Errata and additions in the text

Below are errata and minor alterations that improve the style or clarify the book. To see which printing of the book you have, look on the third page of the text itself, which faces the dedication page. At the bottom you will see:

Printed in the United States of America
10 9 8 7 6 5 4 3

The last number at the right gives the number of the printing; thus, as illustrated here, "3" means that yours is the third printing.

Below, "*line +7*" means the seventh line from the top of the text body (not including figure or table captions, or other headlines unless otherwise indicated), and "*line -5*" means the fifth line from the bottom of the text body. In Algorithms, the numbering refers to the line numbers within the algorithm itself. Thus **Algorithm 4**, *line 5*" means line 5 in Algorithm 4, not the fifth line from the top of the page.

First and second printings

Front matter

page x *line +6*: Change "4.8 Reduced Coulomb" to "*4.8 Reduced Coulomb"

page xv *line -13*: Change "A.4.7 The Law of Total Probability and Bayes' Rule" to "A.4.7 The Law of Total Probability and Bayes Rule"

page xviii Take the last sentence under **Examples**, "In addition, in response to popular demand, a Solutions Manual has been prepared to help instructors who adopt this book for courses." and move it to be the final sentence under **Problems**, lower on the same page.

page xviii *lines -10– -11*: Change "and they are generally" to "and they are typically"

page xix *line -15*: Change "Ricoh Silicon Valley" to "Ricoh Innovations"

Chapter 1

page 1 *line +4*: Change "data and taking" to "data and making"

page 4 the only equation on the page: Change "$\mathbf{x} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$" to "$\mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$"

page 11 *line +21*: Change "us for practical, rather than" to "us for practical rather than"

page 14 *line -4* in the caption to Figure 1.8: Change "of the data impact both" to "of the data affect both"

page 19 *line +15*: Change "is achieved in humans" to "is performed by humans"

Chapter 2

page 21 *line -6* in the footnote: Change "should be written as $p_X(x|\omega)$" to "should be written as $p_x(x|\omega)$"

page 21 *line -4* in the footnote: Change "clear that $p_X(\cdot)$ and $p_Y(\cdot)$" to "clear that $p_x(\cdot)$ and $p_y(\cdot)$"

page 22 *second line after Eq. 3*: Change "probability (or *posterior*) probability" to "probability (or *posterior*)"

page 22 Eq. 5: Change "$P(error, x)$" to "$p(error, x)$"

page 23 *second line after Eq. 7*: Change "By using Eq. 1, we can" to "By using Eq. 1 we can"

page 26 *first line after Eq. 17*: Change "and ω_2 otherwise." to "and otherwise decide ω_2."

page 27 *line -1* above Sect. 2.3.1: Change "gets smaller, as it should." to "gets larger, as it should." [Figure 2.3 is altered to have $\theta_b < \theta_a$.]

page 28 Equation 23: Change "$(\lambda_{11}-\lambda_{22})-(\lambda_{21}-\lambda_{11})$" to "$(\lambda_{11}-\lambda_{22})+(\lambda_{21}-\lambda_{11})$"

page 28 *second line after Eq. 24*: Change "decision boundary gives" to "decision boundary then gives"

page 32 *second line after Eq. 33*: Change "expected values — by these" to "expected values by these"

page 34 Eq. 44: Change "$\mathbf{\Phi\Lambda}^{-1/2}$" to "$\mathbf{\Phi\Lambda}^{-1/2}\mathbf{\Phi}^t$"

page 36 *first equation after Eq. 49*: Change "Let us examine the discriminant" to "Let us examine this discriminant"

page 41 Figure 2.13, caption, *line +2*: Change "unequal variance." to "unequal variance, as shown in this case with $P(\omega_1) = P(\omega_2)$."

page 47 Equation 73: Change "for0" to "for 0" (i.e., add space)

page 47 Equation 75: The $\mathbf{\Sigma}_1$ and $\mathbf{\Sigma}_2$ are interchanged. (This error also appears in Keinosuke Fukunaga, **Introduction to Statistical Pattern Recognition** (2nd ed.) Academic Press 1990, Eq. 3.150, page 98.) Equation 75 should read:

$$\begin{aligned} k(\beta) &= \frac{\beta(1-\beta)}{2}(\boldsymbol{\mu}_1-\boldsymbol{\mu}_2)^t\left[(1-\beta)\mathbf{\Sigma}_1+\beta\mathbf{\Sigma}_2\right]^{-1}(\boldsymbol{\mu}_1-\boldsymbol{\mu}_2) \\ &\quad +\frac{1}{2}\ln\frac{(1-\beta)\mathbf{\Sigma}_1+\beta\mathbf{\Sigma}_2}{|\mathbf{\Sigma}_1|^{1-\beta}|\mathbf{\Sigma}_2|^{\beta}}. \end{aligned}$$

page 47 *third line after Eq. 75*: Change "that minimizes $e^{-k(\beta)}$" to "that minimizes $P^{\beta}(\omega_1)P^{1-\beta}(\omega_2)e^{-k(\beta)}$"

page 47 *line - 10*: Change "substituting the results in Eq. 73" to "substituting this β into Eq. 73"

page 47 *line -2*: Change "This result is the so-called" to "This gives the so-called"

page 48 Example **2**, *line +3*: Change "4.11," to "4.11157,"

page 48 Example **2**, *line +4*: Change "0.016382." to "0.008191."

page 48 Example **2**, second paragraph: Change "A tighter bound" to "A slightly tighter bound"

page 48 Example **2**, second paragraph, *line +2*: Change "0.016380" to "0.008190."

page 50 The x-axis label on Fig. 2.20: Change "$P(x < x^*|x \in \omega_2)$" to "$P(x < x^*|x \in \omega_1)$"

pages 56 − 62 At the time of the release of the first printing, the problem of inference in Bayes belief nets *with loops* was not fully solved. Since that time, however, such a solution has emerged and for this reason Section 2.11 has been rewritten accordingly. This revision is posted on the Wiley site.

page 66 Problem **2**, part (b), *line +2*: Change "for arbitrary a_i and b_i." to "for arbitrary a_i and positive b_i."

page 66 Problem **3**, part (a) equation: End the equation with a period (full stop).

page 67 Problem **5**, part (d): Change "What is the minimax risk?" to "What is the minimax risk for part (c)?"

page 67 Problem **6**, part (2), *line +2*: Change "Determine the decision boundary" to "Determine the single-point decision boundary"

page 69 Move the title "**Section 2.4**" to the top of the page so that Problem **13** is now under **Section 2.4**.

page 71 Problem **20**, part (a), *line +1*: Change "we know only that a distribution is nonzero in" to "we know solely that a distribution is nonzero only in"

page 71 Problem **20**, part (b), *line +1*: Change "we know only that a distribution is nonzero for" to "we know solely that a distribution is nonzero only for"

page 71 Problem **20**, part (c), *line +2*: Change "standard deviation σ^2" to "standard deviation σ"

page 71 Problem **21**, *line +2*: Change "standard deviation σ^2" to "standard deviation σ"

page 71 Problem **23**, at the center of the typeset equation, change "and$\mathbf{\Sigma}$" to "and $\mathbf{\Sigma}$" (i.e., add space)

page 72 Problem **24**, *line +1*: Change "normal density for which $\sigma_{ij} = 0$" to "normal density with mean $\boldsymbol{\mu}$, $\sigma_{ij} = 0$"

page 73 Problem **34**, *line +6–7*: Change "assume the distributions" to "assume $P(\omega_1) = P(\omega_2) = 0.5$ and the distributions"

page 73 Problem **34**, part c), *line +4*: Change "Bayes error is 0.5." to "Bayes error is 0.25."

page 75 Problem **37**, *first equation*: Change "and$P(\omega_1)$" to "and $P(\omega_1)$" (i.e., add space)

page 75 Problem **37**, part (c) *equation*: Change "and$p(\mathbf{x}|\omega_2)$" to "and $p(\mathbf{x}|\omega_2)$" (i.e., add space)

page 75 Problem **39**, *line +1*: Change "Use the signal detection" to "Use signal detection"

page 75 Problem **39**, part (a), *line +1*: Change "and $P(x < x^*|x \in \omega_2)$, taken" to "and $P(x > x^*|x \in \omega_1)$, taken"

page 75 Problem **39**, part (b): Replace the last two sentences with "Estimate d' if $P(x > x^*|x \in \omega_1) = 0.8$ and $P(x > x^*|x \in \omega_2) = 0.3$. Repeat for $P(x > x^*|x \in \omega_1) = 0.7$ and $P(x > x^*|x \in \omega_1) = 0.4$."

