$M = (S, A, P, R, \gamma)$. $\qquad \phi$.

$M_\phi = (S_\phi, A, P_\phi, R_\phi, \gamma)$.

$$\Phi = \begin{bmatrix} 111 & & & \\ & 111 & & \\ & & \ddots & \\ & & & 111 \end{bmatrix}$$

$\forall s, a. \quad |R(s,a) - R_\phi(\phi(s), a)| \le \varepsilon_R$.

$$\| \underbrace{P_\phi(\cdot \mid \phi(s), a)}_{\mathbb{R}^{S_\phi}} - \Phi \underbrace{P(\cdot \mid s, a)}_{\mathbb{R}^{S}} \|_1 \le \varepsilon_P.$$

$$\| [Q^*_{M_\phi}]_M - Q^*_M \|_\infty \le f(\varepsilon_R, \varepsilon_P).$$

$$\le \frac{1}{1-\gamma} \| [Q^*_{M_\phi}]_M - \mathcal{T}_M [Q^*_{M_\phi}]_M \|_\infty.$$

$\forall s, a.$

$$\left| [Q^*_{M_\phi}]_M (s,a) - \left(\boxed{\mathcal{T}_M} [Q^*_{M_\phi}]_M \right)(s,a) \right|$$

$\forall f : S \times A \to \mathbb{R}$.

$\|f - Q^*\|_\infty$.

$= \|f - \mathcal{T}f + \mathcal{T}f - Q^*\|_\infty$

$\le \|f - \mathcal{T}f\|_\infty + \|\mathcal{T}f - \mathcal{T}Q^*\|_\infty$

$\le \|f - \mathcal{T}f\|_\infty + \gamma \|f - Q^*\|_\infty$

$$= \left| [\mathcal{T}_{M_\phi} Q^*_{M_\phi}]_M (s,a) - \left(\mathcal{T}_M [Q^*_{M_\phi}]_M \right)(s,a) \right|$$

$$= \left| (\mathcal{T}_{M_\phi} Q^*_{M_\phi})(\phi(s), a) - \left(\quad \vdots \quad \right)(s,a) \right|$$

$$= \Big| R_\phi(\phi(s),a) + \gamma \langle P_\phi(\cdot \mid \phi(s),a), V^*_{M_\phi} \rangle - R(s,a) - \gamma \langle P(\cdot \mid s,a), [V^*_{M_\phi}]_M \rangle \Big|$$

$$\leq \varepsilon_R + \gamma \Big| \langle P_\phi(\cdot \mid \phi(s),a), V^*_{M_\phi} \rangle - \langle P(\cdot \mid s,a), \Phi^T V^*_{M_\phi} \rangle \Big| .$$

$$\langle P(\cdot \mid s,a), \Phi^T V^*_{M_\phi} \rangle = \langle \Phi P(\cdot \mid s,a), \boxed{V^*_{M_\phi}} \rangle$$

$$= \varepsilon_R + \gamma \Big| \underbrace{\langle P_\phi(\cdot \mid \phi(s),a) - \Phi P(\cdot \mid s,a), V^*_{M_\phi} \rangle}_{\leq \varepsilon_P \cdot V_{max}} \Big| .$$

$$\langle u, Av \rangle .$$
$$= (u^T A) v$$
$$= (A^T u)^T v .$$
$$= \langle A^T u, v \rangle .$$