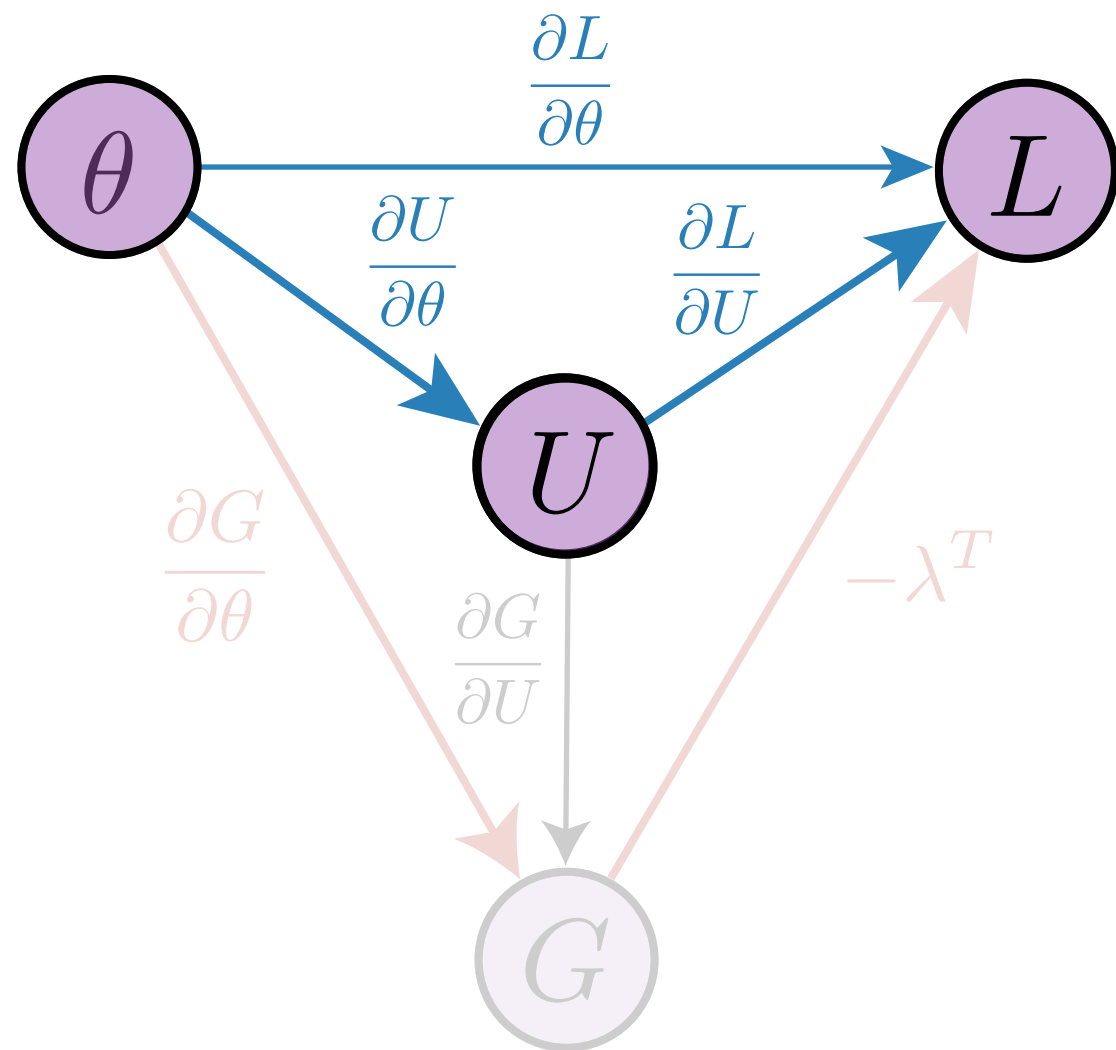
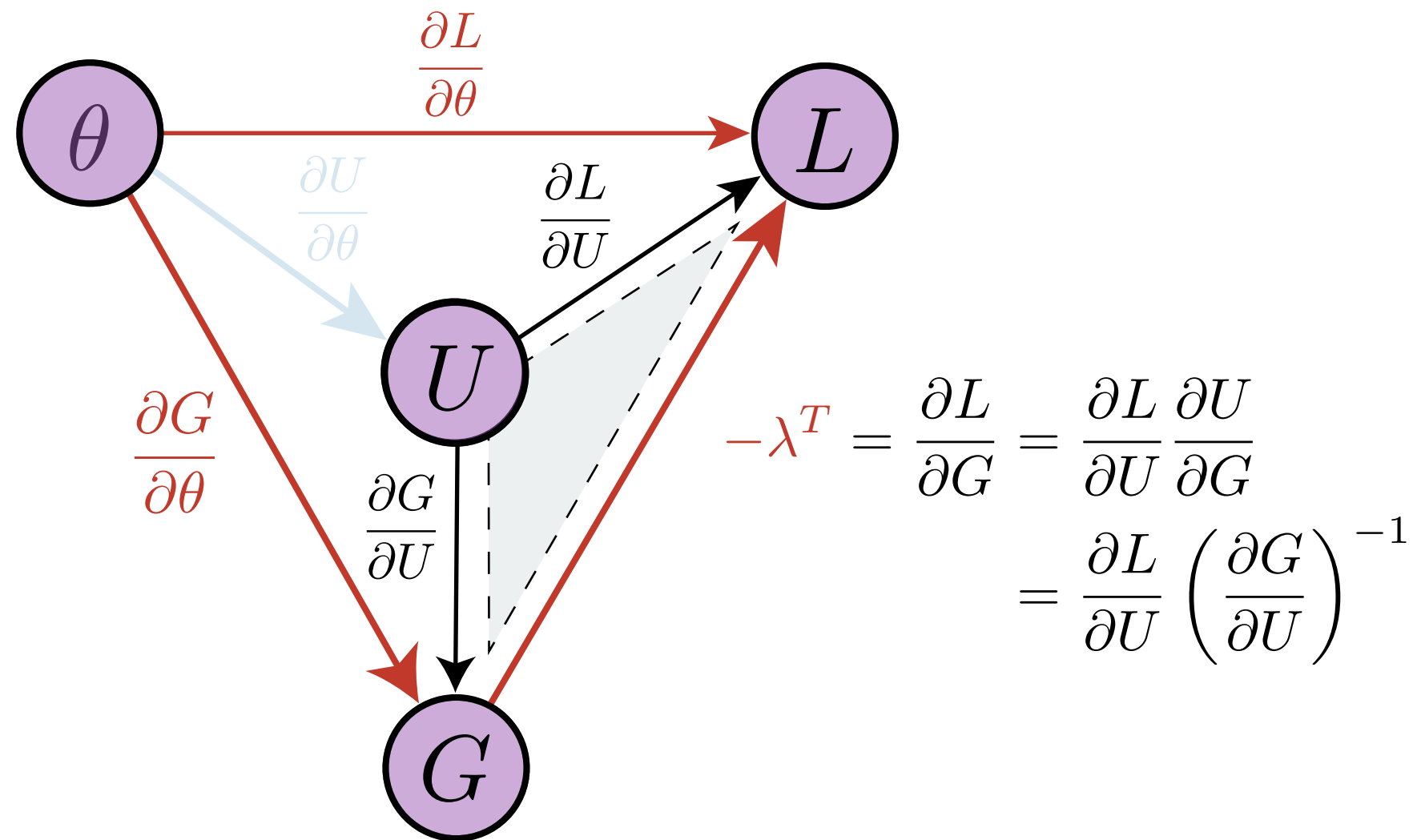


Direct gradient calculation



$$\frac{dL}{d\theta} = \frac{\partial L}{\partial \theta} + \frac{\partial L}{\partial U} \frac{\partial U}{\partial \theta}$$

Gradient based on adjoint



$$-\lambda^T = \frac{\partial L}{\partial G} = \frac{\partial L}{\partial U} \frac{\partial U}{\partial G} = \frac{\partial L}{\partial U} \left( \frac{\partial G}{\partial U} \right)^{-1}$$

$$\frac{dL}{d\theta} = \frac{\partial L}{\partial \theta} + \frac{\partial L}{\partial G} \frac{\partial G}{\partial \theta} = \frac{\partial L}{\partial \theta} - \lambda^T \frac{\partial G}{\partial \theta}$$