page 75 Problem **39**, part (d): Replace the two equation lines with "**Case A:** $P(x > x^*|x \in \omega_1) = 0.8$, $P(x > x^*|x \in \omega_2) = 0.3$ or
Case B: $P(x > x^*|x \in \omega_1)$, $P(x > x^*|x \in \omega_2) = 0.7$."

page 76 Problem **41**, *first line after the equation*: Change "$(\mu_2 - \mu_1)/\delta_i$ " to "$(\mu_2 - \mu_1)/\delta$"

page 76 Problem **41**, part (b): Change "$d'_T = 1.0$." to "$d'_T = 1.0$ and 2.0."

page 76 Problem **41**, part (c): Change "$P(x > x^*|x \in \omega_1) = .2$." to "$P(x > x^*|x \in \omega_1) = .7$."

page 76 Problem **76**, part (e): Change "measure $P(x > x^*|x \in \omega_2) = .9$ and $(x > x^*|x \in \omega_1) = .3$." to "measure $P(x > x^*|x \in \omega_2) = .3$ and $P(x > x^*|x \in \omega_1) = .9$."

page 81 Computer exercise **6**, part (b), *line +1*: Change "Consider" to "Consider the normal distributions"

page 81 Computer exercise **6**, part (b), *equation*: Change "and$p(\mathbf{x}|\omega_2)$" to "and $p(\mathbf{x}|\omega_2)$" (i.e., add space)

page 81 Computer exercise **6**, part (b), *equation*: Move "with $P(\omega_1) = P(\omega_2) = 1/2$." out of the centered equation, and into the following line of *text*.

page 83 *first column*, entry for [21], *lines +3 – 4*: Change "Silverman edition, 1963." to "Silverman, 1963."

Chapter 3

page 87 *line -5*: Change "$l(\boldsymbol{\theta})p(\boldsymbol{\theta})$" to "$l(\boldsymbol{\theta}) + \ln p(\boldsymbol{\theta})$"

page 88 Equation 9: Change "$\boldsymbol{\nabla}_{\boldsymbol{\theta}\boldsymbol{\mu}}$" to "$\boldsymbol{\nabla}_{\boldsymbol{\mu}}$"

page 91 Ninth line after Eq. 22: Change "shall consider), the samples" to "shall consider) the samples"

page 97 *line +3*: Change "Problem 17" to "Problem 18'

page 99 Caption to first figure, change "starts our as a flat" to "starts out as a flat"

page 100 *line -5*: Change "are equivalent to" to "are more similar to"

page 100 *line -5 – -4*: Change "If there are much data" to "If there is much data"

page 102 *line 5*: Change "*invarinace*" to "*invariance*"

page 102 *first line after Eq. 54*: Change "paramter" to "parameter"

page 102 *line -5*: Change "(Computer exercise 22)" to "(Problem 22)"

page 103 *line -2*: Change "choice of an prior" to "choice of a prior"

page 104 *line +6*: Change "if" to "only if"

page 104 *line +16*: Change "only if" to "if"

page 104 Equation 62: Make the usage and style of the summation sign ($\sum$) uniform in this equation. Specifically, in two places put the arguments *beneath* the summation sign, that is, change "$\sum_{\mathcal{D}\in\bar{\mathcal{D}}}$" to "$\sum\limits_{\mathcal{D}\in\bar{\mathcal{D}}}$"

page 105 first line after Eq 63: Change "to this kind of scaling." to "to such scaling."

page 107 First unnumbered equation: Change "$\mathbf{c}(\mathbf{x})$" to "$\mathbf{c}(\mathbf{x}_k)$"

page 107 *2 lines above Eq. 71*: Change "Problem 30" to "Problem 31"

page 111 *lines +9 – 10*: Change "constants c_0 and x_0 such that $|f(x)| \leq c_0|h(x)|$ for all" to "constants c and x_0 such that $|f(x)| \leq c|h(x)|$ for all"

page 111 *line +14*: Change "proper choice of c_0 and x_0." to "proper choice of c and x_0."

page 111 *line -6*: Change "its determinant is an $O(d^2)$" to "its determinant is an $O(d^3)$"

page 111 Eq. 74: Change the annotations above the equation from "$O(dn)$ $O(nd^2)$ $O(1)$ $O(d^2n)$ $O(n)$" to "$O(dn)$ $O(nd^3)$ $O(1)$ $O(d^3)$ $O(n)$"

page 116 Equation 86: Change "$\lambda\mathbf{e}^t\mathbf{e}$" to "$\lambda(\mathbf{e}^t\mathbf{e} - 1)$"

page 125 **Algorithm 1**, *line 1*: Change "$i = 0$" to "$i \leftarrow 0$"

page 126 *first line of the equation at the middle of the page*: Change

$$Q(\boldsymbol{\theta};\ \boldsymbol{\theta}^0) = \mathcal{E}_{x_{41}}[\ln p(\mathbf{x}_g, \mathbf{x}_b;\ \boldsymbol{\theta}|\boldsymbol{\theta}^0;\ \mathcal{D}_g)]$$

to

$$Q(\boldsymbol{\theta};\ \boldsymbol{\theta}^0) = \mathcal{E}_{x_{41}}[\ln p(\mathbf{x}_g, \mathbf{x}_b;\ \boldsymbol{\theta})|\mathcal{D}_g;\ \boldsymbol{\theta}^0]$$

page 127 *lines -2– -1*: Change "$x_{41} = 2$, so that $\mathbf{x}_4 = \binom{2}{4}$" to "$x_{41} = 1$, so that $\mathbf{x}_4 = \binom{1}{4}$"

page 128 *line +6*, (second line after the Example): Change "the EM algorithm, and they" to "the EM algorithm as they"

page 129 second line aboove Section 3.10.3: Change "while the ω_i are unobservable" to "while the ω_j are unobservable"

page 132 *line +3*: Change "b_{kj}, and thus" to "b_{jk}, and thus"

page 132 Equation 136: Replace by:

$$\alpha_j(t) = \begin{cases} 0 & t = 0 \text{ and } j \neq \text{initial state} \\ 1 & t = 0 \text{ and } j = \text{initial state} \\ \left[\sum_i \alpha_i(t-1)a_{ij}\right] b_{jk} v(t) & \text{otherwise.} \end{cases}$$

page 132 third line after Eq. 136: Change "Consequently, $\alpha_i(t)$ represents" to "Consequently, $\alpha_j(t)$ represents"

page 132 fourth line after Eq. 136: Change "hidden state ω_i" to "hidden state ω_j"

page 132 **Algorithm 2**, *line 1*: Delete "$\omega(1)$,"

page 132 **Algorithm 2**, *line 1*: Change "$t = 0$" to "$t \leftarrow 0$"

page 132 **Algorithm 2**, *line 1*: Change "$\alpha(0) = 1$" to "$\alpha_j(0)$"

page 132 **Algorithm 2**, *line 3*: Replace entire line by "$\alpha_j(t) \leftarrow b_{jk} v(t) \sum_{i=1}^{c} \alpha_i(t-1)a_{ij}$"

page 132 **Algorithm 3**: Somehow the line numbering became incorrect. Change the line number to be sequential, $1, 2, \ldots 6$.

page 132 **Algorithm 3**, *line 1*: Change "$\omega(t), t = T$" to "$\beta_j(T), t \leftarrow T$"

page 132 **Algorithm 3**, old *line 4*, renumbered to be *line 3*: Replace entire line by "$\beta_i(t) \leftarrow \sum_{j=1}^{c} \beta_j(t+1)a_{ij}b_{jk}v(t+1)$"

page 132 **Algorithm 3**, old *line 7*, renumbered *line 5*: Change "$P(V^T)$" to "$P(\mathbf{V}^T)$" (i.e., make the "V" bold)

page 133 Figure 3.10, change the label on the horizontal arrow from "a_{12}" to "a_{22}".

