

**Definition 2.14** The joint entropy  $H(X, Y)$  of a pair of random variables  $X$  and  $Y$  is defined as

$$H(X, Y) = - \sum_{x, y} p(x, y) \log p(x, y) = -E \log p(X, Y).$$

**Definition 2.15** For random variables  $X$  and  $Y$ , the conditional entropy of  $Y$  given  $X$  is defined as

$$H(Y|X) = - \sum_{x, y} p(x, y) \log p(y|x) = -E \log p(Y|X).$$