# Thesis corrections

### Further explaination required:

* (1) Deconvolution algorithms (CNND, OASIS, MLSpike)
  + how were parameters chosen, and what were they?
  + OASIS & CNND output real-valued vector time-series (amplitudes of Ca2+ transients) not spikes. How were they converted?
  + How do these parameter and conversion choices alter the conclusions drawn about the biophysical Ca2+ model?
* (2) Quality of Conway-Maxwell model fits:
  + Was the COMb model a little or a lot better? Show e.g. distributions of model likelihoods
  + Show examples of what the best fits of the different models look like for the population activity
  + Give the distributions of parameters for the best-fit models

## Small corrections:

### Chapter 2: biophysical model of Ca2+

* Ca2+ model, give the rationale for:
  + Why are there two types of buffered Ca2+ (why not just 1)?
  + The objective function used to fit the model (pg 15). It sums two RMSEs, of different scales. Why these, and how weighted?
* Model-fitting (pg 22). There are four free parameters. Comment on:
  + Were the fits robust to variations in these parameters?
  + Is there redundancy in the parameter space?
* Ground-truth dataset:
  + what is it? (pg 19)
  + Allowed +/1 bin for spike accuracy – what size are bins? (p20)
* Figs 2.4-2.6: note which deconvolution algorithm was used, comment on results from other algorithms.
* Discussion of results
  + Extreme perturbations of buffer & indicator binding/concentration can alter spike inference. Comment on whether these perturbations are biologically obtainable values (Fig 2.4-2.6)
  + Almost all Ca2+ is bound to the GCaMP indicator (Fig 2.3). Comment on what this implies about the effects of a calcium sensor on how a neuron operates

### Chapter 3: functional networks across brain regions

Methods

* Outline how were cov(E(X|Z1..)) etc computed from the regression model.
* There is a long section on information theory, but it is unclear why: explain why the reader is being told this: e.g.
  + What are Eqs 3.11 and 3.12 for?
  + P 44: why do we care about max entropy limit?
* pg 51 Rand Index: what defines the “same” cluster here etc, when the clustering returns different size clusters?

Results

* section 3.4.4.
  + Comment on the k-partite structure disappearing with increasing time-scales (Fig 3.8, p61)
  + Comment on what causes the fall in dimensions of “connected” neurons with increasing bin-width. Just the increasing correlation between neurons?
* Section 3.4.5: comment on how many communities were found by the clustering in the *d* dimensions
* Comment on the signal correlation results: what does their departure from the total/noise correlation results imply about how the brain regions’ joint activity is related to different behaviours?

### Chapter 4: COMb model fit to ensemble recordings

* Why are we interested in KLD between binomial and COMb? (fig 4.2D)
* Results are shown for one binsize, but the Methods states other binsizes were used too – comment on any effects of other binsizes on the model fits
* Comment on:
  + What do we learn from the COMb model once fitted?
  + What can we do with it next?

### Chapter 5

* ~~Multi-scale model: comment on the intended application in neuroscience~~

### Chapter 6

* ~~p105 states “directed measure like synaptic connectivity” – it is unclear what is meant here, as synaptic connectivity is not a measure~~
* ~~p 107 claims that voltage indicators do not have spatial resolution high enough to single out individual cells, but they very much do. See e.g. Knopfel & Song (2019) Nature Review Neuroscience.~~

## Some typos to consider, corrections not required:

~~Abstract: “large mutli-region”~~

Consider hyphenating inside multi-adjective phrases: novel community detection method -> novel community-detection method (as an example, common throughout)

467 – paragraph long and moves from advantages to a disadvantage and its mitigation in a confusing way.

484 – huge paragraph doing a lot of work

~~518 – year number missing on citation – not sure how you do that!~~

Some shifts between present and past tense

FIG 2.1 - left justify captions – here and elsewhere

~~700 – you may have mixed up depolarization and repolarization here!~~

~~724 - "buffers. Each" -> full stop to comma, otherwise the second sentence has no verb.~~

~~731 / 732 - $$'s missing around "r", also "f" and "b".~~

~~917 – url goes over line.~~

~~958 – something wrong here!~~

~~989 – extra space before full stop.~~

~~1129 - "lead" -> "leads"~~

~~1138 – isn't it 13 parameters?~~

~~1153 – a range and a tilde; hard to interpret.~~

~~1280 – full stop -> comma~~

~~1284 – missed big P in Python~~

~~1352 - on-to-one: add an "e"~~

Eq. 3.7 - used without first defining the conditional entropy which is inconsistent since you do define the joint entropy. - not true. This refers to equation 3.17. Equation 3.16 is the definition of conditional entropy.

Page 79 – needlessly confusing