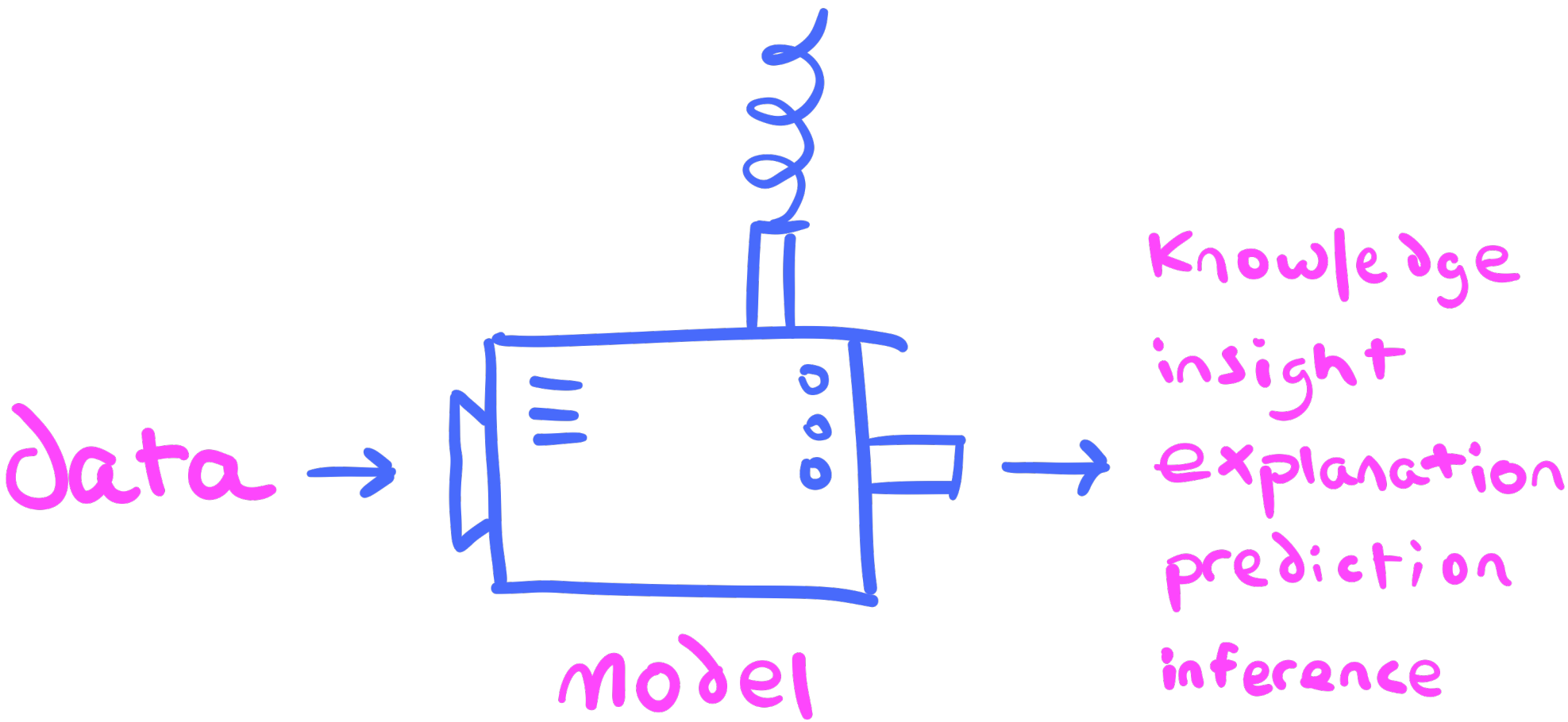
9. The halfway point: pivoting toward models and data analysis

9.1. Why probabilistic models?

Why models?