page 133 Figure 3.10, caption, *line +5*: Change "was in state $\omega_j(t = 2)$" to "was in state $\omega_i(t = 2)$"

page 133 Figure 3.10, caption, *line +6*: Change "is $\alpha_j(2)$ for $j = 1, 2$" to "is $\alpha_i(t)$ for $i = 1, 2$"

page 133 Figure 3.10, caption, *line -1*: Change "$\alpha_2(3) = b_{2k} \sum_{j=1}^{c} \alpha_j(2) a_{j2}$" to "$\alpha_2(3) = b_{2k} \sum_{i=1}^{c} \alpha_i(2) a_{i2}$"

page 133 *line -6*: Change "$\mathbf{V}^5 = \{v_3, v_1, v_3, v_2, v_0\}$" to "$\mathbf{V}^4 = \{v_1, v_3, v_2, v_0\}$"

page 133 *line -44*: Change "is shown above," to "is shown at the top of the figure"

page 134 Figure in Example 3, caption, *line +4*: Change "$\alpha_i(t)$ — the probability" to "$\alpha_j(t)$ — the probability"

page 134 Figure in Example 3, caption, *line +6*: Change "and $\alpha_i(0) = 0$ for $i \neq 1$." to "and $\alpha_j(0) = 0$ for $j \neq 1$."

page 134 Figure in Example 3, caption, *line +6*: Change "calculation of $\alpha_i(1)$." to "calculation of $\alpha_j(1)$."

page 134 Figure in Example 3, caption, *line -6*: Change "calculation of $\alpha_i(1)$" to "calculation of $\alpha_j(1)$"

page 134 igure in Example 3, caption, *line -4*: Change "contribution to $\alpha_i(1)$."to "contribution to $\alpha_j(1)$."

page 135 Algorithm 4: somehow the line numbering became incorrect. Change the line numbering to be sequential, 1, 2, 3, ..., 11. In the old line 4 (now renumbered 3): Change "$k = 0, \alpha_0 = 0$" to "$j \leftarrow -1$"

page 135 Algorithm 4 old *line 5* (now renumbered 4): Change "$k \leftarrow k + 1$" to "$j \leftarrow j + 1$"

page 135 Algorithm 4 old *line 7* (now renumbered 5): Change "$\alpha_k(t)$" to "$\alpha_j(t)$"

page 135 Algorithm 4, old *line 8* (now renumbered 6): Change "$k = c$" to "$j = c$"

page 135 Algorithm 4, old *line 11* (now renumbered 8): Change "*AppendTo* Path $\omega_{j'}$" to "*Append* $\omega_{j'}$ *to* Path"

page 135 *line -5*: Change "The red line" to "The black line"

page 135 *line -4*: Change "value of α_i at each step" to "value of α_j at each step"

page 137 Equation 138: Replace equation by

$$\beta_i(t) = \begin{cases} 0 & \omega_i(t) \neq \omega_0 \text{ and } t = T \\ 1 & \omega_i(t) = \omega_0 \text{ and } t = T \\ \sum_j \beta_j(t+1) a_{ij} b_{jk} v(t+1) & \text{otherwise.} \end{cases}$$

page 137 seventh line after Eq. 138: Change "$\beta_i(T-1) = \sum_j a_{ij} b_{ij} v(T) \beta_i(T)$." to "$\beta_i(T-1) = \sum_j a_{ij} b_{jk} v(T) \beta_j(T)$."

page 137 fourth line before Eq. 139: Change "probabilities a_{ij} and b_{ij}" to "probabilities a_{ij} and b_{jk}"

page 137 Equation 139: Change "b_{ij}" to "b_{jk}"

page 138 *line +3*: Change "whereas at step t it is" to "whereas the total expected number of any transitions from ω_i is"

page 138 first line after Eq. 140: Change "$\hat{b}_{ij}$" to "$\hat{b}_{jk}$"

page 138 Equation 141: Replace equation by:

$$\hat{b}_{jk} = \frac{\sum_{t=1}^{T} \sum_{l} \gamma_{jl}(t)}{\sum_{t=1}^{T} \sum_{l} \gamma_{jl}(t)} \quad {\scriptstyle v(t)=v_k}$$

page 138 **Algorithm 5**, *line 1*: Change "criterion θ"to "criterion $\theta, z \leftarrow 0$"

page 138 Algorithm 5, *line 5*: Change "$\hat{a}_{ij}(z-1)$" to "$\hat{a}_{ij}(z)$"

page 138 Algorithm 5, *line 6*: Change "$\hat{b}_{ij}(z-1)$" to "$\hat{b}_{ij}(z)$"

page 143 Problem **11**, second and third lines after first equation: Change "$p_2(\mathbf{x})$ by a normal $p_1(\mathbf{x}) \sim N(\boldsymbol{\mu}, \boldsymbol{\Sigma})$" to "$p_1(\mathbf{x})$ by a normal $p_2(\mathbf{x}) \sim N(\boldsymbol{\mu}, \boldsymbol{\Sigma})$"

page 143 Problem **11**: Second equations: Change "$\mathcal{E}_2$" to "$\mathcal{E}_1$" in two places

page 143 Problem **11**, last line: Change "over the density $p_2(\mathbf{x})$" to "over the density $p_1(\mathbf{x})$"

page 147 Problem **22**, line between the two equations: Change "has a uniform" to "has a uniform distribution"

page 148 Problem **27**, part (a), line after the equation: Change "as given in Table 3.1." to "as in Table 3.1.1."

page 149 Problem **31**, *line +1*: Change "suppose a and b are constants" to "suppose a and b are positive constants"

page 149 Problem **32**, *line +1*: Change "where the n coefficients" to "at a point x, where the n coefficients"

page 150 Problem **34**, *line +4*: Change "the number of operations n" to "the maximum size n"

page 151 Problem **38**, *line +1*: Change "$p_x(\mathbf{x}|\omega_i)$" to "$p_{\mathbf{x}}(\mathbf{x}|\omega_i)$"

page 151 Problem **38 (b)** bottom equation on page: Change "$(\boldsymbol{\mu}_1 - \boldsymbol{\mu}_2)^2$" to "$(\mu_1 - \mu_2)^2$"

page 152 *line +1*: Change "and" to "is maximized by"

page 153 Problem **43**, *line +4*: Change "and the d mean vectors." to "and the c mean vectors."

page 154 Problem **46**, (top equation): Change "0 otherwise." to "ϵ otherwise."

page 154 Problem **46**, *line +1* (after the equation): Change "missing feature values." to "missing feature values and ϵ is a very small positive constant that can be neglected when normalizing the density within the above bounds."

page 154 Problem **46**, part (b): Add "You may make some simplifying assumptions."

page 154 Problem **47**, first equation: Change "$e^{-\theta_1 x_1}$" to "e^{-x_1/θ_1}"

page 156 Computer exercise 2, after the equation: Change "calculate a density" to "calculate the density"

page 156 Computer exercise 2. After "x_2 feature of category ω_2." add "Assume your priors on the parameters are uniform throughout the range of the data."

page 157 Computer exercise **4**, *line -3*: Change "apply it to the $x_1 - x_2$ components" to "apply it to the x_1–x_2 components" (i.e., eliminate spaces and note that the dash is not subtraction sign, but an n-dash)

page 157 Computer exercise **6**, part (a), *line +2*: Change "in the Table above." to "in the table above."

page 159 Computer exercise **13** table, sample 4 under ω_1: Change "`AD`" to "`ADB`"

Chapter 4

page 172 Figure 4.9, caption, *line -1*: Change "where $\mathbf{I}$ is the $d \times d$ idenity matrix." to "where $\mathbf{I}$ is the d-by-d identity matrix."

