

$R =$

$$\frac{\nabla Z}{\|Z\|} -$$

$$\begin{pmatrix} \\ \end{pmatrix} \begin{pmatrix} \\ \end{pmatrix}$$

$$\nabla R = \frac{\nabla Z}{\|Z\|} - \frac{1}{2} \frac{\nabla(Z^T Z) Z}{(Z^T Z)^{3/2}}$$

$$= \frac{\nabla Z}{\|Z\|} - \frac{Z Z^T \nabla Z}{Z^T Z \|Z\|} \quad \text{since } \nabla(Z^T Z) = 2 Z Z^T$$

$$= \left(I_n - \frac{Z Z^T}{Z^T Z} \right) \left(\frac{\nabla Z}{\|Z\|} \right)$$

$$\nabla Z \sim N(0, I)$$

$$Z_i = \underline{Y_i - \hat{\mu}} \Rightarrow \nabla Z_i = \nabla Y_i - \nabla \hat{\mu}$$

$$\begin{aligned} Y_i - \hat{\mu} &= Y_i - \frac{1}{n} \sum Y_j = \left(Y_i - \frac{1}{n} Y_i \right) - \frac{1}{n} \sum_{j \neq i} Y_j \\ &= \frac{n-1}{n} Y_i - \frac{1}{n} \sum_{j \neq i} Y_j \end{aligned}$$