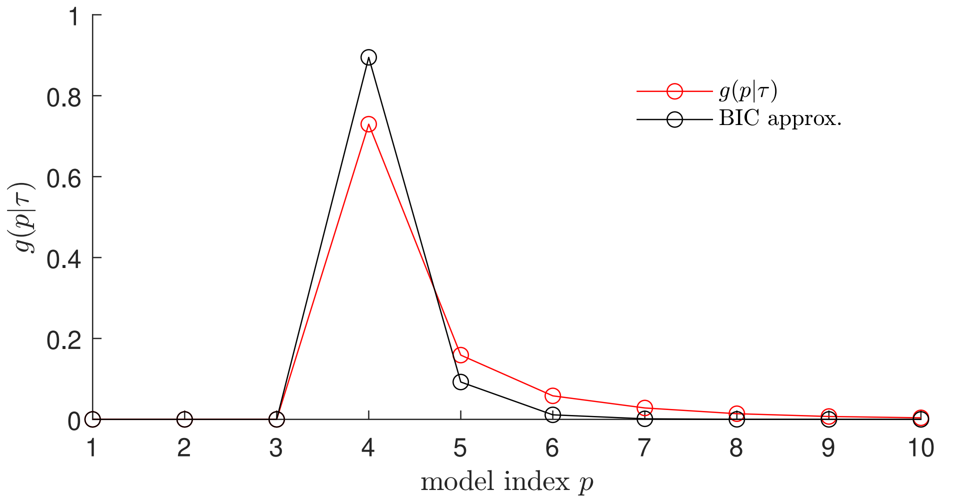
Data Science and Machine Learning:
Mathematical and Statistical Methods

Errata

(Last Update 7th February 2022)

1. Page 33, definition of the Hilbert matrix: $\mathbf{H}_p = \int_0^1 [1, u, \ldots, u^{p-1}]^\top [1, u, \ldots, u^{p-1}]\, \mathrm{d}u$.
2. Page 37, line 3 from the top: replace $\mathbb{E}Y_i$ with $\mathbb{E}_{\mathbf{X}} Y_i$.
3. Page 38, lines 3,4 in second paragraph: replace $\ell_{\mathcal{T}_{-k}}$ symbol with ℓ_{C_k}.
4. Page 38, first line in displayed equation: replace $\ell_{\mathcal{T}_{-k}}$ symbol with $\ell_{C_k}(g_{\mathcal{T}_{-k}})$.
5. Page 57, Figure 2.16. There was a mistake in the drawing of the BIC approximation. The actual BIC approximation matches the posterior density quite well:



6. Page 72, Line −2: ... in terms of the probability ... (remove repeated "the").
7. Page 74, Lines 6 and 10 of `accrejgamma.py`: The parameter `lam` should be replaced with 4 for the proposal pdf `g`.
8. Page 74, Line −3. ... from state x_{t-1} to state x_t ...
9. Page 78, Algorithm 3.27 input: Replace $q(\boldsymbol{x}, \boldsymbol{y})$ with $q(\boldsymbol{y} \,|\, \boldsymbol{x})$.
10. Page 85, Line 7: 0.025 and 0.975 quantiles
11. Page 98, Figure 3.10. Change "unnormalized" to "normalized" in the caption. Also, 0.4.0.2 should be 0.4, 0.2.
12. Page 100, Line −8: $(1 - \alpha\boldsymbol{v})$ should be $(1 - \alpha)\boldsymbol{v}$.
13. Page 103, line above 4th statement of Algorithm 3.4.4: $X_{(1)}$ should be $\mathbf{X}_{(1)}$.
14. Page 104, Line 2: $\lceil\ \rceil$ should be $\lfloor\ \rfloor$.

15. Page 108, Lines 5 and 11: $\mathbb{E}S(\lambda)$ should be $S(\lambda)$.

16. Page 109, Line 12: 1.6 should be 0.6.

17. Page 110, Line −2: …bits that *do not* match …

18. Page 111, Caption of Figure 3.15: …that *do not* match …

19. Page 111, Line 4 under Figure 3.15: “maximize” should be “minimize”

20. Page 112, Lines 1-2: “Note that …”. Should be deleted.

21. Page 112, Line 3: 200 should be 100.

22. Page 112, Line 8: “maximizer” should be “minimizer”

23. Page 112, Line 12: “maximum” should be “minimum”

24. Page 124, Equation (4.9): $\boldsymbol{S}(\boldsymbol{X};\boldsymbol{\theta})$ should be $\boldsymbol{S}(\boldsymbol{X}\,|\,\boldsymbol{\theta})$

25. Page 145, Line 1 of Example 4.6: This refers to Figure 4.4, not Figure 4.8.

26. Page 149, Line −1: $|d_{im} - d_{jm}|$ should be divided by 2.

27. Page 156, Line −5: $u_\ell^\top$ should be $\boldsymbol{u}_\ell^\top$.

28. Page 151, Line −5: Figure 4.12 depicts the ellipsoid $\boldsymbol{x}^\top\boldsymbol{\Sigma}^{-1}\boldsymbol{x} = 1$.