page 173 **Algorithm 1**, *line 1*: Change "$j = 0$" to "$j \leftarrow 0$"

page 173 *Algorithm 1*, *line 5*: Change "$\mathbf{x} \in \omega_i$" to "$\mathbf{x}_j \in \omega_i$"

page 173 *line after Eq. 28*: Change "each output unit" to "each category unit"

page 173 *two lines above Eq. 29*: Change "activation function function" to "activation function"

page 173 **Algorithm 2**, *line 1*: Change "test pattern," to "test pattern"

page 178 *line +3*: Change "Becuase" to "Because"

page 179 Equation 41: Change "$\int_{\mathbf{x}' \in \mathcal{S}}$" to "$\int\limits_{\mathbf{x}' \in \mathcal{S}}$" (i.e., place the limits underneath the integral sign)

page 184 *lines +2 – 3*: Keep "$k - i > i$" on the same line (i.e., do not put a line break in this equation)

page 185 *line 1*: Change "$O(dn^2)$" to "$O(dn)$"

page 186 **Algorithm 3**, *line 1*: Change "$j = 0, \mathcal{D} =$ data set, $n =$ # prototypes" to "$j \leftarrow 0, \mathcal{D} \leftarrow$ data set, $n \leftarrow$ # prototypes"

page 187 Figure 4.18, caption, *line -4*: Change "by a factor 1/3" to "by a factor $\alpha = 1/3$"

page 188 First margin note: Change "MINKOWSKI METRIC" to "MINKOWSKI METRIC" (i.e., capitalize the M in MINKOWSKI)

page 188 Second margin note: Change "MANHATTAN DISTANCE" to "MANHATTAN DISTANCE" (i.e., capitalize the M in MANHATTAN)

page 188 Third margin note: Change "TANIMOTO METRIC" to "TANIMOTO METRIC" (i.e., capitalize the T in TANIMOTO)

page 189 *line +5*: Change "the relative shift is a mere" to "the relative shift s is a mere"

page 192 *line -7*: Change "is that that in the extreme cases the" to "is that in the extreme cases when the"

page 192 Figure 4.23, caption, *lines -4– -2*: Eliminate the second-to-last sentence.

page 193 Equation 61: Replace the full equation with "$\mu_x(x) \cdot \mu_y(y)$"

page 194 *line +19*: Change "beief about memberships" to "belief about memberships"

page 194 *3 lines above numbered list*: Change "we should deman" to "we should demand"

page 194 *one line above numbered list*: Change "Cox-Jaynes axioms):" to "Cox-Jaynes axioms), which includes:"

page 195 *line +9*: Change in the title "**4.8 REDUCED COULOMB**" to "***4.8 REDUCED COULOMB**"

page 196 **Algorithm 4**, *line 1*: Change "$j = 0, n = \#$ patterns, $\epsilon =$ small parameter, $\lambda_m =$ max radius" to "$j \leftarrow 0, n \leftarrow \#$ patterns, $\epsilon \leftarrow$ small parameter, $\lambda_m \leftarrow$ max radius"

page 196 *Algorithm 4*, *line 4*: Change the small element below from "$\mathbf{x} \notin \omega_i$" to "$\mathbf{x}' \notin \omega_k$"

page 196 *Algorithm 4*, *line 5*: Replace equation portion by "$\lambda_j \leftarrow \min[\max[D(\hat{\mathbf{x}}, \mathbf{x}'), \epsilon], \lambda_m]$"

page 197 **Algorithm 5**, *line 1*: Change "$j = 0, k = 0, \mathbf{x} =$ test pattern, $\mathcal{D}_t = \{\}$" to "$j \leftarrow 0, k \leftarrow 0, \mathbf{x} \leftarrow$ test pattern, $\mathcal{D}_t \leftarrow \{\}$"

page 199 *line -7*: Change "prior knowledge." to "prior beliefs."

page 200 *line -8*: Change "Jayne" to "Jaynes"

page 202 Problem 6c, first line: Change "increases" to "increase"

page 203 Problem **11**, part (d), *line +1*: Change "close to an edge" to "close to a face"

page 203 Problem **11**, part (d) *line +4*: Change "closer to an edge" to "closer to a face"

page 203 Problem **11**, part (d), *line +5*: Change "even though it is easier to calculate here" to "and happens to be easier to calculate"

page 204 Problem **13** *line +1*: Change "from the distributions" to "with priors $P(\omega_1) = P(\omega_2) = 0.5$ and the distributions"

page 205 Problem **21**, part (a), *line +1*: Change "As given in the text, take" to "Follow the treatment in the text and take"

page 206 Problem **23** part (d) *line +2*: Change "space, then the **b**" to "space, then in the **b**"

page 206 Problem **26**, *line +4*: Change "and find its nearest" to "and seek its nearest"

page 207 Problem **26** part (d), first line: change "Calculate the probability" to "Estimate through simulation the probability"

page 207 Problem **27**, part (a) equation: Replace current equation with "$D_{Tanimoto}(\mathcal{S}_1, \mathcal{S}_2) = \frac{n_1+n_2-2n_{12}}{n_1+n_2-n_{12}}$,"

page 207 Problem **29**, first equation: Change "δ_i" to "δ_1" in all three places

page 207 Problem **29**, second equation: Change "$\hat{C}(x, \mu_i$" to "$\hat{C}(x;\ \mu_i$"

page 207 Problem **29** second equation: Change "δ_i" to "δ_2" in all three places

page 207 Problem **29** *line -5*: Change "we have for the length $\delta_i = 5$" to "we have for the length $\delta_1 = 5$"

page 207 Problem **29** *line -4*: Change "and for lightness $\delta_j = 30$" to "and for the lightness $\delta_2 = 30$"

page 213 Replace reference [23] with: "Edwin T. Jaynes and G. Larry Bretthorst, *Probability Theory: The Logic of Science*, Cambridge U. Press, 2003."

Chapter 5

page 218 *line +6*: Change "the problem to $c - 1$" to "the problem to c"

page 218 Equation 2: Change "$\mathbf{w}^t\mathbf{x}_i$" to "$\mathbf{w}_i^t\mathbf{x}$"

page 218 Figure 5.3, bottom sub-figure: The pink "ambiguous" region should not include the three small triangles $\Delta H_{14}H_{23}H_{24}$, $\Delta H_{24}H_{13}H_{34}$, $\Delta H_{34}H_{12}H_{23}$ nor the quadralateral $\Box H_{14}H_{34}H_{24}H_{12}$.

page 219 second line after the second (unnumbered) equation: Change "is given by $(g_i - g_j)/\|\mathbf{w}_i - \mathbf{w}_j\|$" to "is given by $(g_i(\mathbf{x}) - g_j(\mathbf{x}))/\|\mathbf{w}_i - \mathbf{w}_j\|$"

page 220 sentence before Eq. 5, Change "this in turn suggest" to "this in turn suggests"

page 221 *line +8*: Change "Figure 5.6 shows" to "Figure 5.5 shows"

page 221 *line -11*: Change "$O(\hat{d}^k)$" to "$O(d^k)$"

pages 221–222 (across the page break): Change "mul-tilayer" to "multi-layer" (i.e., hyphenate as "multi-layer")

page 225 **Algorithm 1**, *line 1*: Change "$k = 0$" to "$k \leftarrow 0$"

page 228 **Algorithm 3**, *line 1*: Change "$k = 0$" to "$k \leftarrow 0$"

page 229 *line +5*: Change "We shall begin our examination" to "We begin our examination"

page 229 Caption to Figure 5.12, *line +4*: Change "this sequence is $\mathbf{y}_2$, $\mathbf{y}_3$, $\mathbf{y}_1$, $\mathbf{y}_3$" to "this sequence is $\mathbf{y}_1 + \mathbf{y}_2 + \mathbf{y}_3$, $\mathbf{y}_2$, $\mathbf{y}_3$, $\mathbf{y}_1$, $\mathbf{y}_3$"

page 229 *line -3*: Change "Thus we shall denote" to "Thus we denote"

page 230 **Algorithm 4**, *line 1*: Change "$k = 0$" to "$k \leftarrow 0$"

page 230 fourth line before **Theorem 5.1**: Change "correction is clearly moving" to "correction is hence moving"

page 230 *line -2*: Change "From Eq. 20," to "From Eq. 20 we have"

page 232 first line after Eq. 24: Change "Because the squared distance" to "Because this squared distance"

page 233 **Algorithm 5**, *line 1*: Change "$k = 0$" to "$k \leftarrow 0$"

page 233 **Algorithm 6**, *line 1*: Change "$k = 0$" to "$k \leftarrow 0$"

page 234 *line +22* (counting from the end of the Algorithm): Change "that it will have little effect at all." to "that it will have little if any effect."

page 235 *lines +3 –4* (counting from the end of the Algorithm): Change "and this means the "gap," determined by these two vectors, can never increase in size for separable data." to "and this means that for separable data the "gap," determined by these two vectors, can never increase in size."

