

Chapter 1

Page 6 Paragraph 2: “weights y’s” should be “weighted y’s”

Page 8 Replace Equation 1.13 with the following:

$$x_3 - x_2 = v(t_3 - t_2) + \xi(t)\sigma_q\sqrt{(t_3 - t_2)} \quad (1.13)$$

where $\xi(t)$ is drawn from a normal distribution with mean 0 and variance 1.

The expected (average) displacement, $\langle x_3 - x_2 \rangle$, over many attempts is

$$\langle x_3 - x_2 \rangle = v(t_3 - t_2)$$

and the expected increase in uncertainty of the position, $\sigma_x^2(t)$, grows as

$$\sigma_x^2(t_3) = \sigma_x^2(t_2) + (t_3 - t_2)\sigma_q^2$$

and replace the next paragraph “The integration ... stochastic integrals.” with:

The integration of the random q is quite nontrivial. Intuitively, you can sense why the above is true. The presence of a random walk on top of a constant velocity, v , does not change the expected value of the displacement over many trials. But the uncertainty relentlessly grows unless you make another measurement. If you integrate a Brownian noise process, that is integrate values drawn from a Gaussian distribution throughout a time interval, the increase in uncertainty grows linearly throughout that time interval. In physics this is related to a Langevin equation (a particle diffusing with a restoring force), and in economics it is related to the Black-Scholes equation (a way to price options). Klebaner’s textbook [Kle05] is an excellent resource to seek further understanding of such stochastic integrals.

Page 12 Last line (footnote 7): “readily be $2Ax$.” should be “readily be $2A^T Ax$.”

Page 15 Eqn 1.42: $\sum_x (x - \mu_x)^2 p(x) V \equiv \sigma_x^2$ should be $\sum_x (x - \mu_x)^2 p(x) \equiv \sigma_x^2$

Page 16 Paragraph 3: “If one refers back to figure 1.3c” should be “If one refers back to figure 1.2c”

Page 21 Paragraph 1: “(they are the variance of y plus the mean of y , all constants)” should be : “(the variance of y is assumed known and constant)”

Page 22 exercise 1.1: “and the cofactors, C_{ij} , are” should be “and the cofactors, C_{ji} , are”

Page 23, exercise 1.3: “1.3. Another computer exercise. Assume the measured ...” should be “1.3. Assume the measured ...” [Solve by hand not computer.]

“solve for \hat{x} using” should be “solve for \hat{x} using the unweighted formula”

“Assuming that” should be “We will now add weighting, letting the weights all be equal. Assuming that”

Page 24, add at end of exercise 1.3: “Is your answer different from the unweighted calculation? Why?”

Chapter 2

Page 27 paragraph 2: “in equation (2.5), both take” should be “in equation (2.6), both take”

Page 29 paragraph 1: “then P_i is minimized” should be “then the increase in P_i is minimized”

Page 33:

“The matrix square root of M is defined as

$$M \equiv (\sqrt{M})^T \sqrt{M}$$

and in practice, one chooses the i th row (or column) from \sqrt{M} to sum with the average of \bar{x} in equation (2.13).

As in other forms of particle filtering, one weights the sigma points. Julier and Uhlman

used for their weights, q ,

$$q_0 = \kappa/(n+\kappa)$$

$$q_i = 1/2(n+\kappa)$$

$$q_{i+n} = 1/2(n+\kappa) \quad (2.14)$$

but in practice, one can often drop the q_0 weight ...”

Should be

“The matrix square root of P is defined as

$$P \equiv (\sqrt{P})^T \sqrt{P}$$

and in practice, one chooses the i th row (or column) from \sqrt{P} to sum with the average of \bar{x} in equation (2.13).

As in other forms of particle filtering, one weights the sigma points. Julier and Uhlman

used for their weights, w ,

$$w_0 = \kappa/(n+\kappa)$$

$$w_i = 1/2(n+\kappa)$$

$$w_{i+n} = 1/2(n+\kappa) \quad (2.14)$$

but in practice, one can often drop the w_0 weight ...”

Page 38 Paragraph 5: “application of equations (2.22) will be transparent” should be “application of equations (2.22) to neurons will be transparent”

Page 39 exercise 2.1:

“Calculate \hat{x}_2^-
What is P_1^+ ?”

Should be

“and assume that for the first measurement y_1 that $P_1^+ = \sigma^2$
Calculate \hat{x}_2^- ”

Page 39 exercise 2.3:

“Assume that the variance P_{xx} to start with is 1, and that for this simple one-dimensional problem, $n = 1$. We will start again setting $x_1 = y_1 = 1$, and the two sigma points will simply be 2 and 0.”

