On smooth models for complex domains and distances: list of minor corrections

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January 30, 2012

1 Notes on Chapter 1

- p29 Need $\cdots$ between the integrals in (1.3) and (1.4).
- p29 Reference to Wood (2006; p126) refers to the incorrect page.
- p30 Equation for S_{ij} needs $\cdots$ between the integrals. Also, I'm assuming that $\mathbf{b}_i$ and $\mathbf{b}_j$ are the basis functions are given in (1.1). In which case, they should not be bold.
- p32 "Say we put" is a bad way to start a sentence.
- p34 "practise" should be "practice". There are a few other examples of this throughout the thesis which should also be corrected.
- p34 For the P-splines derivation, the initial use of x_{i1} isn't compelling, particularly when the B_j^m are defined in terms of x. Additionally, you change from x_{i1} to x_{1i}. The summation in the basis representation of f is incorrect whilst your statement of the B_j^m is also incorrect (i terms!).
- p35 I think the objective function is incorrect, in particular the penalty function.
- p35 Reference to Section 1.1.3: you are still in Section 1.1.3.
- p36 The statement of f is incorrect.
- p36 β_j and δ_j should be defined in relation to the form of $f(x)$.
- p36 In Chapters 2 and 3, cyclic cubic splines are used so there should be some discussion of these here.
- p36 Consistency of notation: you use both $f''(x)$ and $\frac{\delta^2 f(x)}{\delta x^2}$ here.
- p37 Incorrect double use of j as subscript for tensor products. The model used in Chapter 2 uses different dimensions for the basis size for each direction so that approach should be adopted here.
- p38 Equation (1.8): what is $\hat{\mathbf{f}}$ and why is it a vector?

- p39 Spelling mistake: "leasst".
- p40 PIRLS algorithm, is the pseudodata correctly defined?
- p40 Need $\cdots$ between the integrals.
- p40 Is the smoothing parameter a vector in the discussion of the hierarchical optimisation method of Wood (2011)? If so, the later discussion of λ needs to be tighter.
- p40 Reference should be Reiss and Ogden (2009) in third line from the bottom.
- p41 There are quite a few missing brackets in the references on this page. e.g. It should be (Rue et al. (2009) suggest ...); (Rue et al., 2009) would be fine without the additional discussion.
- p44 "Considering the boundary ... relatively extreme". This sentence doesn't make sense.
- p44 Correct "no not".
- p46 Correct "where as".
- p48 Remove "provided it doesn't pop!".
- p48 Correct "boundary is something".

2 Notes on Chapter 2

- p64 Correct "giving a an idea".
- p66 Remove "not only due to the author's relative lack of patience".
- p66 "The methods developed in the coming chapters should take this into account". You don't really address this point further in the thesis as far as I can see. It would be nice to have a clear link to which work in the thesis does take this into account.

3 Notes on Chapter 3

- The Schwarz-Christoffel formulas in Section 3.2.2 are maps onto the interior of a polygon, so you need to take care throughout Chapter 3 that $\varphi : W^* \to W$ and the inverse map, $\varphi^{-1} : W \to W^*$. (Even here you have to be slightly careful as you are assuming that W is the interior of a polygon).
- p48 This gives the first reference to the Schwarz-Christoffel transform and you state $\varphi : W \to W^*$. Whilst it's not exactly wrong here as you haven't yet defined φ I think that it's better if you can omit the direct reference to φ here.
- p69 Opening paragraph. I think you should expand the peninsulae example a little and place it into some context to help motivate the idea.

- p69 Third paragraph "one could transform a region into a rectangle, circle or other familiar shape to avoid leakage via a mapping such as φ in figure 3-1." The mapping in Figure 3.1 is mapping from a rectangle so is the other way around. It's crucial for this idea to work that the map is invertible (which being conformal it is) so I think Figure 3.1 would be better replaced by Figure 3.5 and a description of the idea of the "$W \to W^*$ (smooth) $\to W$" process given.

- p70 Figure 3.2 "A mapping of the upper half-plane to the polygon". The picture actually shows the map $\varphi^{-1} : W \to W^*$ applied to the vertices of W and thus to the prevertices on the real line. Also, $\varphi^{-1}(w^*)$ on the picture is incorrect (for the arrow shown it should be $\varphi^{-1}(w_1)$; a general point would be $\varphi^{-1}(w)$). In the caption it is w_6 not w_6^* mapped to ∞.

- p70 "The Schwarz-Christoffel mapping takes an arbitrary polygon and maps it to a specified shape". No, it's the other way around.

- p71 Figure 3.3. Similar issues as with Figure 3.2 with the addition that we are dealing with the mapping of the polygon into the **unit disc**. Also, $\varphi^{-1}(w^*)$ on the picture is incorrect (for the arrow shown it should be $\varphi^{-1}(w_6)$; a general point would be $\varphi^{-1}(w)$).

- p71 For the procedure in step 1 (p70) don't you need the region to be a polygon for Schwarz-Christoffel? Step 2 suggests that $\varphi : W \to W^*$ when it doesn't. Shouldn't you obtain both φ and φ^{-1} here? In Step 3 you want to use φ^{-1} not φ. At what stage do you project back to W; should any inference in Step 5 be performed over W or W^*?