page 235 second and third lines after the section title **5.6 RELAXATION PROCEDURES**: Change "in so-called "relaxation procedures" to include" to "in so-called "relaxation procedures," to include"

page 235 first and second lines after Eq. 32: Change "misclassified by $\mathbf{a}$, as do J_p, J_q focus attention" to "misclassified by $\mathbf{a}$. Both J_p and J_q focus attention"

page 235 second line after Eq. 32: Change "Its chief difference is that its gradient" to "The chief difference is that the gradient of J_q is"

page 236 **Algorithm 8**, *line 1*: Change "$k = 0$" to "$k \leftarrow 0$"

page 236 **Algorithm 8**, *line 4*: Change "$j = 0$" to "$j \leftarrow 0$"

page 236 **Algorithm 9**, *line 1*: Change "$k = 0$" to "$k \leftarrow 0$"

page 238 *line -5*: Change "*procedures*, because" to "*procedures* because"

page 242 *line -2*: Change "We begin by writing Eq. 47" to "We begin by writing Eq. 45"

page 246 *lines +1 – 2*: Don't split the equation by the line break

page 246 first (unnumbered) equation, second line: Change "$(\mathbf{Ya}_k - \mathbf{b})$." to $(\mathbf{Ya}(k) - \mathbf{b})$."

page 246 margin note: Change "LMS RULE" to "LMS RULE" (i.e., capitalize "LMS")

page 246 Equation 61, second line: Change "$(b_k - \mathbf{a}(k)^t\mathbf{y}^k)$" to "$(b(k) - \mathbf{a}^t(k)\mathbf{y}^k)$"

page 246 **Algorithm 10**, *line 1*: Change "$k = 0$" to "$k \leftarrow 0$"

page 248 second line after Eq. 66: Change "obtain the MSE optimal" to "obtain the MSE-optimal"

page 250 Equation 79: Co-align vertically the ">" in the top equation with the "=" in the bottom equation

page 250 Equation 79: Change "$\mathbf{a}(k)$" to "$\mathbf{b}(k)$"

page 251 Algorithm 11, *line 5*: Change "$\mathbf{a}$" to "$\mathbf{b}$"

page 252 top equation: Change "$= \mathbf{0} =$" to "$= 0 =$" (i.e., de-bold the "$\mathbf{0}$")

page 252 *second unnumbered equation below Eq. 84, middle*: Change "$-\eta\mathbf{e}^t(k)\mathbf{e}^{+t}(k)$" to "$-\eta\mathbf{e}^t(k)\mathbf{e}^{+}(k)$"

page 253 *line -7*: Change "requires that $\mathbf{e}^+(k) = 0$ for" to "requires that $\mathbf{e}^+(k) = \mathbf{0}$ for"

page 254 line after Eq. 90: Change "constant, positive-definite" to "constant, symmetric, positive-definite"

page 255 First (unnumbered) equation on page: Change the first term in parentheses on the right-hand side from "$\eta^2\mathbf{YRY}^t\mathbf{YRY}$" to "$\eta^2\mathbf{YRY}^t\mathbf{YRY}^t$"

page 255 Eq. 92: Last term on the right-hand-side, change "$\eta^2\mathbf{RY}^t\mathbf{R}$" to "$\eta^2\mathbf{RY}^t\mathbf{YR}$"

page 257 Figure 5.18, caption, *line +2*: Change "form $\mathbf{Au}\boldsymbol{\beta}$" to "form $\mathbf{Au} = \boldsymbol{\beta}$"

page 262 fourth line after Eq. 105: Change "with the largest margin" to "with the *largest* margin" (i.e., italicize "largest")

page 263 fourth line after Eq. 107: Change "equation in Chapter 9," to "topic in Chapter 9,"

page 266 Equation 114: Change "$\mathbf{a}_i^t(k)\mathbf{y}^k \leq \mathbf{a}_j(k)^t\mathbf{y}^k$." to "$\mathbf{a}_i^t(k)\mathbf{y}^k \leq \mathbf{a}_j^t(k)\mathbf{y}^k$."

page 266 *line +3*: Change "that $\mathbf{y} \in \mathcal{Y}_1$" to "that $\mathbf{y}_k \in \mathcal{Y}_1$"

page 266 Eq. 113: Change "$\hat{\mathbf{a}}_i^t\mathbf{y}_k$" to "$\hat{\mathbf{a}}_1^t\mathbf{y}_k$"

page 266 *9 lines above Sect. 5.12.2*: Change "we construct $(c-1)c\hat{d}$-dimensional" to "we construct $(c-1)c\ \hat{d}$-dimensional" (that is, add a space)

page 266 *8 lines above Sect. 5.12.2*: Change "into $c\hat{d}$-dimensional" to "int $c\ \hat{d}$-dimensional" (that is, add a space)

page 270 twelfth line under **BIBLIOGRAPHICAL AND HISTORICAL REMARKS**: Change "error-free case [7] and [11] and" to "error-free case [7,11] and"

page 270 *line -13*: Change "support vector machines" to "Support Vector Machines"

page 270 *line -8*: Change "support vector machines" to "Support Vector Machines"

page 271 Problem 2, *line +1*: Change "$\mathbf{w}^t\mathbf{x}$" to "$\mathbf{w}_i^t\mathbf{x}$"

page 271 Problem **2**, *line +3*: Change "if $0 \leq \lambda \leq 1$." to "for $0 \leq \lambda \leq 1$."

page 272 Problem **7**, *line +3*: Change "may not be linearly" to "may not be totally linearly"

page 272 Problem **8**, *line +2*: Change "if $\mathbf{a}^t\mathbf{y}_i \geq 0$" to "if $\mathbf{a}^t\mathbf{y}_i \geq b$"

page 274 Problem **22**, second term on the right-hand side change "$(\mathbf{a}^t\mathbf{y} - (\lambda_{12} - \lambda_{22}))^2$" to "$(\mathbf{a}^t\mathbf{y} + (\lambda_{12} - \lambda_{22}))^2$"

page 275 Problem **27**, last line: Change "by Eq. 85." to "by Eq. 95."

page 277 *lines +2 – 3*: Change "satisfies $z_k\mathbf{a}^t\mathbf{y}_k = 0$" to "satisfies $z_k\mathbf{a}^t\mathbf{y}_k = 1$"

page 277 Problem **38**, *line -2*: Change "procedures Perceptron" to "procedures. Generalize the Perceptron"

page 278 Problem **1**, part (a): change "data in in order" to "data in order"

page 278 Computer exercise **2**, part (a): Change "Starting with $\mathbf{a} = 0$," to "Starting with $\mathbf{a} = \mathbf{0}$," (i.e., make bold the "0")

page 278 First heading after the table: Change "**Section 5.4**" to "**Section 5.5**"

page 278 Computer Exercise 1: Change "(Algorithm 1) and Newton's algorithm (Algorithm 2) applied" to "(Algorithm 1) and the Perceptron criterion (Eq. 16)"

page 278 Second heading after the table: Delete "**Section 5.5**"

page 279 *line +1*: Change "length is greater than the pocket" to "length is greater than with the pocket"

page 279 Computer exercise **4**, part (a), *line +2*: Change "and $\boldsymbol{\mu}_1 = 0$," to "and $\boldsymbol{\mu}_1 = \mathbf{0}$," (i.e., make bold the "0")

Chapter 6

page 286 Equation 5: Change "$z_k = f(net_k)$." to "$z_k = f(net_k)$,"

page 287 *line +2*: Change "all identical." to "all the same."

page 288 *line -3*: Change "depend on the" to "depends on the"

page 291 Two lines before Eq. 3: Change "hidden-to-output weights, w_{ij}" to "hidden-to-output weights, w_{kj}"

page 292 Equation 19, first line (inside brackets): Change "1/2" to "$\frac{1}{2}$" (i.e., typeset as a full fraction)

page 292 After Eq. 19, *line +3*: Change "activiation" to "activation"

page 293 Figure 6.5: Change "w_{ij}" to "w_{ji}"

page 294 Algorithm 2, *line 3*: Change "$\Delta w_{kj} \leftarrow$" to "$\Delta w_{kj} \leftarrow 0$"

page 295 *line -5*: Change "In addition to the use of the training set, here are" to "In addition to the use of the training set, there are"

page 299 *line -1*: Change "and can be linearly separable" to "and are linearly separable"

page 305 *line 10*: Change "ratio of such priors." to "ratio of such priors, though this need not ensure minimal error."

