Week-5 Inference

→ Given data we saw in the past & its distribution what can we infer about the new data?

→ given an observation (containing a bunch of features), what's the probability the object came from a class i

$$P(y=i \mid feature_1 = x_1, feature_2 = x_2 \ldots feature_D = x_D)$$

↓ abbreviate

$$P(y=i \mid f_1 = x_1, f_2 = x_2, f_3 = x_3 \ldots f_D = x_D) = P(y=i \mid f = x)$$

→ we call this value $P(y=i \mid f=x)$ as posterior

notation → $P(a, b, c) = P(a \wedge b \wedge c)$

$$P(y \mid x) = \frac{P(y \wedge x)}{P(x)} = \frac{P(y, x)}{P(x)}$$ ← evidence

Joined Distribution

steps:
1) make a truth table of all combinations of values (M bool vars → 2^M rows)
2) count how many times in your data each combination occurs
3) normalize counts by toll no. of data size to get probabilities

$P(row)$ = records matching row / toll no. of records.

Using law of total probability, we know,

$$P(y) = \sum_i P(y \cap x_i) = \sum_{\text{rows with } y} P(row)$$

also, written as

$$P(y \mid x) = \frac{P(y \wedge x)}{P(x)} = \frac{\sum \text{rows of } y \,\&\, x \; P(row)}{\sum \text{rows with } x \; P(row)}$$

Inference Proves helpful in Classifying outcome for given data

→ I got this evidence, what's the chance my conclusion is true?

→ I got sore neck, How likely is it I got Mening itis?

✱ you see new obs, you try to relate with what you already know.

Using Inference for Classification:

↳ consider x, a set of D features to calc. which class a set of features belong to, we choose to max. its posterior probability.