$\min_{x \in \mathbb{R}, y \in \mathbb{Z}} (a - x)^2 + 50(y - x^2)^2$  $s.t. y \ge \frac{1}{2}b, x^2 \le b, x \le 0, y \ge 0$ **Input:** a = 3.83, b = 6.04

## **Relaxed Solution Mapping** $\pi_{\Theta_1}(a,b)$

Learnable Threshold  $\varphi_{\Theta_1}(a,b,\bar{x},\bar{y})$ 

## **Hidden State:**



 $h_x = 0.14, h_v = -1.84$ 

 $\hat{x} = \bar{x} + h_x = -1.83$ 

Neural Network  $\delta_{\Theta_2}(a, b, \bar{x}, \bar{y})$ 

**Round Integer Var:** 

**Update Continuous Var:** 

Sigmoid $(\bar{y} - |\bar{y}| - h_v) > 0.5$  $\rightarrow \hat{\mathbf{y}} = |\bar{\mathbf{y}}| = 3$ 

Mixed-Integer Solution:  $\hat{x} = -1.83$ ,  $\hat{y} = 3$ 

Loss Function:  $\mathcal{L}_{Obj} + \lambda \cdot \mathcal{L}_{Viol}$