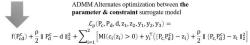
# Step 1: Initialize Parameters for Each Heterogeneous ctDNA Sample Parameter Optimization: Initializing Parameters to Build Surrogate Models FP/FN Constraint : Initializing Parameters to Build Surrogate Models

## Step 2: Decoupling Parameter Optimization and Constraint Condition by ADMM

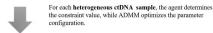


### Step 3: Optimal Constraint Decision by AGENT

AGENT : Iteratively constraints for optimal decision-making, with the constraint value passed to ADMM for optimization.

$$L(\theta) = E_{(s,a,r,s') \sim \mathbb{D}} \left[ \left( r + \gamma \max_{a'} Q(s',a';\theta^{-}) - Q(s,a;\theta) \right)^{2} \right]$$

### Step 4: Repeat Step 3 and Step 2 iteratively.



# Step 5:Train the meta-model.

Link **heterogeneous ctDNA genomic** data meta-features with their corresponding optimal variant detection parameter configurations to construct a comprehensive meta-dataset.

$$y^* = \arg\min_{y} \mathcal{L}(y, g(X)) + \lambda \cdot \mathcal{C}(y, X)$$

