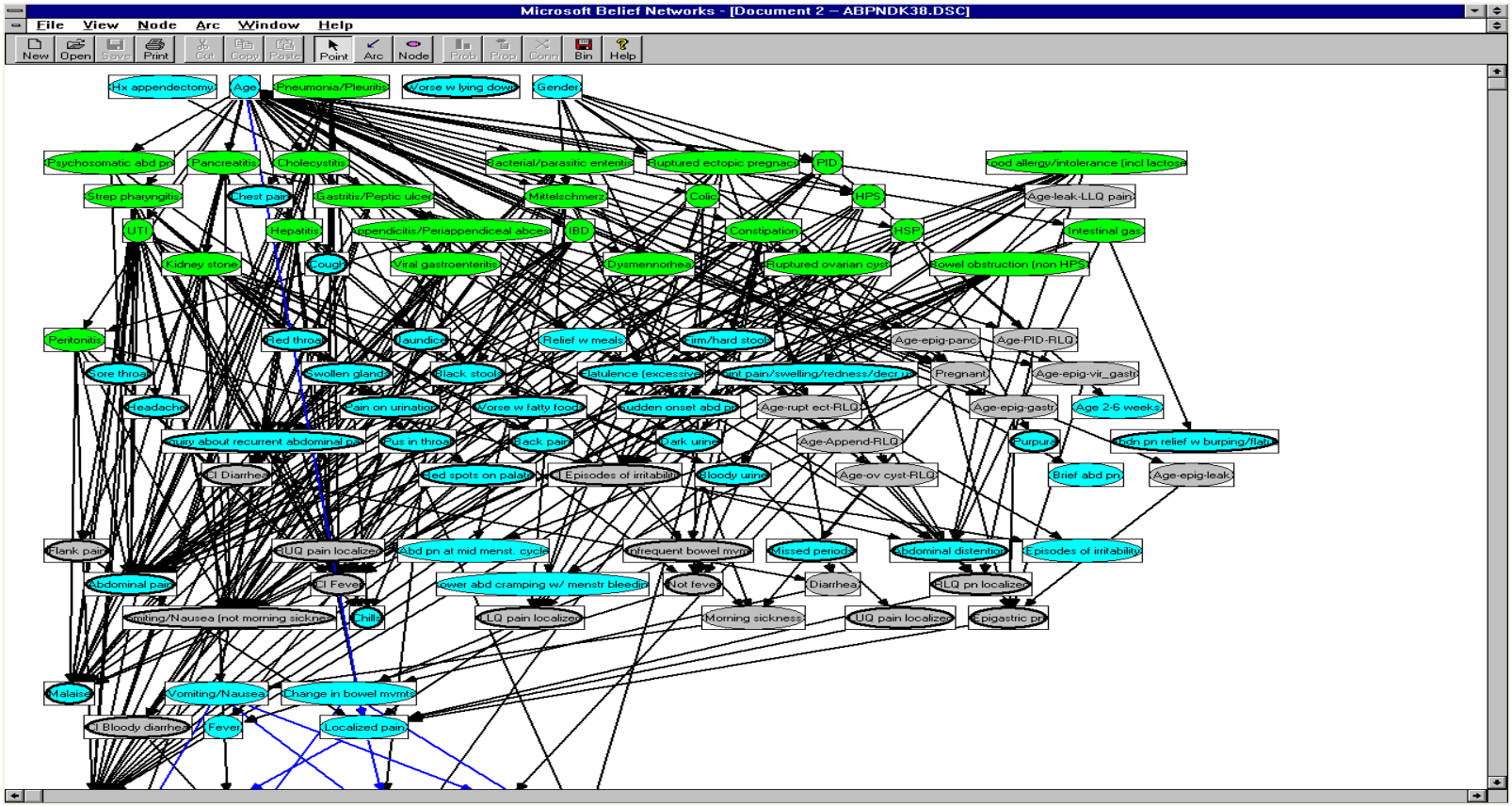
CPCS



# of parameters:
2^{1000} to 133,931,430 to 8254

M. Pradhan , G. Provan ,
B. Middleton , M.Henrion,
UAI 94

Medical Diagnosis (Microsoft)



Thanks to: Eric Horvitz, Microsoft Research

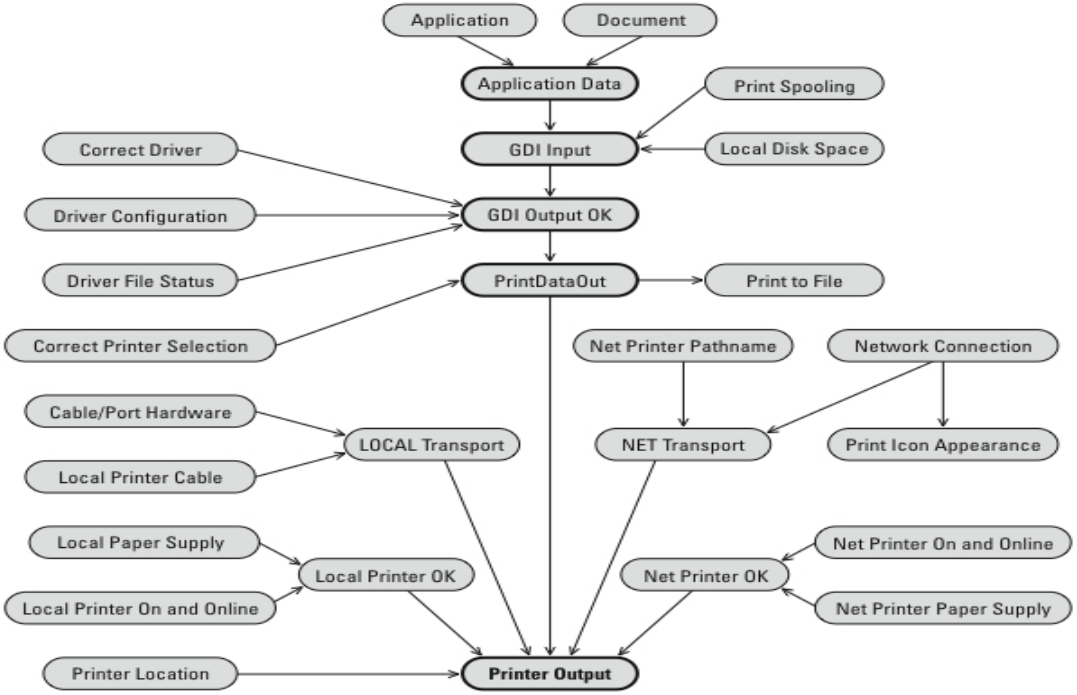
Daphne Koller

Medical Diagnosis (Microsoft)

Thanks to: Eric Horvitz, Microsoft Research

Fault Diagnosis

- Microsoft troubleshooters



Daphne Koller

Fault Diagnosis

- Many examples:
  - Microsoft troubleshooters
  - Car repair
- Benefits:
  - Flexible user interface
  - Easy to design and maintain ←