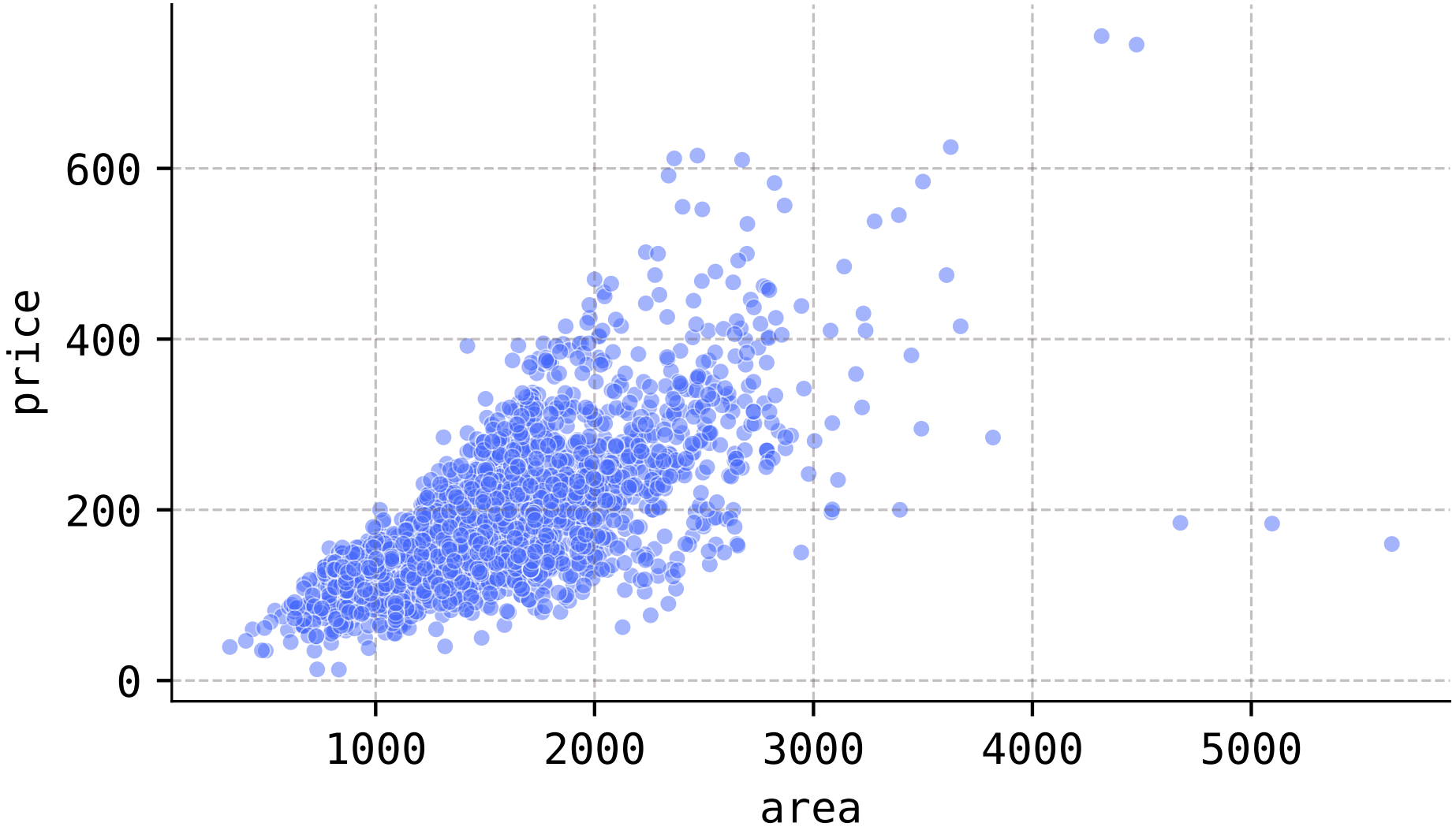

data
model
knowledge
insight
explanation
prediction
inference

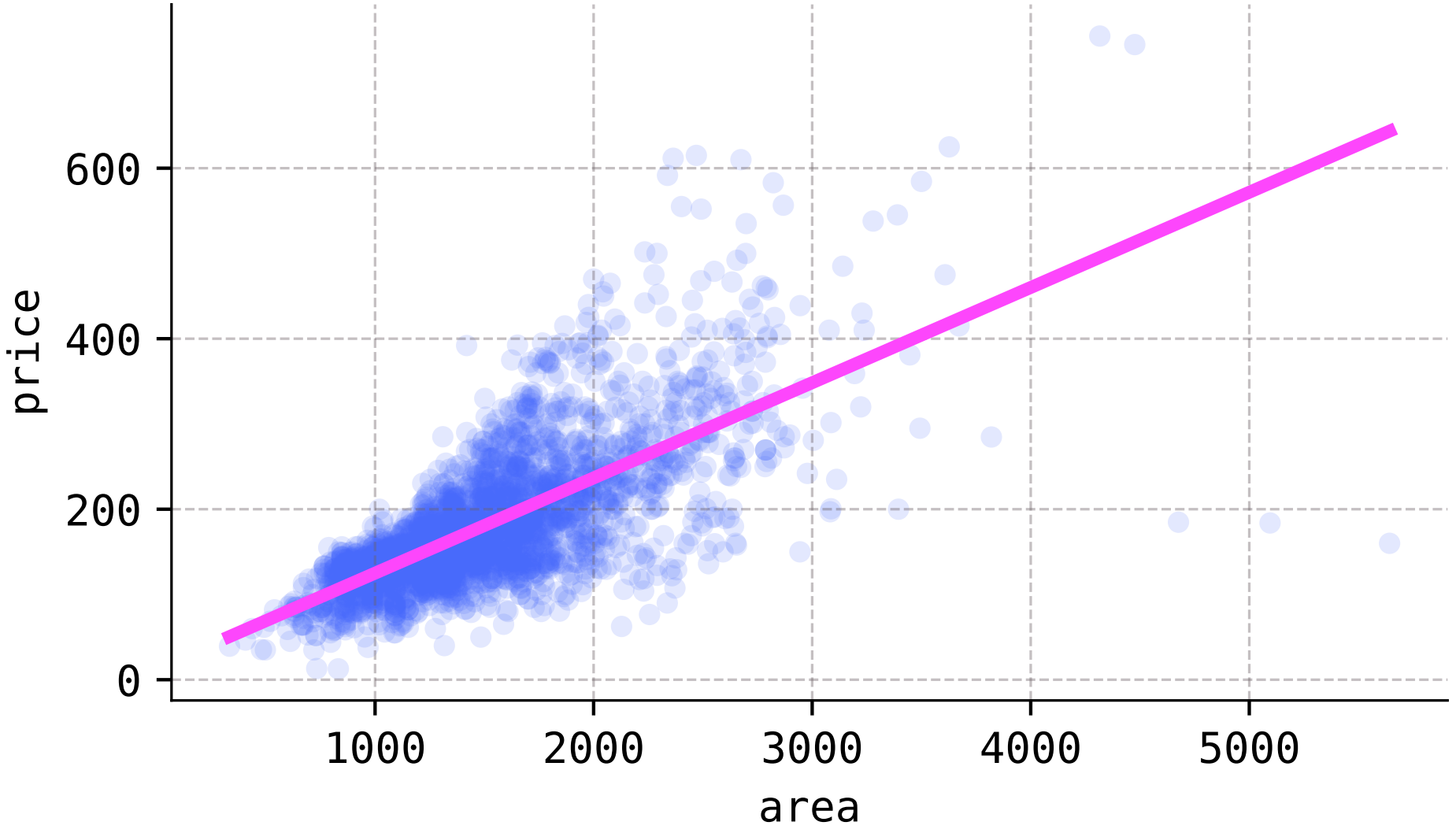
Variables

$\vec{p}, t, \vec{F}$

link

$$\vec{F} = \frac{\partial \vec{p}}{\partial t}$$