page 306 sixth and seventh line after Eq. 33: Change "in a sum squared error sense" to "in a sum-squared-error sense"

page 307 *lines +2 – 3*: Change "been found useful" to "found to be useful"

page 307 *line +6*: Change "as continuity of f and its derivative" to "as continuity of $f(\cdot)$ and its derivative"

page 308 *line +10*: Change "that is," to "or is an "odd" function, that is,"

page 308 *line +19*: Change "values that ensure $f'(0) \simeq 1$" to "values that ensure $f'(0) \simeq 0.5$"

page 315 first line after Eq. 38: Change "reducing the criterion" to "reducing the error"

page 316 Figure 6.19 caption, *line -1*: Change "trained network." to "trained network (red)."

page 318 *line +8*: Change "to compute is nonnegative" to "to compute, is nonnegative"

page 318 margin note: Change "MINKOWSKI ERROR" to "MINKOWSKI ERROR" (i.e., captialize "M" in "MINKOWSKI")

page 320 line between Eqs. 50 and 51: Change "The optimimum change" to "Therefore, the optimum change"

page 319 Equation 48: Change last entry from "$f'(net)y_{n_H}x_d$" to "$f'(net)f'(net_{n_H}x_d$"

page 322 Equation 56: Replace the current equation by

$$\beta_m = \frac{\nabla J^t(\mathbf{w}(m))\nabla J(\mathbf{w}(m))}{\nabla J^t(\mathbf{w}(m-1))\nabla J(\mathbf{w}(m-1))} \qquad (56)$$

page 322 Equation 57: Replace the current equation by

$$\beta_m = \frac{\nabla J^t(\mathbf{w}(m))[\nabla J(\mathbf{w}(m)) - \nabla J(\mathbf{w}(m-1))]}{\nabla J^t(\mathbf{w}(m-1))\nabla J(\mathbf{w}(m-1))} \qquad (57)$$

page 323 Fourth (unnumbered) equation on the page: Replace the left portion by

$$\beta_1 = \frac{\nabla J^t(\mathbf{w}(1))\nabla J(\mathbf{w}(1))}{\nabla J^t(\mathbf{w}(0))\nabla J(\mathbf{w}(0))} =$$

page 323 Caption to bottom figure, *line +2*: Change "shown in the contour plot," to "shown in the density plot,"

page 325 last line of the section **Special Bases**: Add "This is very closely related to model-dependent maximum-likelihood techniques we saw in Chapter 3."

page 326 first line after Eq. 63: Change "of the filter in analogy" to "of the filter, in analogy"

page 326 *line -5*: Add a red margin note "TIME DELAY NEURAL NETWORK"

page 330 three lines above Eq. 67: Change "write the error as the sum" to "write the new error as the sum"

page 332 Figure 6.28, caption, *line +1*: Change "a function of weights, $J(\mathbf{w})$" to "a function of weights, $J(\mathbf{w})$,"

page 337 Problem **8**, pagt (b) *line +2*: Change "if the sign if flipped" to "if the sign is flipped"

page 337 Problem **14**, part (c), *line +2*: Change "the 2×2 identity" to "the 2-by-2 identity"

page 339 Problem **22**, *line +4*: Add "Are the discriminant functions independent?"

page 340 Problem **26**, equation: Change "$-b\ net$" to "$-2b\ net$" in three places

page 341 Problem **31**, *lines +1 – 2*: Change "for a sum squared error criterion" to "for a sum-square-error criterion"

page 344 Computer exercise **2**, *line +2*: Change "backpropagation to (Algorithm 1)" to "backpropagation (Algorithm 1)"

page 345 Computer exercise **7**, *line +2*: Change "on a random problem." to "on a two-dimensional two-category problem with 2^k patterns chosen randomly from the unit square. Estimate k such that the expected error is 25% . Discuss your results.

page 346 Computer exercise **10**, part (c), *line +1*: Change "Use your network" to "Use your trained network"

page 347 Column 2, entry for [14], *line +5*: Change "volume 3. Morgan Kaufmann" to "volume 3, pages 853–859. Morgan Kaufmann"

page 348 column 2, entry for [43], *line +4*: Change "2000." to "2001."

Chapter 7

page 351 fourteenth line after Eq. 1: Change "of the magnets with the most stable configuration" to "of the magnets that is the most stable"

page 351 footnote, *line -1*: Change "in a range of problem domains." to "in many problem domains."

page 352 Figure 7.1, caption, *line +7*: Change "While our convention" to "While for neural nets our convention"

page 352 Figure 7.1, caption, *line +8*: Change "Boltzmann networks is" to "Boltzmann networks here is"

page 352 Caption to Figure 7.1, *line -1*: Change "$0 \leq \alpha \leq 2^{10}$" to "$0 \leq \alpha < 2^{10}$"

page 353 Figure 7.2, caption, *line +3*: Change "or "temperature" T to avoid" to "or "temperature" T, to avoid"

page 357 Figure 7.4, caption, *line +3*: Change "values e^{-E_γ}/T." to "values $e^{E_\gamma/T}$."

page 360 first line in Section 7.3: Change "will use modify the" to "will use the"

page 360 second line in Section 7.3: Change "to specifically identify" to "and specifically identify"

page 360 second line in Section 7.3: Change "and other units as outputs" to "and others as outputs"

page 361 fourth line after Eq. 6: Change "possible hidden states." to "possible hidden states consistent with α."

page 364 at the end of the body of the text: insert "One benefit of such stochastic learning is that if the final error seems to be unacceptably high, we can merely increase the temperature and anneal — we do not need to re-initialize the weights and re-start the full anneal."

page 365 seventh line after the subsection **Pattern Completion**: Change "components of a partial pattern" to "components of the partial pattern"

page 367 *line +1*: Change "Recall, at the end" to "As mentioned, at the end"

page 373 fourteenth line in Section 7.5: Change "repeated for subsequent" to "repeated for the subsequent"

page 373 fifth line above the subsection **Genetic Algorithms**: Change "In both cases, a key" to "In both cases a key"

page 374 *line +2*: Change "used in the algorithm. Below" to "used in the algorithm; below"

page 374 *line +3*: Change "P_{co} and P_{mut}, respectively, but first we present the general algorithm:" to "P_{co} and P_{mut}."

page 379 third line in the subsection **Representation**: Change "Here the syntactic" to "Whereas the syntactic"

page 381 third line under **BIBLIOGRAPHICAL AND HISTORICAL REMARKS**: Change "branch-and-bound, A^*" to "branch-and-bound and A^*

page 382 *line +28*: Change "been fabricated as described" to "been fabricated, as described"

page 383 Problem **3**, part (b), *line +1*: Change "The figure shows" to "That figure shows"

page 384 Problem **7**, part (c), *line +1*: Change "magnets, total" to "magnets, the total"

page 384 Problem **8**, part (b), equation: Change "$= P(s = +1)(+1) + P(s = -1)(-1)$." to "$= \Pr[s = +1](+1) + \Pr[s = -1](-1)$."

page 385 Problem **12**, *line +1*: Change "Train a six-unit Hopfield network with the following three patterns using the" to "Determine the weights in a six-unit Hopfield network trained with the following three patterns. Use the"

page 385 Problem **15** *line +1*: Change "not be in a set of" to "not be in a subset of"

page 387 Problem **24**: Change "crossover operator" to "crossover operator, and the multiplication operator, `*`, and the addition operator, `+`, can take two or more operands."

page 393 column 1, entry for [54], *line +3*: Change "*Evoultions-*" to "*Evolutions-*"

page 393 column 2, entry for [62], *line +2*: Change "neurobilogical system." to "neurobiological systems."