- p72 Figure 3.4. The angles should be $\theta_k\pi$ and $\alpha_k\pi$. The shading is too feint to appear on my copy (it does on the pdf version of the thesis).

- p72 "(of the plane, unit disk or rectangle)" should be something like "(for example, the upper half-plane, unit disk or rectangle)".

- p72 In the third paragraph you have both $\varphi : W^* \to W$ and $\varphi : W \to W^*$!

- p72 "for may examples" should be "for many examples".

- p72 Section 3.2.2 needs further clarification. The technical issues with the various Schwarz-Christoffel mappings are insufficiently discussed. Firstly, each depend upon what are termed the "prevertices" which are solutions to highly nonlinear equations. In the formula for the map from the half-plane, the prevertices are numbers from the real line but this is not made explicit and the space of the prevertices in the other formulae are not discussed (are they real?). Secondly, the integrals in the formulae typically do not have a closed form. Thirdly, solving the nonlinear equations to find the prevertices is a highly difficult problem. These issues can be solved numerically and such a solution is provided by the MATLAB package. This aspect should be clearly stated.

- p73 The upper half-plane. "When mapping Γ to the upper half-plane ..." Equation (3.2) gives the map **from** the upper half-plane to Γ. I suspect there are subtle technical issues about the base point (which you have in the text as w_0 rather than w_0^*). On p73 you are purely viewing (3.2) as a computational tool, so I would say something like "when calculating $\varphi(w^*)$ numerically, w_0^* is normally chosen ...".

- p74 Rectangle. Once again, this suggests that φ is a map from Γ to the rectangle. The second paragraph is not clear and needs a more careful explanation.
- p74 Rectangle. "The computation of this map ...". Once again, we are jumping between theory and computational issues. This also gives the impression that you are having to address this rather than (I guess) it's an issue solved in the MATLAB package?
- p74 Section 3.2.3 could merit an introductory statement that you are now going to explain how the Schwartz-Christoffel mapping can be obtained computationally. An earlier discussion of the need to find the prevertices (as outlined in the previous item in the discussion of the numerical issues) will have aided the clarity of this section
- p75 The discussion makes references to (3.3) and a choice of prevertices in the unit disc case. Given that you use the rectangle, this could be remedied.
- p75 Sentence following (3.5) isn't really clear. Do we need to know this?
- p76 In the algorithm, the starting values should be placed at the top and it should also be made clear that these are initial choices for the *prevertices* $w_1^*, \ldots, w_{K-3}^*$.

4 Notes on Chapter 4

- p100 The description of the MDS procedure follows that of Diaconis et al. (2008) though you've omitted some crucial details, for example that the x_i^*s were centred so that $\tilde{\mathbf{X}}^{*T}\mathbf{1} = 0$.
- p103 $\text{diag}(\tilde{X}^*\tilde{X}^{*T})_{ii}$ should this be $(\tilde{\mathbf{X}}^*\tilde{\mathbf{X}}^{*T})_{ii}$?
- p110 "since objective" should be "since the objective".
- p111 You should place the figures in the order in which you discuss them in the "Results" section. Currently, you discuss Figure 4.6 then Figure 4.5 and, finally, Figure 4.4.
- p116 Correct "and sample size" to "and the sample size". Correct "Prediction grid was" to "The prediction grid was".
- p117 The sentence "There is not a massive difference between the results in MSE terms, the soap film smoother consistently has a statistically significantly lower MSE" seems a little contradictory: are you using "not a massive difference" as "no practical difference"?
- p119 Is the prediction time for MDS+RS given in Table 4.1 correct? Compare it to the value given in Table 4.2.
- p119 Penultimate sentence does make sense; correct the grammar.
- p131 "The +1 in the denominator" I'd write the denominator as $\{\mathcal{L}(x_1, x_2) + 1\}^{3/2}$ to give this a tighter relationship.
- p131 Bad line break four lines from the bottom.

5 Notes on Chapter 5

- p141 Amend "computational burden, the point" to "computational burden. The point".
- p148 Correct "requires backfitting be used" to "requires that backfitting be used".
- p150 First equation is incorrect. Compare it to equation (1.5) on p31.
- p150 You give equation (1.6) on the bottom of p149 so it seems more sensible to refer to that rather than (1.6) on this page and on p152.
- p152 "Duchon suggests ..." add that this is for some choice of s and add some insight into what s does (which then leads to the discussion on p153).
- p153 Above (5.5) do you mean any s satisfying (5.5) or the smallest s? I presume, in general, you mean the former and that in the example you'll use the latter.
- p153 The hyphen in the heading of Section 5.2.2 is potentially confusing (could be confused for a minus sign): replace it by a colon.
- p156 When using the AIC on p195 you use l rather than $\hat{l}$. Consistency is needed.
- p161 Correct the sentence containing the phrase "the their".
- p162 You refer to Section 1.2 for the logit link function. As far as I can tell, p162 is the first reference to a logit in the thesis.
- p161 Correct the sentence containing the phrase "many of these covariates not be useful".
- p168 Reference should be "(as was the case in Wit and McClure (2004; p240-245))".
- p169 "Let $\mathbf{x}_i$" should this be "Let $\mathbf{m}_i$"?
- p173 "MP example" should be "MP voting data example".
- p177 "models fit to" should be "models fitted to".

