The variance-covariance matrix of the score

The variance-covariance matrix of the score is

$$\mathcal{I}_{jk} = \mathbb{E}[\mathbf{U}_j \mathbf{U}_k] \tag{3.1.5}$$

which represents the information matrix

$$egin{aligned} \mathcal{I}_{jk} &= \mathbb{E} \left\{ \sum_{i=1}^{N} \left[rac{(\mathrm{Y}_i - \mu_i)}{\mathbb{V}\mathrm{ar}(\mathrm{Y}_i)} \mathrm{X}_{ij} \left(rac{d\mu_i}{d\eta_i}
ight)
ight] \sum_{i=1}^{N} \left[rac{(\mathrm{Y}_i - \mu_i)}{\mathbb{V}\mathrm{ar}(\mathrm{Y}_i)} \mathrm{X}_{ik} \left(rac{d\mu_i}{d\eta_i}
ight)
ight]
ight\} \ &= \sum_{i=1}^{N} rac{\mathbb{E}[(\mathrm{Y}_i - \mu_i)^2 \mathrm{X}_{ij} \mathrm{X}_{ik}]}{[\mathbb{V}\mathrm{ar}(\mathrm{Y}_i)]^2} \left(rac{d\mu_i}{d\eta_i}
ight)^2 \end{aligned}$$

because $\mathbb{E}[(\mathrm{Y}_i - \mu_i)(\mathrm{Y}_l - \mu_l)] = 0$ for i
eq l .

Since $\mathbb{E}[(\mathbf{Y}_i - \mu_i)^2] = \mathbb{V}\mathrm{ar}(\mathbf{Y}_i)$

$$\mathcal{I}_{jk} = \sum_{i=1}^{N} \frac{\mathbf{X}_{ij} \mathbf{X}_{ik}}{\mathbb{V}\mathrm{ar}(\mathbf{Y}_i)} \left(\frac{d\mu_i}{d\eta_i}\right)^2 \tag{3.1.6}$$

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