Relaxed Solution Mapping

 $\pi_{\Theta_1}(a,b)$

Relaxed Solution:

 $\bar{x} = -1.17, \bar{y} = 2.98$

$$\min_{x \in \mathbb{R}, y \in \mathbb{Z}} (a - x)^2 + 50(y - x^2)^2$$

$$s.t. \ y \ge \frac{1}{2}b, x^2 \le b, x \le 0, y \ge 0$$

Input:
$$a = 3.83, b = 6.04$$

Rounding Classification $\varphi_{\Theta_1}(a,b,\bar{x},\bar{y})$

 $\hat{x} = \bar{x} + h_x = -1.85$



 $h_x = -0.68, h_y = 9.49$



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

Round Integer Var:

Gumbel_Sigmoid $(h_v) \ge 0.5$

Update Continuous Var:

Mixed-Integer Solution:
$$\hat{x} = -1.85$$
, $\hat{y} = 3$

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