**Implementation of the predictive processing model in the BabyBench self-touch task Summary**

This model implements body schema learning based on predictive processing theory. The core is to drive self-exploration through prediction errors. The specific implementation is divided into three parts:

Predictive model architecture (PredictiveEncoder class)

Use lightweight VAE structure: encoder (128-64) compresses sensory input into potential representation

Predictor (64+action→64) learns state transition dynamics

Decoder (64-128) reconstructs sensory input

Core formula: total error = reconstruction error + prediction error + 0.05\*KL divergence

Intrinsic reward mechanism (PredictiveProcessingWrapper class)

python

intrinsic\_reward = - (recon\_loss + pred\_loss + 0.05\*kl\_div)

Calculate the prediction error of the current tactile/proprioception

The negative value of the error is used as a reward to drive the reduction of uncertainty

Training optimization (train\_predictive\_processing)

Observation space: proprioception (47) + tactile (81) = 128 dimensions

Action space: 30 dimensions (spring damping model)

Lightweight PPO parameters: 1024 steps/round, 32 batch sizes, 20k total steps

Update the body dynamic model at each step

The model enables the agent to spontaneously learn the hand-body contact pattern through a cycle of actively generating actions → predicting sensations → minimizing errors, and completes training within 15 minutes (Lenovo 450 notebook).