29. Page 160, Exercise 5: $\mathbf{F}(\boldsymbol{\theta})$ should be $\mathbf{F}(\boldsymbol{\theta})/n$.

30. Page 162: Line 12: $\boldsymbol{\Sigma}^{1/2}\boldsymbol{x}$ should be $\boldsymbol{\Sigma}^{-1/2}\boldsymbol{x}$.

31. Page 162: Lines 17 and 20: $\boldsymbol{\Sigma}^{1/2}(\boldsymbol{x}_i - \boldsymbol{\mu})$ should be $\boldsymbol{\Sigma}^{-1/2}(\boldsymbol{x}_i - \boldsymbol{\mu})$.

32. Page 178: fourth line below Table 5.1: replace “qualitative” with “quantitative”.

33. Page 179, Line 5: For independent $Y_1, \ldots, Y_n$, where each Y_i corresponds to the factor values $u_{i1}, \ldots, u_{ir}$, let

34. Page 179, fourth line in Example 5.5: replace “row-wise” with “column-wise” and the vector $\boldsymbol{y}$ with $\boldsymbol{y} = [9.2988, 8.2111, 9.0688, 8.2552, 9.4978, \ldots, 8.9485]^\top$.

35. Page 179, Line −6. Estimation of $\boldsymbol{\beta}$ …

36. Page 181, formula for R^2_{adjusted} at the bottom: replace $n - p - 1$ in the formula with $n - p$.

37. Page 184, formula for F_i should have the norms squared:
$$F_i = \frac{\|\boldsymbol{Y}^{(i)} - \boldsymbol{Y}^{(i-1)}\|^2/p_i}{\|\boldsymbol{Y} - \boldsymbol{Y}^{(d)}\|^2/(n-p)}\ .$$

38. Page 211, Exercise 12 (b): $\mathbf{P}_{ii}$ should be $(1 - \mathbf{P}_{ii})$; that is 1 minus the i-th leverage.

39. Page 219, Line −2: ... only β_1 is regularized.

40. Page 221, Line 8: ... one obtains the so-called ...

41. Page 222, 5th line after Definition 6.1: $\kappa(\boldsymbol{x}, \boldsymbol{x}')$ should be $\kappa(\boldsymbol{x}', \boldsymbol{x})$.

42. Page 235, Line 7: $\int_0^1 (g''(x))^2 \, \mathrm{d}x$ instead of $\int_0^1 (g'')^2 \, \mathrm{d}x$.

43. Page 247, Algorithm 6.8.1, Line 1: $\mathbb{R}^p$ should be $\mathbb{R}^n$.

44. Page 248, Algorithm 6.8.2, Line 1: Set $\mathbf{B} \leftarrow (n\gamma \mathbf{I}_p)^{-1}$.

45. Page 264, Line 8: Replace $g_X(\boldsymbol{x})$ with $g_X(\boldsymbol{x} \,|\, \boldsymbol{\theta})$

46. Page 273, 3rd line under Figure 7.9: The results are summarized in Table 7.6.

47. Page 290, first line under Algorithm 8.2.1: change R_{ν_T} and R_{ν_F} to $\mathcal{R}_{\nu_\mathrm{T}}$ and $\mathcal{R}_{\nu_\mathrm{F}}$.

48. Page 291, line 2: $g^v(\boldsymbol{x})$ should be $g^w(\boldsymbol{x})$.

49. Page 313, formula (8.21): g_0 should be $g_0(\boldsymbol{x})$.

50. Page 329, line 12 from below: change y_{i-k} to y_{i-k+1}.

51. Page 331, last displayed equation:

$$\frac{\partial C}{\partial \boldsymbol{b}_l} = \frac{\partial z_l}{\partial \boldsymbol{b}_l} \frac{\partial C}{\partial z_l} = \boldsymbol{\delta}_l, \quad l = 1, \ldots, L.$$

52. Page 333, line 4 of Example 9.4: "inputs y" should be "inputs $\boldsymbol{x}$".

53. Page 335, Algorithm 9.4.2, Line 2: ... using $\frac{\partial C}{\partial g} = 1$ ...

54. Page 340, second displayed line:

$$[p_0, p_1, p_2, p_3] = [1, 20, 20, 1].$$

55. Page 341, Line 3: Remove the line `S = RELU`.

56. Page 351, Exercise 7(b): In the displayed formula, $\mathbf{B}$ should be replaced with $\mathbf{B}^{-1}$.

57. Page 361, 3rd line in the proof of Theorem A.3: $\{v_i\}$ should be $\{\boldsymbol{v}_i\}$.

58. Page 362, First sentence in paragraph above Theorem A.4: ... the matrix $\mathbf{P}$ projects any vector in $\mathcal{V}$ onto itself.