Chapter 8

page 396 *2 lines above Sect. 8.3*: Change "knowledge if of greatest" to "knowledge is of greatest"

page 403 line above **Section 8.3.4 Pruning**: Change "splitting is stopped." to "splitting should be stopped."

page 405 Table at top, x_2 entry in fifth row under ω_1, change ".48" to ".44"

page 405 caption to figure, *line -2*: Change "marked * were instead slightly lower (marked †)," to "marked * were instead slightly lower (marked †)," (i.e., change the color of the special symbols to red)

page 413 8.5, lines 3 – 4: Change "nucleic acids" to "bases"

page 414 *line +16*: Change "⁄⁄⁄ `GACTG`" to "⁄⁄⁄`GACTG`" (i.e., eliminate space)

page 416 Algorithm 2, line 2: Change "$\mathcal{F}(\mathbf{x})$" to "$\mathcal{F}$"

page 416 Algorithm 2, line 3: Change "$\mathcal{G}(\mathbf{x})$" to "$\mathcal{G}$"

page 416 Algorithm 2, line 11: Change "$\mathcal{G}(0)$" to "1"

page 416 Algorithm 2, lines 9–12: These lines are indented too far to the right. They should be moved the same distance to the left so the **if** of line 9 is directly under the **while** of line 7, and lines 10–12 are indented slightly farther to the right.

page 416 *line -1*: Change "$\mathcal{F}(\mathbf{x})$" to "$\mathcal{F}$"

page 417 *lines -9 – -4*, Replace last full paragraph by "Consider target string $\mathbf{x}$. Each location j (for $j < m$) defines a suffix of $\mathbf{x}$, that is, $\mathbf{x}[j+1, \ldots, m]$. The *good-suffix function* $\mathcal{G}(j)$ returns the starting location of the right-most instance of another occurrence of that suffix (if one exists). In the example in Fig. 8.8,

$\mathbf{x}$ = `estimates` and thus $j = 8$ defines the suffix `s`. The right-most occurrence of another `s` is 2; therefore $\mathcal{G}(8) = 2$. Similarly $j = 7$ defines the suffix `es`. The right-most occurrence of another `es` is 2; therefore $\mathcal{G}(7) = 1$. No other suffix appears repeatedly within $\mathbf{x}$, and thus $\mathcal{G}$ is undefined for $j < 7$."

page 418 fifth line before **Algorithm 3**: Change "consider interchanges." to "consider the interchange operation."

page 418 fourth line before **Algorithm 3**: Change "be an $m \times n$ matrix" to "be an m-by-n matrix"

page 422 *line -3*: Change "specify how to transform" to "specifies how to transform"

page 424 *line -7, right-hand side of equation*: Change "$\alpha x \beta$" to "$\alpha \gamma \beta$"

page 424 *line -5*: Change "x is an intermediate or terminal symbol" to "γ is a string made up of intermediate or terminal symbols"

page 424 *line -4*: Change "as x in" to "as γ in"

page 425 *top equation*: Change "x" to "γ"

page 245 *line +1* Change "and x an intermediate or termal symbol" to "and γ is a string made up of intermediate or terminal symbols"

page 425 *line +3*: Change "rewriting of I by x." to "rewriting of I by γ."

page 426 *line +1*: Change "The grammar takes *digit6* and" to "This grammar takes *digits6* and"

page 428 *line -1*: Change "subsequent characters." to "subsequent characters, or instead starting and the last (right) character in the sentence."

page 429 caption to Figure 8.16, add after the last line: "Such finite-state machines are sometimes favored because of their clear interpretation and learning methods based on addition of nodes and links. In Section 8.7, though, we shall see general methods for grammatical learning that apply to a broader range of grammatical models."

page 438 Problem 5, *line +2*: Change "Eqs. 1 and 5." to "Eqs. 1 and 5 for the case of an arbitrary number of categories."

page 438 Problem **6** after the first set of equations: Replace the $i^*(\boldsymbol{\alpha})$ equation by "$i^*(\alpha) = i(\alpha P^a(\omega_1) + (1-\alpha)P^b(\omega_1), ..., \alpha P^a(\omega_c) + (1-\alpha)P^b(\omega_c))$"

page 438 Problem **6** last line before part (a): Replace line by "then we have $i^* \geq \alpha i_a + (1-\alpha) i_b$."

page 445 Problem **36**, part (d), *line +1*: Change "Give a derivation" to "Attempt a derivation"

page 445 Problem **40**, part (d), *line +2*: Change "either grammar as" to "either grammar, or can be parsed in both grammars, as"

page 446 Table, sample 12: Change "D" to "E"

page 447 Computer exercise **3**, part b): Change "{C, D, J, L, M}" to "{C, E, J, L, M}"

Chapter 9

page 455 *line -9 – -10*: Change "a zero-one loss function, or, more generally, the cost for a general loss function $L(\cdot,\cdot)$" to "a zero-one or other loss function."

page 460 Table for rank $r = 3$, third row: Change "$\mathbf{x}_1\ OR\ \mathbf{x}_3\ OR\ \mathbf{x}_3$" to "$\mathbf{x}_1\ OR\ \mathbf{x}_3\ OR\ \mathbf{x}_4$"

page 461 *Equation 6, in the lower limit on the summation*: Change "$r-2$" to "$r = 2$"

page 462 *line +12*: Change "upon a specification method L," by "upon a specification method,"

page 462 *line +13*: Change "transmitted as y, denoted $L(y) = x$." to "transmitted as y and decoded given some fixed method L, denoted $L(y) = x$."

page 462 *line +15 – 16*: Change "denoted $\min_{|y|}$ L(y) = x; this minimal...[[to end of paragraph]]" to "denoted $\min_{y:L(y)=x} |y|$."

page 462 *line +17 – 18*: Change "by analogy to entropy, where instead of a specification method L we consider" to "by analogy to communication, where instead of a fixed decoding method L, we consider"

page 462 *line +25*: Change "and so on. A universal description would" to "and so on. Such a description would"

page 462 *line +26*: Change "different binary strings." to "different binary strings x_1 and x_2."

page 462 third and second line above Eq. 7: Change "the *shortest* program y (where the length" to "the *shortest* program string y (where y's length"

page 462 Equation 7: Replace the entire equation by:

$$K(x) = \min_{y:U(y)=x} |y|,$$

page 463 *line -10*: Change "No Free Lunch Theorems." to "No Free Lunch Theorem."

page 468 *two lines above Eq. 16*: Change "error rate $\Pr[g(\mathbf{x};\ \mathcal{D})] = y$" to "error rate $\Pr[g(\mathbf{x};\ \mathcal{D})] \neq y$"

page 468 *Eq. 16, lhs*: Change "$\Pr[g(\mathbf{x};\ \mathcal{D})] = y$" to "$\Pr[g(\mathbf{x};\ \mathcal{D})] \neq y$"

page 468 *Eq. 17, lhs*: Change "$\Pr[g(\mathbf{x})] = y$" to "$\Pr[g(\mathbf{x})] \neq y$"

page 468 *Eq. 17, rhs*: Change "$\Pr[y_B(\mathbf{x}) = y]$" to "$\Pr[y_B(\mathbf{x}) \neq y]$"

page 469 *Eq. 21*: Change "$e^{-1/2u^2}$" to "$e^{-u^2/2}$"

page 472 Equation 23: Change "$\frac{1}{(n-1)}$" to "$\frac{1}{n(n-1)}$"

page 472 Equation 24: Change "$\sum_{j\neq i}$" to "$\sum_{j\neq i}^{n}$" (i.e., place the upper limit n over the summation sign)

page 472 *line -4*: Change "jackknife estimate of the variance" to "variance of the jackknife estimate"

page 479 *line +1*: Change "in line 4" to "in line 5"

page 485 *line -10*: Change "good estimates, because" to "good estimates because"

page 488 Caption to Fig. 9.13, *line +6*: Change "approximated as a k-dimensional" to "approximated as a p-dimensional"

page 488 *line +10* (i.e., second line of the second paragraph of text): Change "is k-dimensional and the" to "is p-dimensional and the"

page 496 Equation 54: Change "$P(r|\mathbf{x}, \boldsymbol{\eta}^0)$" to "$P(r|\mathbf{x}, \boldsymbol{\theta}_0^0)$"

page 497 Equation 58: Change $\boldsymbol{\mu}_r$ to $\boldsymbol{\theta}_r$ in two places

page 501 *line -15*: Change "and learning algorithm was first described" to "and learning algorithm were first described"

page 502 Problem **6**, last line: Change "this way" to "this sense"

page 504 Problem **20**, *line -2*: Change "denoted $p(g(\mathbf{x};\ \mathcal{D}))$ is a" to "denoted $p(g(\mathbf{x};\ \mathcal{D}))$, is a"

page 507 Problem **39** part **2**, last line: Change "full circle" to "full circular disk"

page 508 Problem **45**, *line +1*: Change "mixture of experts classifier" to "mixture-of-experts classifier"

page 512 *line -3*: Add "Now what is the training error measured using ω_A and ω_B?"