price
600
400
200
0
1000
2000
3000
4000
5000
area


price
600
400
200
0
1000
2000
3000
4000
5000
area

variables

x, y

link

$p(x, y)$

Variables

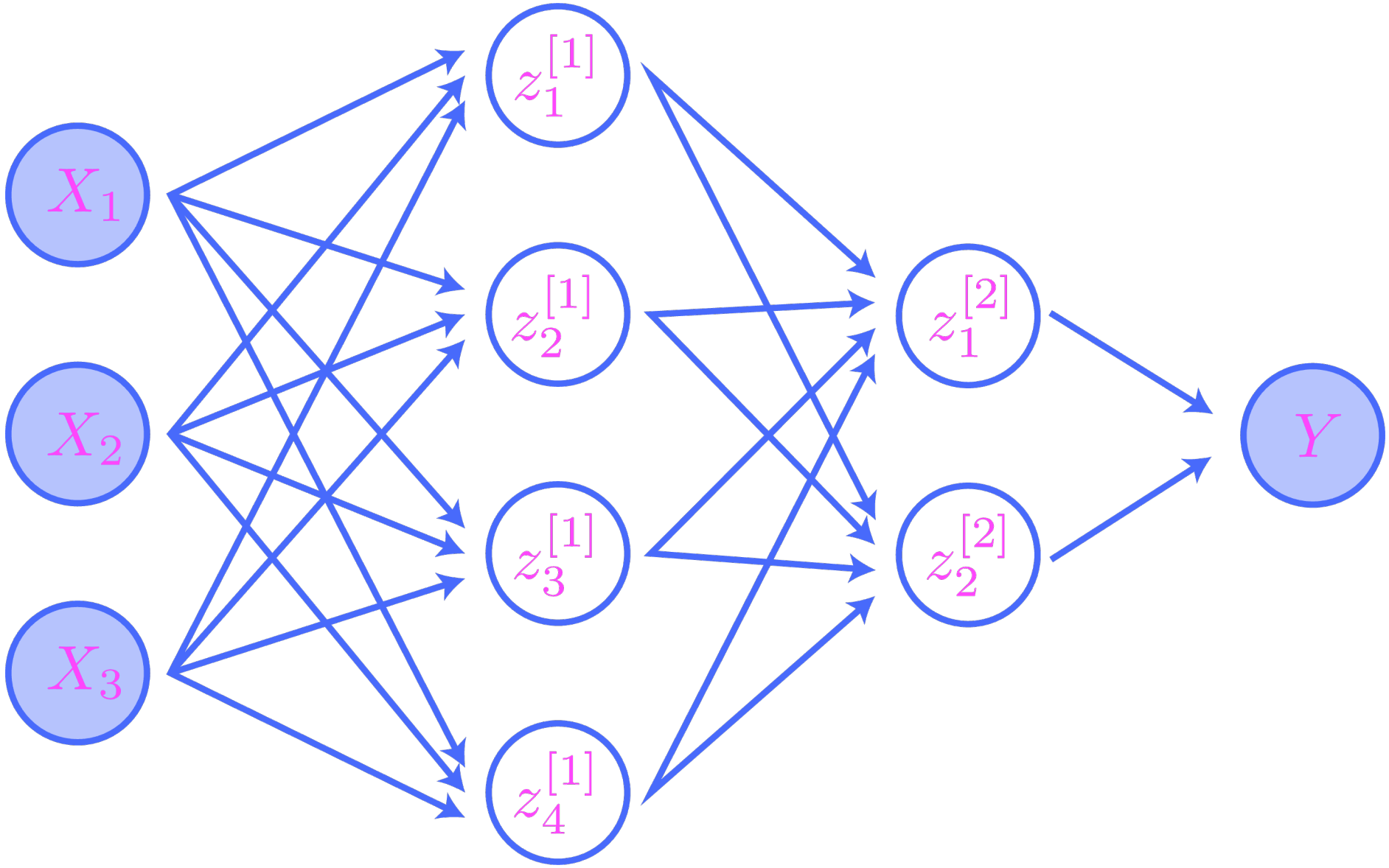
directed links