Should be

“Assume that the variance P_{xx} to start with is σ^2 , and that for this simple one-dimensional problem, $n = 1$. We will start again setting $x_1^+ = y_1 = 1$, and the two sigma points will simply be $1 + \sigma$ and $1 - \sigma$. Assume R and Q both = σ^2 ”

and

“[Hint: The answer should be the same as the least squares solution.]”

should be

“[Hint: The answer should be the same as the least squares solution. Is the answer different if I gave you values of $\sigma^2 = 1$?]”

Chapter 3

Page 41 paragraph 2: “phenomenology enough for the reader” should be “phenomenology sufficient for the reader”

Page 43 paragraph 2: “transmembrane potential was observed” should be “transmembrane potential during an action potential was observed”

Page 46 paragraph 1: “These membrane action potentials were uniform within” should be “These membrane action potentials were confined within”

Page 54 last line footnote 7: “gotten to the conclusions that they came to.” should be “gotten to the underlying truth.”

Page 55 paragraph 1: “The second concerns” should be “The second paper concerns”

Page 64 last paragraph: “that a substance changes” should be “that a substance, n , changes”

Page 65 figure 3.30:

Upper right equation is $g_k \sim (1 - \exp(-t))^4$ and should be $g_k \sim (\exp(-t))^4$

Page 65 paragraph 1: “turn-on could be fit by a third or fourth power” should be “turn-on could be fit by a third or higher power”

Page 76 exercise 3.2:

“Pulse width of 15 out of 100 integration steps, starting at $t = 2$ ” should be “Pulse width of 15 out of 1000 integration steps, starting at $t = 2$ ”

$V_{Na} = 115$
 $V_K = -12$
 $V_L = 10.6$ ”

Should be

$V_{Na} = -115$
 $V_K = 12$
 $V_L = -10.6$

Page 77 figure 3.44 should be:

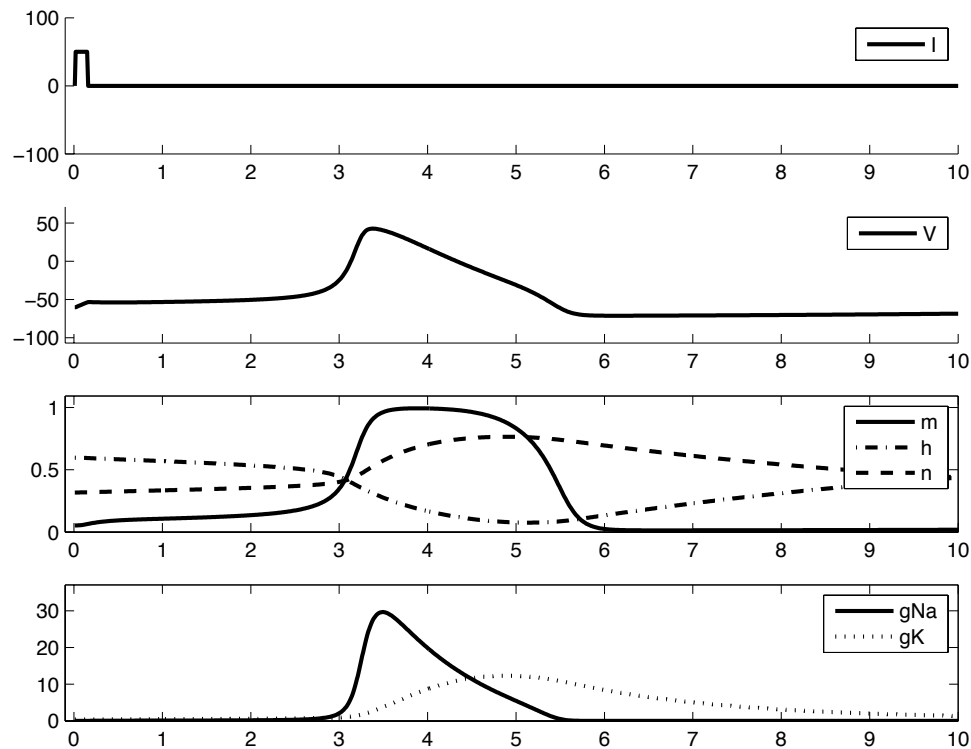


Figure 3.44 legend: “Sample output from integrating the Hodgkin-Huxley equations using the preceding suggestions. Pulse amplitude 500 for fifteen time steps.” should be “Sample output from integrating the Hodgkin-Huxley equations using the preceding suggestions. Pulse amplitude 50 for fifteen time steps.”

