feature vector $\phi(x) \in \mathbb{R}^d$

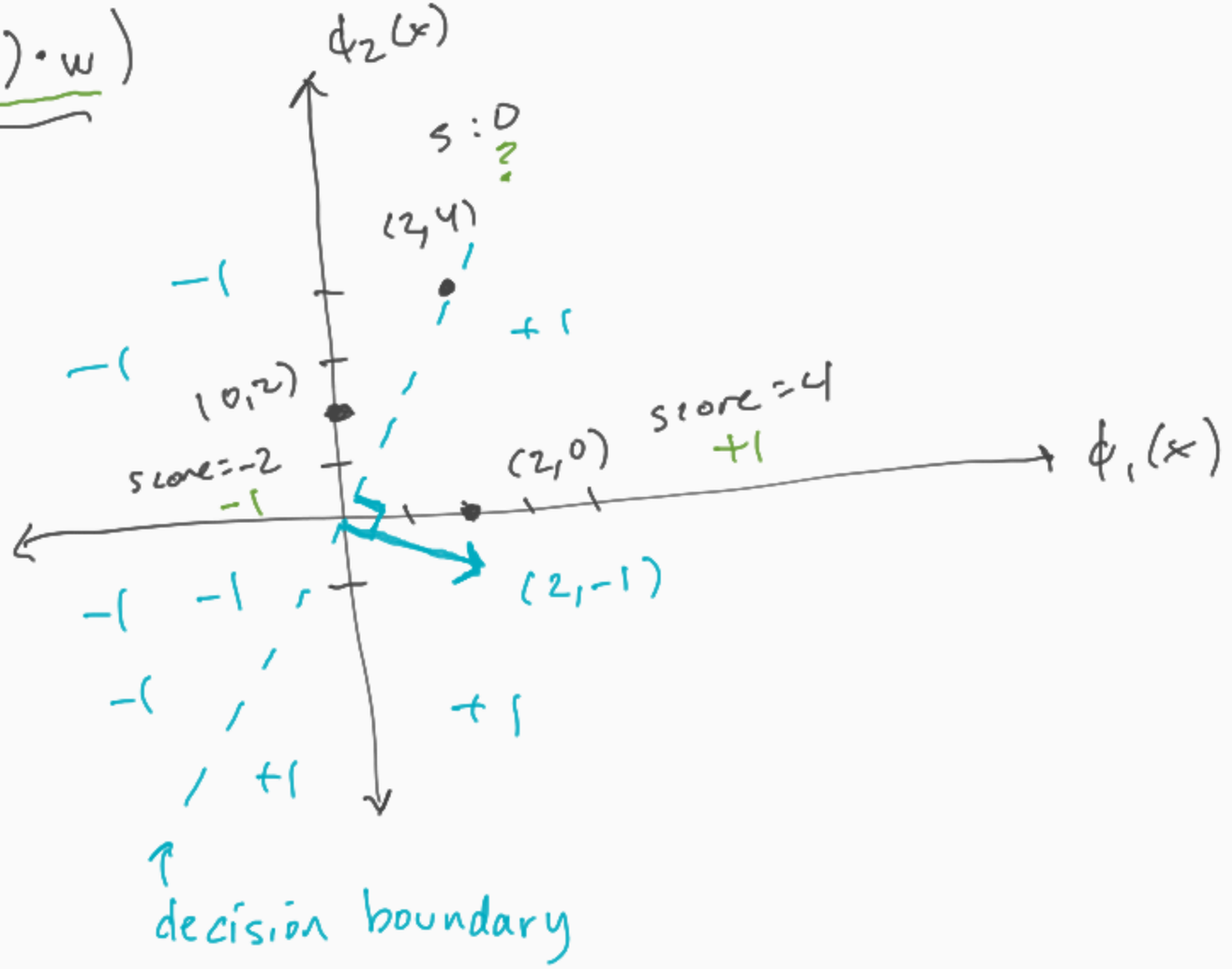
weight vector $w \in \mathbb{R}^d$

score $\phi(x) \cdot w$

linear classifier $f_w(x) = \text{sign}(\phi(x) \cdot w)$

