Regressor $\quad \hat{y} = g(x) \quad$ predict function

$$\ell(\hat{y}, y) = (\hat{y} - y)^2$$

Dataset $\quad \{y_i, x_i\}_{i=1}^n$

Emp Risk: $\quad R_n(g) = \frac{1}{n} \sum_{i=1}^n \ell(g(x_i), y_i)$

True Risk: $\quad R(g) = \underline{\mathbb{E}} \, \ell(g(x), y)$

Use ERM the ER is smaller than True Risk!
$\qquad$ (with high probability)

Holdout:

$\qquad$ Subsample from $\quad \mathcal{D} = \{x_i, y_i\}_{i=1}^n \quad$ a

$\qquad\qquad$ training set $\quad \mathcal{D}_{train}$

$\qquad\qquad$ test set $\quad \mathcal{D}_{test}$

$\qquad$ Perform ERM on $\mathcal{D}_{train}$ $(OLS) \overset{\Rightarrow}{\quad} \hat{g}$ then

$\qquad$ test error: $\quad \dfrac{1}{|\mathcal{D}_{test}|} \displaystyle\sum_{x_i, y_i \in \mathcal{D}_{test}} \ell(\hat{g}(x_i), y_i)$

Leave-one-out

$\qquad\qquad$ training set of size $n-1 \Big\}$ $(\ast)$

training set of size $n-1$ $\Big\}$ (✱)
test set of size 1

Perform (✱) for every possible such split
average resulting test errors

Start w/ regression object: fit, predict $\quad (\hat{R} = 0)$

For $\quad j = 1, \ldots, n$

$\quad$ fit $\left(\{x_i, y_i\}_{i \neq j} \right)$

$\quad \hat{y} = $ predict (x_j)

$\quad$ Add loss $\quad \hat{R} \leftarrow \hat{R} + \ell(\hat{y}, y_j)$

k-NN: tuning parameter k