Page 78 exercise 3.2: “ $V(t) = V(t-1) + dV$ ” should be “ $V(t) = V(t-1) + dV$ ” and assume that $C = 1 \mu F / cm^2$ ”

“Plot your results for current pulses of from -500 to $+500$.”

Should be

“Plot your results for current pulses of from -50 to $+50$.”

Chapter 4

Page 79 paragraph 2: “send electrons from one end to the other” should be “send electrons from one to the other”

Page 79 last line:
“and from a point” should be “and starting from a point”

Page 82 paragraph 2: “A key feature of the dynamics where ε is much different from 1 is shown in equation (4.1), where the dynamics”
Should be

“A key feature of the dynamics where ε is much greater than 1 in equation (4.1) is that the dynamics”

Page 88 paragraph 1: “When x goes up, y will decrease at a slower rate (an effective lag), and as y subsequently increases this causes x to decrease” should be “When x goes up from its minimum, y will decrease at a slower rate (an effective lag), and as y subsequently increases from its minimum this causes x to decrease”

Chapter 5

Page 97 paragraph 5 “This extreme form along the spectrum” should be “This extreme form of activity along the spectrum”

Page 98 paragraph 1: “systems are chaotic or not an infinitely open question.” Should be “systems are chaotic or not an indefinitely open question.”

Page 106 paragraph 4: “the estimation of inaccessible parameters” should be “the estimation of inaccessible variables”

Page 111 exercise 5.1: “5.1. For the first exercise, let’s modify this program so that it tracks all parameters, a , b , and c , in addition to the input current.” Should be “5.1. For the first exercise, let’s modify this program so that it tracks, in addition to the input current, the rest of the parameters, a , b , and c .”

Chapter 6

Page 116 footnote 1: “Upon her death,” should be “Upon his death,”

Page 120 paragraph 1: “different population contributions” should be “different population thresholds”

Page 123 figure 6.4 legend: “Comparison of (6.4) (light line) with (6.5) (heavy line).” Should be “Comparison of (6.4) (thin line) with (6.5) (heavy line).”

Page 126 paragraph 2: “be extended into the one-dimensional propagating action potential.” Should be “be extended spatially to account for the one-dimensional propagating action potential.”

Page 132 last line: “version of the following Wilson-Cowan equations to cortical wave experiments.” Should be “version of the Wilson-Cowan equations to cortical wave experiments.”

Page 139 figure 6.31 legend: “and observable function A” should be “and observation function A”

Page 145 upper code fragment missing end statement:

```
“end
u0=u1;a0=a1;”
```

should be

```
“end
end
u0=u1;a0=a1;”
```

Chapter 7

Page 154 paragraph 3: “eigenvector, and $Av = \lambda v$, then” should be “eigenvector of $A^T A$, and $A^T A v = \lambda v$, then”

Page 155 paragraph 1: “and that the u_i ” should be “and the u_i ”

Page 158 figure legend 7.3: “Official group photo of Supreme Court Justices taken in 1998. Photo in public domain.” Should be “Official group photo of Supreme Court Justices taken in 2003 by Richard Strauss, Smithsonian Institution, courtesy Supreme Court of the United States. Photo in public domain.”

Page 161 paragraph 2: “we will now need to be kept track” should be “we will now need to keep track”

Page 166 paragraph 2:

$$\text{Energy} \sim \sum_{i=1}^m s_i / \sum_{i=1}^n s_i$$

should be

$$\text{Energy} \sim \sum_{i=1}^m s_i^2 / \sum_{i=1}^n s_i^2$$

Page 173 figure legend 7.12 [plate 11]: “from fMRI dataset” should be “from first 20 modes from an fMRI dataset”

Chapter 8

Page 189 figure legend 8.3 [plate 16]: “methods standard post-processing (post) to remove bias.” Should be “methods. Standard post-processing (Post) to remove bias.”

Page 199 footnote 6: “unsuccessful in the literature for the Lorenz 1963 equations” should be “unsuccessful in the literature for synchronizing the Lorenz 1963 equations”

Page 201 paragraph 2: “where if each column of B were normalized to 1, then $\sum_{i=1}^k \sigma_i^2 = k$.”

Should be “where if each column of B were normalized to 1, then $\sum_{i=1}^k \sigma_i^2 = k$, where σ_i^2 are the eigenvalues of $B^T B$.”

Page 204 paragraph 1: “the drive systems [SSC+96].” Should be “the stochastic drive system [SSC+96].”