6 Notes on Chapter 6

- p180 Reference should be "(see Diggle and Ribeiro (2007; p47) for more information)".
- p181 Reference should be "(the criterion given by Curriero (2006) to ensure valid semivariograms)".
- p185 Correct the grammar in the sentence with the phrase "touched in".
- p185 Correct "because the computational" to "because of the computational burden".

7 Notes on Chapter 7

- p192 "Can be written as" should this be "Can be estimated as"?
- p193 In stating the assumptions, you haven't explicitly separated them into those about the physical setting and those regarding the estimation of the density as Buckland typically does. In terms of the phrase "the assumptions are given in order of importance from most to least", does this then refer to all the assumptions or just those for estimation?
- p193 "Observing an animal" should be "observing an object".
- p193 "Figures 7.2" should be singular.
- p194 The technical details of Buckland (1992)'s "key function plus adjustment terms" formulation are omitted though aspects of this formulation are constantly referred to. I'd like to see an explicit statement of the formulation.
- p195 Caption to Figure 7.5. Omit parenthesis around $g(x)$, μ and w. Also reference should be Buckland et al. (2001).
- p196 Equation (7.5) needs x_i.
- p197 "Instead of effective" needs to be "instead of effective".
- p198 In the discussion above (7.6) I would prefer a more general setting than a specific aspect of a detailed example that has no (current) context.
- p199 You need to be a little more explicit about the assumptions underpinning the covariate modelling (for example, that the covariates affect the scale but not the shape of the detection function; this point is mentioned on p207). Also, there should be reference to Borchers (1996) if that's the originator of this approach.
- p199 Compare the definition of ν_i with that of ν on p197 and the 2π term.
- p200 First line of Section 7.6.1: is that a critical underpinning assumption?
- p201 It's bizarre to have a concluding section followed by two additional sections.
- p202 I'd like a little more detail about the problem of non-monotonicity of the detection function and whether this has been addressed in the literature previously. For example, Williams and Thomas (2007) appear not to comment upon the lack of monotonicity in the example referred to. Make it clear that the reference to Thomas et al. (2010) is to the Distance software.
- p204 The acknowledgement is a little strangely placed here (and I assume it's Chapter 8 not Chapter 7 which is the *basis* for the paper).

8 Notes on Chapter 8

- p206 Correct "being fit to data" to "being fitted to the data".
- p207 "Following on from the definitions of the detection functions ...": which definitions?
- p207 Both the LHS and RHS of equation (8.1) are incorrect. More crucially, you need to make it clear here and throughout the chapter (and appendix) how you are treating the covariates and thus whether you have the detection function being conditional on the covariates. The presentation suggests you are looking at the joint detection function over x and $\mathbf{z}$ rather than the detection function of x conditional on $\mathbf{z}$. I think you mean the latter and you need a far more careful discussion of this. See, for example, Marques and Buckland (2003)'s Biometrics paper (which is the motivation for Chapter 3 of Buckland et al. (2004)). You should also reference this paper.
- p208 I think it's worth making explicit that you are writing $\sigma_{ij} = \sigma_i \sigma_j$.
- p208 With reference to Marques and Buckland (2003) again, do you mean the conditional likelihood?
- p208 Does μ_i depend upon $\mathbf{Z}$?
- p209 Do ν_i and p_i depend upon $\mathbf{Z}$?
- p210 Section 8.3.1 needs tightening in the use of subscripts. For example, the final equation on p211 gives α_j.
- p212 What do you mean by "sorted distances" and "equal parts" in Section 8.3.2?
- p213 This illustrates the weakness of not having directly stated forms of detection functions in Chapter 7. What do you mean by a non-covariate k-point detection function?
- p218 In Table 8.1 the columns are not really labelled (compare with the labelling in Table 8.2). Moreover, there's no discussion of the K-S p values. Should I be concerned about a model fit with a p-value of 0.99 suggesting an almost perfect fit? For the Harbour seal (in water), there is a seemingly small difference in the AIC between the two models but a larger difference in $\hat{P}_a$ and even more in the K-S p values. What's going on here?
- p220 Figure 8.5 (and elsewhere) what do you mean by "the mixture components of the detection function, averaged over covariate values"? Are you trying to estimate/plot the marginal detection function (i.e. that over x) and, if so, are you arguing that this is $\sum_i g(x \mid z_i)$? Or, do you mean you are plotting $g(x \mid \overline{z})$?
- p221 The results in Table 8.2 would merit a reference to the K-S p values. For example, the smallest AIC value often corresponds to a (relatively) low K-S p value: the second smallest for the ants and a value of 0.036 for the Amakihi: would we reject H_0 for this p-value of 0.036?