

### Mapping categorical features to numerical features (one hot encoding)

Categorical feature with  $L$  classes is mapped into  $L$  numerical features

$$\text{Class "k"} \Rightarrow \vec{e}_k = \left( 0, 0, \dots, \underset{k}{1}, 0, 0, \dots, 0 \right) \in \mathbb{R}^L, 1 \leq k \leq L.$$

Examples:

- Male/female  $\Rightarrow \{(1,0), (0,1)\}$ ,
- Red/Green/Blue  $\Rightarrow \{(1,0,0), (0,1,0), (0,0,1)\}$ .
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### Mapping classification problems to vector valued regression (one hot encoding)

$$\text{Class "k"} \Rightarrow \vec{e}_k = \left( 0, 0, \dots, \underset{k}{1}, 0, 0, \dots, 0 \right) \in \mathbb{R}^L, 1 \leq k \leq L.$$

So if a sample  $y_i = "k"$ , we map it to  $\vec{y}_i = \vec{e}_k$ .

Any (inference) vector  $\vec{y} \in \mathbb{R}^L$  can be mapped to the "closest" class by

$$\min_{1 \leq k \leq L} \|\vec{y} - \vec{e}_k\|_{l_2(\mathbb{R}^L)}$$