$w = (2, -1)$

$\phi(x) \in \{(2,0), (0,2), (2,4)\}$



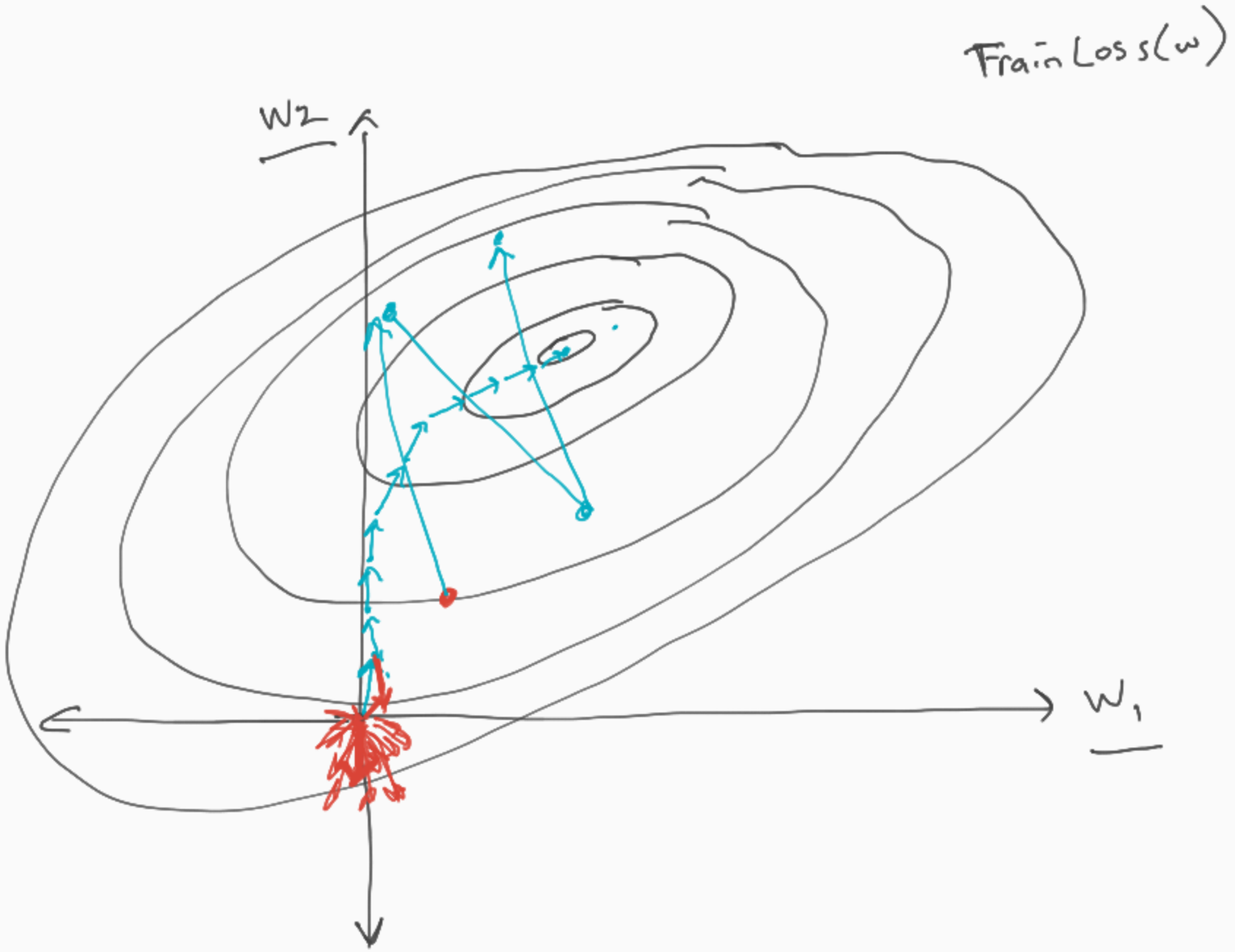
$Loss(x, y, w) \to \mathbb{R}$ $\Rightarrow$ $TrainLoss(\underline{w}) \to \mathbb{R}$