Page 207 paragraph 2: “iterated sigma points to estimate whether” should be “iterated sigma point vectors to estimate whether”

Page 208 paragraph 3: “Fitzhugh-Nagumi and the Hindmarsh-Rose neuronal models. In this application, they assumed compete knowledge” should be “Fitzhugh-Nagumo and the Hindmarsh-Rose neuronal models. In this application, they assumed complete knowledge”

Page 209 end of paragraph 2: “assume a unique value.” add: “We can do this by fixing the value of c_5 .”

Page 212 exercise 8.2 paragraph 2: “Implement Bias Model II from section 8.4. Augment the state variable by a vector of b ’s,” should be “Implement Bias Model II from section 8.4. Augment the state variable by a vector of c ’s,”

Page 212 exercise 8.2 paragraph 3: “Implement Bias Model III by further augmenting the state variable with a vector of c ’s,” should be “Implement Bias Model III by further augmenting the state variable with a vector of b ’s,”

Chapter 9

Page 221 legend figures 9.6: “Schematic of linear filtering of spike times.” Should be “Schematic of linear filtering of spike times showing shape and dimensions of the matrices.”

Page 223 figure 9.8 legend: “Range of reconstruction accuracy versus number of randomly selected neurons.” Should be “Range of reconstruction accuracy versus number of randomly selected neurons. r^2 is regression coefficient between expected and observed hand position.”

Page 223 paragraph 1: “and reproduce the results of [SHP+02] shown in figure 9.6.” should be “and reproduce the results of [SHP+02] shown in figure 9.5.”

Page 224 paragraph 3: “scalp-based electroencephalograms” should be “people using scalp-based electroencephalograms”

Page 229 last equation should be:

$$p(x_k | x_{k-1}, x_{k-2}, \dots, x_1) = p(x_k | x_{k-1})$$

Page 230 paragraph 3: “The temporal prior is $x_{k+1} = A_k x_k + q_k$, where A is a linear matrix of the equations of motion, and q_k is drawn from a ” should be “The temporal prior is $x_k = A_{k-1} x_{k-1} + q_{k-1}$, where A is a linear matrix of the equations of motion, and q_{k-1} is drawn from a ”

Page 231 equation for z : delete arrow

Chapter 10

Page 241 paragraph 1: “the brain loss consciousness [PP07].” Should be “the brain loses consciousness [PP07].”

Page 244 equation 10.1: put minus sign before I_L

Page 244 paragraph 2: “The first three currents ($I_L - I_K - I_{Na}$)” should be “The first three currents ($-I_L - I_K - I_{Na}$)”

Chapter 11

Page 275 footnote 2: “inspiring school students.” Should be “inspiring secondary school students.”

Page 278 paragraph 1: “the junction of the electrodes” should be “the junction potential of the electrodes”

Page 284 figure legend 11.9: “electrical field (upper) and combining noise with a sinusoidal electrical field signal.” Should be “electrical field (upper) and combining noise with a sinusoidal electrical field signal (lower).”

Page 284 paragraph 1: “sensory information processing the lateral interparietal cortex,” should be “sensory information processing in the lateral interparietal cortex,”

Page 298 equation:

$$V(t) = \alpha \otimes *I(t)$$

should be

$$V(t) = \alpha \otimes I(t)$$

Page 299 legend figure 11.17: “Thomsons F-statistic normalized to a critical value (0.1%) at 15 Hz.” Should be “Thomsons F-statistic normalized to a critical value (0.1%) at 15 Hz, , and (Bd, Bh) number of entrained windows N_w for each frequency (0.25 Hz resolution) for the seizures.”

Chapter 12

Page 303 figure 12.1: Section C of figure should be B

Page 315 figure legend 12.8 last line: “blockade flanked by high-frequency activity.”
Should be “blockade (B) flanked by high-frequency activity (A, C).”

Page 317 figure legend 12.9: “energy required in direct proportion to” should be “energy required in direct proportional control to”

Page 319 paragraph 3: “either pyramidal inhibitory cells,” should be “either pyramidal or inhibitory cells,”

Page 320 figure legend 12.11: “coupled both synaptically and through” should be “coupled both synaptically (I_{AMPA} , I_{GABA}) and through”

Page 320 last paragraph: “These cells receive excitation from branches of the excitatory cells,” should be “These cells receive excitation from axon branches of the excitatory cells,”

Page 329 paragraph 3: “He was then taught to respond yes to one form of imagery and no to the” should be “He was then taught to respond yes with one form of imagery and no with the”