59. Page 362, Sentence above Theorem A.4: ... where $\mathbf{U}$ is not ...

60. Page 376, last displayed equation: Replace $\begin{bmatrix} \boldsymbol{x}_1, x_2 \end{bmatrix}$ with $\begin{bmatrix} \boldsymbol{x}_1 \\ x_2 \end{bmatrix}$.

61. Page 377, Lines 6,7: $\boldsymbol{u}_n$ should be $\boldsymbol{u}_m$ and $\mathbb{C}^n$ should be $\mathbb{C}^m$.

62. Page 378, line 3: Replace $\mathbf{V}^\top$ with $\mathbf{V}$.

63. Page 380, third line from below: change b_{i-k} to b_{i-k+1}.

64. Page 394, line 5: ... can be computed with the aid ... (missing "the")

65. Page 385, halfway: ...counting measure on $\mathbb{Z}^d$.

66. Page 400, first two lines of Section B.1.2: $\boldsymbol{f} : \mathbb{R}^k \to \mathbb{R}^m$, $\boldsymbol{g} : \mathbb{R}^m \to \mathbb{R}^n$, and $\boldsymbol{g} \circ \boldsymbol{f}$ is a function from $\mathbb{R}^k$ to $\mathbb{R}^n$.

67. Page 401, Line -1: By Theorem A.8 ...

68. Page 405, Line 8: replace "$f(\boldsymbol{x} + t_1\boldsymbol{d}) \geq f(\boldsymbol{x}) + t_1\, \boldsymbol{v}^\top \boldsymbol{d}$ and $f(\boldsymbol{x} + t_2\boldsymbol{d}) \geq f(\boldsymbol{x}) + t_2\, \boldsymbol{v}^\top \boldsymbol{d}$ for some subgradient $\boldsymbol{v}$" with "$f(\boldsymbol{a}) \geq f(\boldsymbol{b}) + (\boldsymbol{a} - \boldsymbol{b})^\top \boldsymbol{v}$ for some subgradient $\boldsymbol{v}$" and replace "Subtracting the last two equations" with "Substituting with $\boldsymbol{a} = \boldsymbol{x} + t_1\boldsymbol{d}$ and $\boldsymbol{b} = \boldsymbol{x} + t_2\boldsymbol{d}$".

69. Page 404, last two lines: replace H with $\mathbf{H}$.

70. Page 414, Section B.3.4: Replace ℓ with ℓ_τ.

71. Page 433, displayed equation in the proof of Theorem C.4: replace $|\mathbf{J}_{\mathbf{g}^{-1}}(z)|$ with $|\det(\mathbf{J}_{\mathbf{g}^{-1}}(z))|$.

72. Page 439, line 4: is equal to $\Gamma(\alpha)\lambda^{-\alpha}$ times ...

73. Page 442, 4th line from the bottom: $x \geq c$ should be $x > c$.

74. Page 445, halfway on the page: $|\mathrm{e}^{\mathrm{i}x} - 1| = \left|\int_0^x \mathrm{i}\, \mathrm{e}^{\mathrm{i}\theta}\, \mathrm{d}\theta\right| \leq \left|\int_0^x |\mathrm{i}\, \mathrm{e}^{\mathrm{i}\theta}|\, \mathrm{d}\theta\right| = |x|$.

75. Page 446, displayed equation below (C.37): $\mathcal{O}(t/n)$ should be $o(t/n)$, and in the next displayed equation, $o(1)$ should be $o(1/n)$.

76. Page 448, line 2: $\mathcal{O}(t^3/n^{3/2})$ should be $o(t^2/n)$.

77. Page 450, first displayed equation after (C.39): The $\mathbf{\Sigma}$ in the denominator should be $\mathbf{\Sigma}_n$.

78. Page 451: Delete "ln" after "An application ... yields"

79. Page 451, line starting with "asymptotically negligible": Replace n with $-n$ in the exponent.

80. Page 456, Sentence under (C.47): Similar to the one-dimensional case ($d = 1$), replacing the factor $1/n$ with $1/(n-1)$ gives an unbiased estimator, called the *sample covariance matrix*.

81. Page 457, last line of Example C.13: $g'(\theta)$ should be $l'(\theta)$.

82. Page 511, line 13 from above: 'expectation of'.