Bayesian Belief Networks

"Conditional independence is overrated"
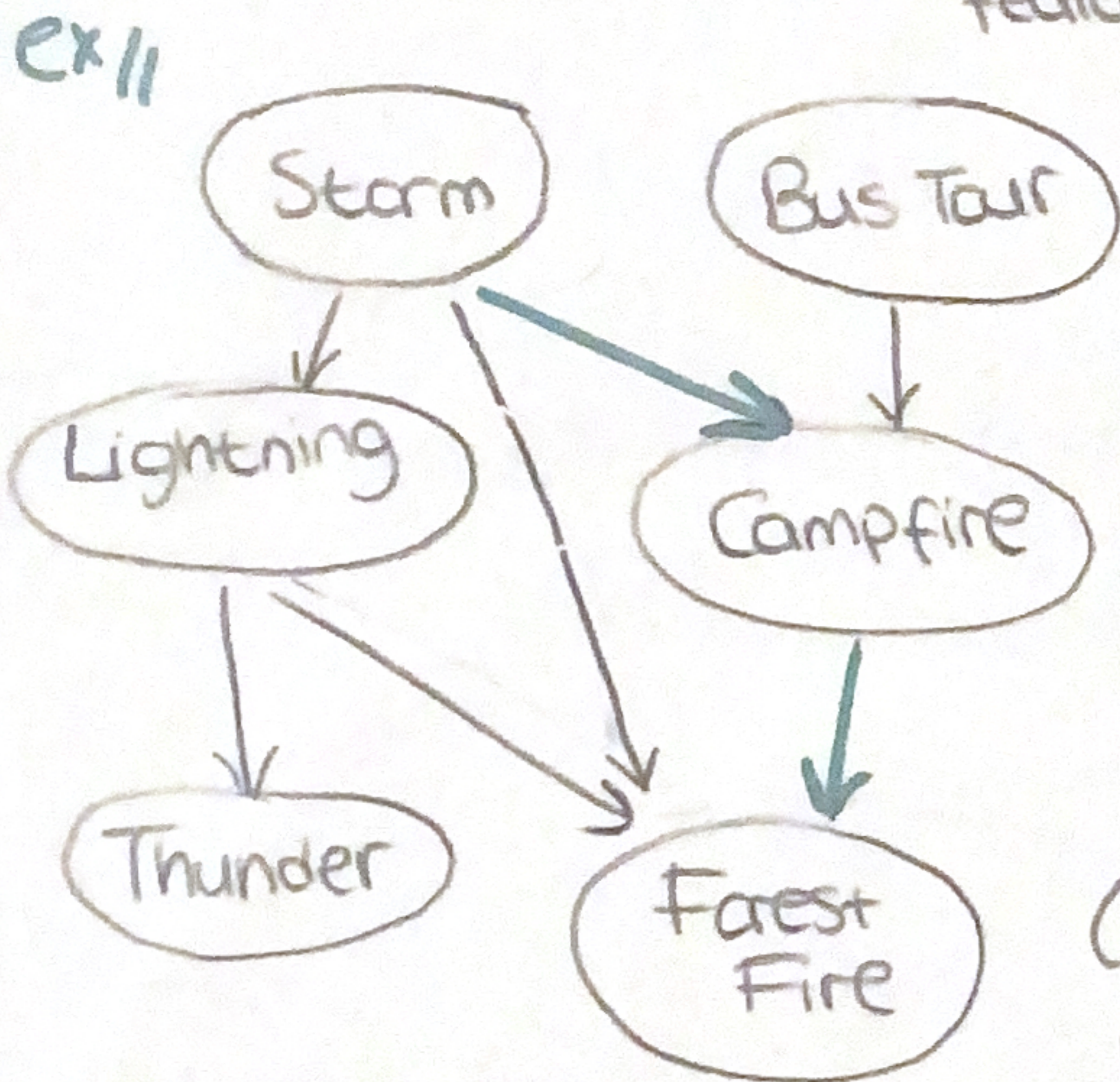
Naive Bayes → All of the variables are conditionally independent

Belief Nets → Some of the variables are conditionally independent

if X is independent of y then ignore y!

ex. $P(X=x_i \mid y=y_j, z=z_k) = P(X=x_i \mid z=z_k)$

X is conditionally independent of y given a value of z

What NB does → $P(A_1, A_2 \mid V) = P(A_1 \mid A_2, V) P(A_2 \mid V)$

features target $= P(A_1 \mid V) P(A_2 \mid V)$

if all the features are independent, simply multiply all the likelihoods

ex.

What BBN does:

Features are conditionally independent of their non-descendants.

(X is descendant of y if there's directed path from X to y)

$P(y_1, \ldots, y_n) = \prod P(y_i \mid Parents(y_i))$

→ Should be immediate parent

$P \rightarrow C$

$P(C=True \mid S=True, B=True) = 0.4$

★ $P(T=True \mid L=True, C=True) = P(T \mid L)$

$P(L=True \mid S=True, B=True) = P(L \mid S)$

↳ Look at immediate parents only!

	S,B	S,¬B	¬S,B	¬S,¬B
C	0.4	0.1	0.8	0.2
¬C	0.6	0.9	0.2	0.8

ex. Thunder is conditionally independent of other variables, given Lightning is True (we calculate Lightning by looking at its parents and go backwards in the graph for all parents)