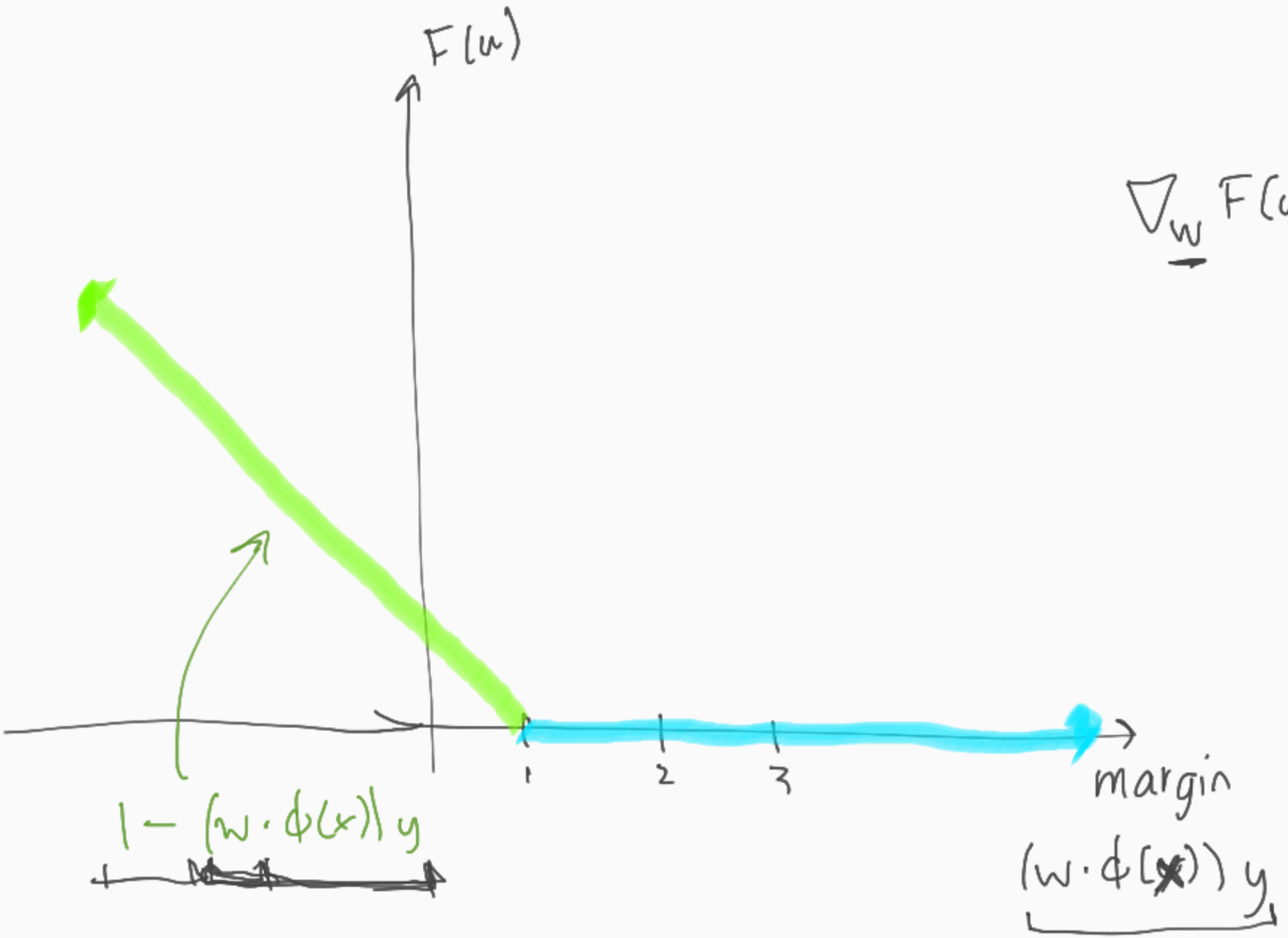
Classification

- score $w \cdot \phi(x)$ how confident you are
- predictor/linear classifier $\text{sign}(w \cdot \phi(x))$
- margin $(w \cdot \phi(x))\, y$ how correct you are

Regression

- predictor $w \cdot \phi(x)$
- residual $w \cdot \phi(x) - y$


Train Loss(w)
W2
W1



$$\nabla_w F(w) = \begin{cases} 0 & w \cdot \phi(x) y > 1 \\ -\phi(x) \cdot y & (w \cdot \phi(x)) y < 1 \end{cases}$$

$$w \leftarrow w - \eta \nabla_w$$

$$w - \eta(-\phi(x) y)$$

$$w + \eta \phi(x) \cdot y$$