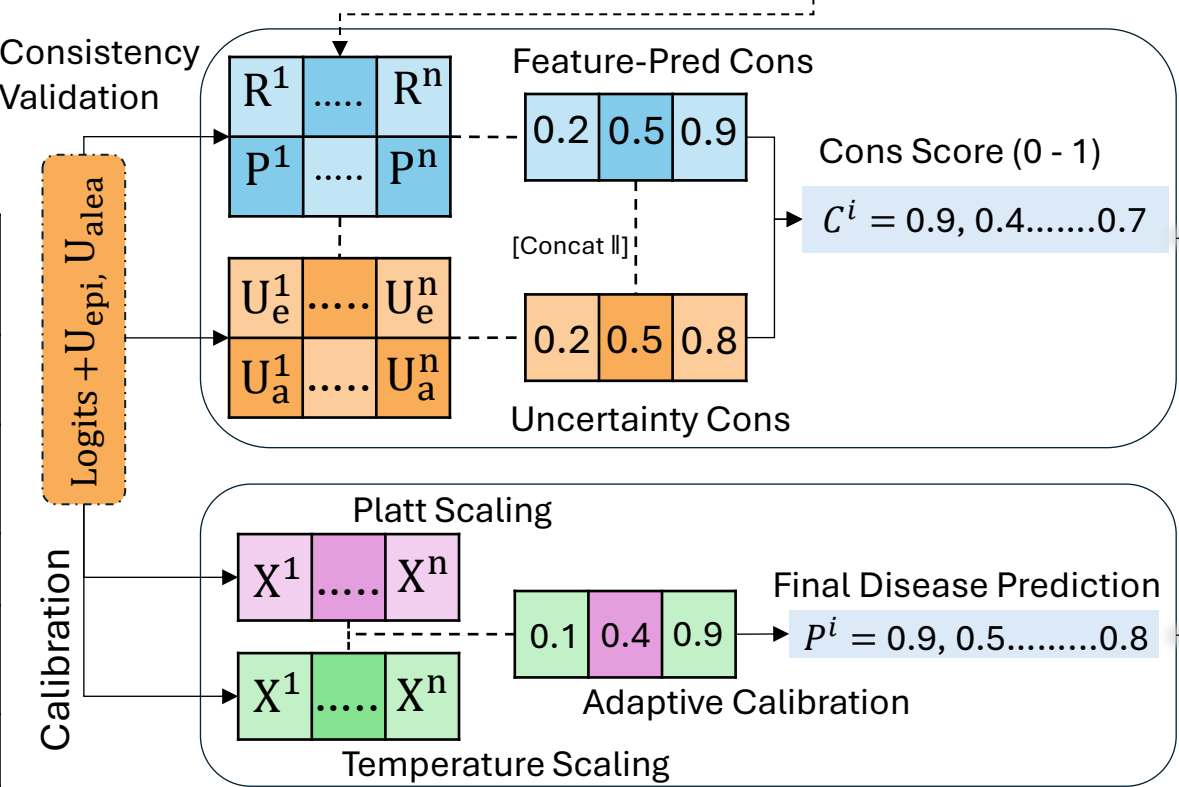


\hat{P} = predicted probability
 y = true label (0 or 1)
 $C_{target} = \min(0.9, 0.5 + 0.005)$

Components	Learnable Parameters
Bayesian Encoder	M, l, σ, l
Classification Network	$\gamma, \epsilon(\text{eps})$
Uncertainty Heads	μ, σ
Consistency Validation	μ, σ
Calibration	$\alpha, \beta, \sigma, T, \gamma$



Multi Objective Loss

$$\text{Cons}_{\text{loss}} = \sum_{i=1}^N (C_{\text{tot}}^i - C_{\text{target}}(t))^2$$

$$: C_{\text{tot}}^i = \alpha \cdot C_{\text{feat}}^i + (1 - \alpha) C_{\text{unc}}^i, \alpha = 0.6$$

$$\text{Calib}_{\text{loss}} = \text{ECE} + 0.2 \cdot \text{Brier} + 0.1 \cdot \text{CP}$$

$$\text{Class}_{\text{loss}} = L_{\text{BCE}}$$

$$\text{Unc}_{\text{loss}} = 0.5 \cdot L_{\text{corr}} + 0.3 \cdot L_{\text{MSE}} + 0.2 \cdot L_{\text{balance}}$$

Where:

$$L_{\text{corr}} = -\text{mean}(U \cdot |\hat{P} - y|)$$

$$L_{\text{MSE}} = ||U - U_{\text{target}}||^2$$

$$U_{\text{target}} = 0.2(1 - C) + 0.1, C = 2|\hat{p} - 0.5|$$

$$L_{\text{balance}} = ||\sigma_e - 0.7 \cdot u_{\text{target}}||^2 + ||\sigma_e - 0.3 \cdot U_{\text{target}}||^2$$