Chapter 10

page 524 The second to last equation: Increase the size of the final bracket, "$\big]$" to match its mate

page 525 line following Eq. 23: Change "results in Eq. 12" to "results into Eq. 12"

page 529 *line +5*: Change "$\hat{P}(w_j)$" to "$\hat{P}(\omega_j)$"

page 529 Algorithm 2: Change "**(Fuzzy k-Means Clustering)**" to "**(Fuzzy k-Means Clustering)**"

page 529 *line -1*: Change "as given by Eq. 17." to "that is, each point belongs in only one cluster."

page 534 *line +2*: Change "overlap, thus" to "overlap; thus"

page 535 First equation: move the second, third, and fourth lines so as to co-align vertically the corresponding terms

page 536 *line +19*: Change "classification analog of Chapter 3" to "classification case in Chapter 3"

page 537 *line -20*: Change "distributed, these statistics" to "distributed these statistics"

page 541 two lines after Eq. 52: Change "Tanimoto coefficient or *Tanimoto distance*" to "Jaccard coefficient or *Jaccard distance*"

page 541 In margin: Change "TANIMOTO DISTANCE" to "JACCARD DISTANCE"

page 545 *line -6*: Change "Furthermore, $\mathbf{S}_B$" to "Furthermore, $\mathbf{S}_W$"

page 549 *Eq. 75, middle line, rhs, subscript on the summation*: Change "$\mathbf{x} \in \mathcal{D}_i$" to "$\mathbf{x} \in \mathcal{D}_j$"

page 552 *Algorithm 4, line 5*: Change "$c = \hat{c}$" to "$\hat{c} = c$"

page 553 *one line above* **The Nearest-Neighbor Algorithm**: Change "$O(cn^2d)$" to "$O(n^2(c + d))$"

page 556 *Algorithm 5, line 5*: Change "$c = \hat{c}$" to "$\hat{c} = c$"

page 557 *line 14 of Sect. 10.10*: Change "decrease rapidly until $\hat{c} = c$" to Change "decrease rapidly until $c = \hat{c}$"

page 559 *last three lines*: Change "For reasons that will become clear, each d-dimensional pattern is augmented (with $x_0 = 1$) and normalized" to "Each d-dimensional pattern is augmented (with $x_0 = 1$) and, for reasons that will become clear, normalized"

page 571 *line +1 – +2*: Change "mi-crophones" to "micro-phones" (i.e., re-hyphenate)

page 571 *line -1*: Change "Jacobean" to "Jacobian"

page 577 Chaption Figure 10.28, line -3: Change "sensed point, thought" to "sensed point, though"

page 577 Eq. 113: Change "$\boldsymbol{\phi}_i$" to "$(\boldsymbol{\phi}_i - \mathbf{w}_{ki}(t))$"

page 578 Figure 10.31, caption, *line +2*: Change "space that leads maximally" to "space that maximally"

page 579 Figure 10.32, caption, *line -1*: Change "to this center region" to "to this central region"

page 580 *line +15*: Change "cluster centers being used to" to "*cluster centers* being used to" (i.e., italicize "cluster centers")

page 580 *line +16*: Change "with combined features being" to "with *combined features* being" (i.e., italicize "combined features")

page 582 four lines above **BIBLIOGRAPHICAL and HISTORICAL REMARKS**: Change "between points that, too, seeks to preserve neighborhoods" to "between points that preserves neighborhoods"

page 583 *lines +9 – 10*: Change "The classificatory foundations of biology, cladistics (from the Greek *klados*, branch) provide useful" to "Cladistics, the classifactory foundation of biology (from the Greek *klados*, branch), provides useful"

page 583 *line +18*: Change "analysis, and explained the very close" to "analysis, and in reference [36] explained the very close"

page 583 *line +19*: Change "information maximization in reference [36]." to "information maximization."

page 584 Problem **2**, equation: Change "$(1-|x-\mu_1|)/(2w_i)$" to "$(w_i-|x-\mu_i|)/w_i^2$"

page 584 Problem **4** a, right-hand side: Change "$\mathbf{x}_i$" to "x_j"

page 585 Problem **6**, *line +1*: Change "Consider a c component" to "Consider a c-component"

page 587 Problem **13**, *line +3*: Change "that for any observed x, all but one" to "that for any observed x all but one"

page 589 Problem **24** b, Change "the trace criterion" to "the determinant criterion"

page 591 Problem **41**, *line +1*: Change "null hypothesis in associated" to "null hypothesis associated"

page 592 Problem **44**, part (c), *line +3*: Change "$(\delta\mathbf{e})^t\mathbf{\Sigma}\lambda(\delta\mathbf{e})^t\mathbf{e}=0$" to "$(\delta\mathbf{e})^t\mathbf{\Sigma}\mathbf{e}-\lambda(\delta\mathbf{e})^t\mathbf{e}=0$"

page 592 Problem **46**, *line +1*: Change "principal componet analysis" to "principal component analysis"

page 593 Problem **48**, *line +3*: Change "linearity is given by" to "linearity is the one given by"

page 596 Problem **11**, *lines +3 – 4*: Change "to the date in the table above using the distance measure indicated" to "to the data in the table above using the distance measures indicated"

page 597 Problem **13**, *line +1*: Change "a basic competitive learning" to "a basic Competitive Learning"

page 597 Problem **13**, *lines +4 – 5*: Change "hy-persphere" to "hyper-sphere" (i.e., re-hyphenate "hypersphere")

Appendix

page 608 Section A.2.5 *line +5*: Change "In this case the absolute value of the determinant" to "In this case the determinant"

page 609 first line after Eq. 26: Change "the $i,\ j$ *cofactor* or" to "the i,j *cofactor* or" (i.e., eliminate the space in "i,j")

page 609 second line after Eq. 26: Change "is the $(d-1)\times(d-1)$ matrix" to "is the $(d-1)$-by-$(d-1)$ matrix"

page 609 fourth line after Eq. 26: Change "whose $i,\ j$ entry is the $j,\ i$ cofactor" to "whose i,j entry is the j,i cofactor" (i.e., eliminate the space in "$i,\ j$" and "$j,\ i$")

page 609 *line -2*: Add "The inverse of the product of two square matrices obeys $[\mathbf{MN}]^{-1} = \mathbf{N}^{-1}\mathbf{M}^{-1}$, as can be verified by multiplying on the right or the left by $\mathbf{MN}$."

page 615 *line -12* (i.e., just before Section A.4.7): Change "and $\frac{n_{11}/n}{(n_{01}+n_{11})/n}$ is approximately" to "and $(n_{01} + n_{11})/n$ is approximately"

page 624 Figure A.3, caption, *line +2*: Change "between $-\sqrt{2}u$ and $\sqrt{2}u$, that is" to "between $-\sqrt{2}u$ and $\sqrt{2}u$; that is"

page 624 Equation 98: Change "$n\Gamma(n-1)$"to "$(n-1)\Gamma(n-1)$"

page 629 *line +9*: Change "from a distribution" to "from a standarized Gaussian distribution"

page 631 *line +9*: Change "equally likely is" to "equally likely, is"

page 631 *line +12*: Change "outcome and $H = \log_2 2^3 = 3$" to "outcome and $H = -\sum_{i=0}^{7} \frac{1}{2^3} \log_2 2^3 = \log_2 2^3 = 3$"

page 631 Equation 118: Change "$\ln p(x)$" to "$\ln p(x)$" (i.e., reduce the space between "ln" and "$p(x)$")

page 631 first line after Eq. 119: Change "For this Dirac function" to "For this Dirac density"

page 632 Red margin note: Change "Kullback-leibler distance"to "Kullback-Leibler distance" (i.e., capitalize the "L" in "Leibler")

page 632 *line -2*: Change is always larger than" to "is never smaller than"

page 634 *line +3*: Change "$f(x) \leq c_0 g(x)$ for all" to "$f(x) \leq cg(x)$ for all"

page 634 *line +7*: Change "proper choice of c_0 and x_0" to "proper choice of c and x_0"

Index

page 644 column 1, *line -14*: Insert "Gini impurity, 399, 401"

page 645 column 2, insert an entry for: "Jaccard coefficient, 541"

page 648 column 1, Entry for metric, Tanimoto: delete reference to page "541"

page 653 column 1, *line -3*: Change "multi-variate" to "multivariate"