$X \longrightarrow Y$

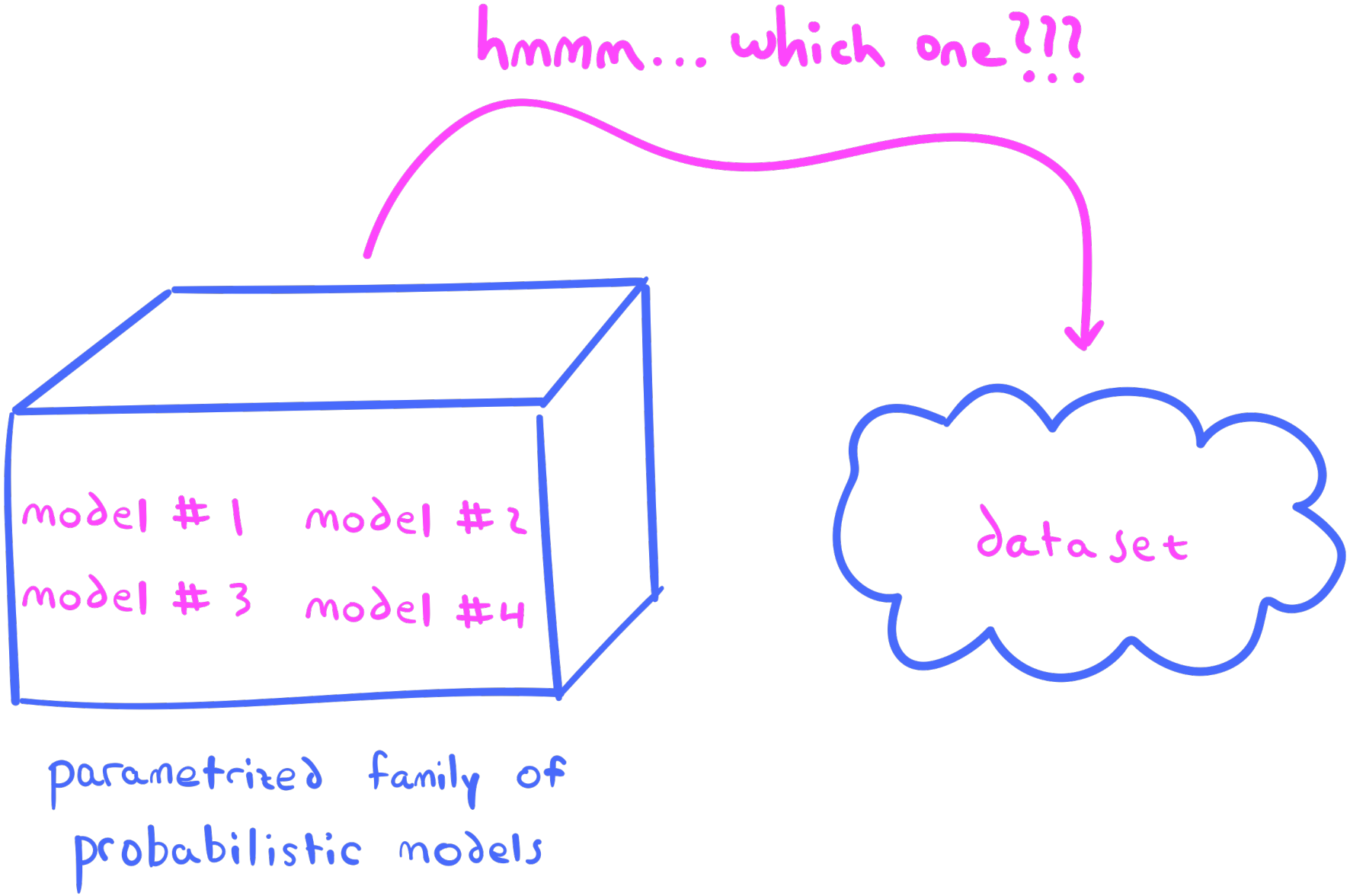
$Y \longrightarrow X$

$P(y|x)$

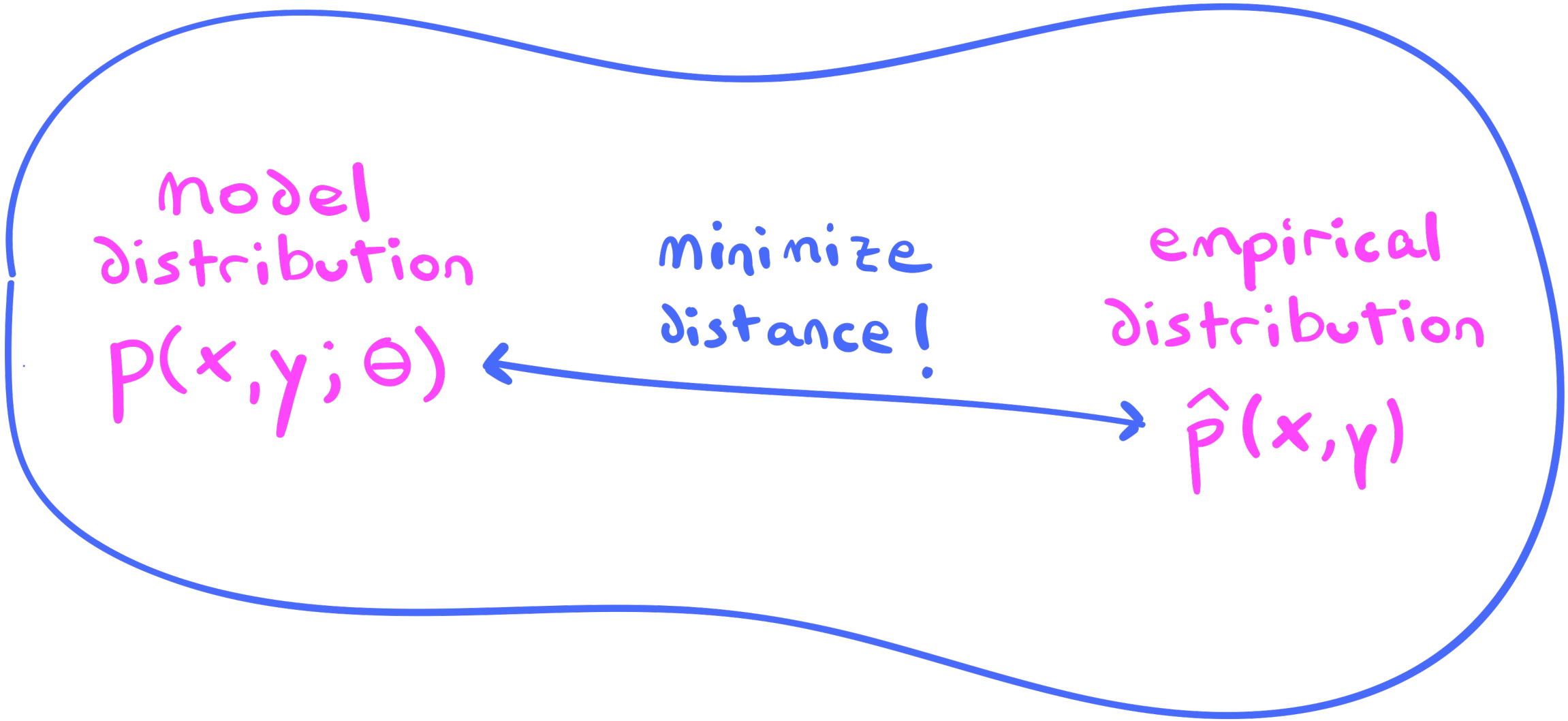
$P(x|y)$


X_1
X_2
X_3
$z_1^{[1]}$
$z_2^{[1]}$
$z_3^{[1]}$
$z_4^{[1]}$
$z_1^{[2]}$
$z_2^{[2]}$
Y

9.2. Learning and optimization


hmmm... which one???
model #1
model #2
model #3
model #4
dataset
parametrized family of probabilistic models

The Distance Criterion for Parameter Choice. Given two probabilistic models within the same parametric family, choose the model whose *distance* from the empirical distribution of the data is smaller.


model
distribution
$p(x, y; \theta)$
minimize
distance!
empirical
distribution
$\hat{p}(x, y)$