Reinforcement Learning - Exercises Lectures 1-5

Maurice Frank
11650656
maurice.frank@posteo.de
Code: github

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0.1 Linear algebra and multivariable derivatives

1.

$$AB = \begin{bmatrix} a_{11} & 0 \\ 0 & a_{22} \end{bmatrix} \cdot \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \tag{1}$$

$$= \begin{bmatrix} a_{11}b_{11} & a_{11}b_{12} \\ a_{22}b_{21} & a_{22}b_{22} \end{bmatrix} \tag{2}$$

$$AB^T = \begin{bmatrix} a_{11} & 0 \\ 0 & a_{22} \end{bmatrix} \cdot \begin{bmatrix} b_{11} & b_{21} \\ b_{12} & b_{22} \end{bmatrix} \tag{3}$$

$$= \begin{bmatrix} a_{11}b_{11} & a_{11}b_{21} \\ a_{22}b_{12} & a_{22}b_{22} \end{bmatrix} \tag{4}$$

$$d^T B d = \begin{bmatrix} d_1 & d_2 \end{bmatrix} \begin{bmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{bmatrix} \begin{bmatrix} d_1 \\ d_2 \end{bmatrix} \tag{5}$$

$$= d_1^2 b_{11} + d_1 d_2 b_{12} + d_1 d_2 b_{21} + d_2^2 b_{22} \tag{6}$$

2.

$$A^{-1} = \begin{bmatrix} a_{11}^{-1} & 0 \\ 0 & a_{22}^{-1} \end{bmatrix} \tag{7}$$

$$B^{-1} = \frac{1}{b_{11}b_{22} - b_{21}b_{12}} \begin{bmatrix} b_{22} & -b_{21} \\ -b_{12} & b_{11} \end{bmatrix} \tag{8}$$

3.

$$\frac{\partial c}{\partial x} = \begin{bmatrix} -2x \\ \frac{1}{yx} \end{bmatrix} \tag{9}$$

$$\frac{\partial c}{\partial e} = \begin{bmatrix} -2x & 1 \\ \frac{1}{yx} & -\ln(x)y^{-2} \end{bmatrix} \tag{10}$$

4.

$$f(\boldsymbol{x}) = \sum_{i}^{N} i x_i \tag{11}$$

$$\frac{\partial f(\boldsymbol{x})}{\partial \boldsymbol{x}} = \sum_{i}^{N} i \tag{12}$$

0.2 Probability theory

1.

$$\mathbb{E}[X + \alpha Y] = \mathbb{E}[X] + \alpha \mathbb{E}[Y] \tag{13}$$

$$= \mu + \alpha \nu \tag{14}$$

2.

$$\mathrm{Var}[X + \alpha Y] = \mathrm{Var}[X] + \alpha^2 \mathrm{Var}[Y] + 2\alpha \mathrm{Cov}[X, Y] \tag{15}$$