Errata for the Second Edition of the Monograph: Concentration of Measure Inequalities in Information Theory, Communications, and Coding

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The following minor corrections and clarifications refer to the monograph:

M. Raginsky and I. Sason, *Concentration of Measure Inequalities in Information Theory, Communications, and Coding*, Foundations and Trends in Communications and Information Theory, second edition, Now Publishers Inc., 2014. ISBN: 978-1-60198-906-2.

1. Page 14, third item of Example 2.2: after $X_i \in \mathbb{L}^2(\Omega, \mathcal{F}_i, \mathbb{P})$, add '(i.e., for every i, the random variable X_i is defined on the same sample space Ω, it is $\mathcal{F}_i$-measurable, and $\mathbb{E}[X_i^2] < \infty$)'.

2. Page 18, third line of Section 2.2.2: should be 'for *sums of* independent and bounded random variables'.

3. Page 29, Lemma 2.2.6: should be $t \geq 0$ (instead of $t \in \mathbb{R}$).

4. Page 30, Eq. (2.2.44): should be $\lambda \geq 0$ (instead of $\lambda \in \mathbb{R}$). The same also holds for the caption of Figure 2.1 (on page 31).

   Remark: Note that the corrections in items 2 and 3 above do not affect the result in Theorem 2.2.7 (since the corresponding optimized value of t in the Chernoff bound is $t = \frac{r}{2\sum_k c_k(b_k - a_k)^2} \geq 0$).

5. Page 33, two lines before Theorem 2.3.1: should be *strengthens*.

6. Page 45, fifth line: replace this last line in the chain of equalities by

$$= \ln 2 \left[1 - h_2\left(\frac{1}{2}\left(1 - \frac{\alpha}{d}\right)\right)\right] = f(\delta)$$

   where the last equality follows from (2.3.14) and (2.3.26).

7. Page 47, one line after (2.3.34): should be '*power* series expansion'.

8. Page 48, 8 lines after (2.3.35): one left parenthesis is redundant.

9. Page 49, 10th line: add parentheses to $\frac{S_n}{\sqrt{n}}$, i.e., it should be $\left\{\frac{S_n}{\sqrt{n}}\right\}$.

10. Page 50, 6 lines before Section 2.4.2: in continuation to "... except for the additional factor of 2", add afterwards "in the pre-exponent (see the right-hand side of (2.3.31)."

11. Page 51: there should be a full-stop at the end of equation (2.4.5).

12. Page 53, 3rd line from the top: λ should be replaced by $|\lambda|$, so this line reads

$$\leq |\lambda|^{-n} \, |\psi(X_n)| + |\lambda|^{-(n-1)} \, |\psi(X_{n-1})|.$$

13. Page 54, 7th line: 'instant time' should be 'instant of time'.

14. Page 57, last sentence of the first paragraph needs to be modified to: 'As a result of this drawback, linear transmitter circuitry is required, which suffers from a poor power efficiency.'

15. Page 64: From (2.5.14), the bounds on the right-hand sides of (2.5.15) and the un-numbered deviation inequality after (2.5.15) can be improved by a multiplication of their exponents by $\frac{\alpha}{\eta} > 1$.

16. Page 76: as a clarification to the calculation of p_{BP}, add the following at the end of the sentence ' ... bits per channel use' (8th line of this page): '(note that the above calculation of p_{BP} for the BEC follows from the fixed-point characterization of the threshold in [13, Theorem 3.59] with the pair of degree distributions $\lambda(x) = x$ and $\rho(x) = x^{19}$).' Furthermore, as a clarification to the threshold σ_{BP} for the binary-input AWGN (BIAWGN) channel (9th line of p. 76), please add after $\sigma_{\text{BP}} = 0.416560$: '(this numerical result is based on a computation that follows from [41, Example 11].'

17. Page 78, 2nd line: to improve readability of the explanation of inequality (e), please modify it to 'inequality (e) is due to the stability condition for a BEC with erasure probability p, which states that satisfying the inequality $p\lambda'(0)\rho'(1) < 1$ is a necessary condition for reliable communication under BP decoding (see [13, Theorem 3.65])'.

18. Page 87, three lines after (2.D.3): delete the full-stop at the end of the equation, and add afterwards 'where $P_{\text{t}}^{(\ell)}$ and $P_{\bar{\text{t}}}^{(\ell)} \triangleq 1 - P_{\text{t}}^{(\ell)}$ denote the probabilities that the sub-graph $\mathcal{N}_{\vec{e}}^{(\ell)}$ is or, respectively, is not a tree.'

Remark: Note that $P_{\bar{\mathrm{t}}}^{(\ell)}$ was earlier defined in Theorem 2.5.4 (on p. 67), but $P_{\mathrm{t}}^{(\ell)}$ was not defined as the probability of the complementary event (however, it is easy to guess its definition from the context). It is better to write $P_{\mathrm{t}}^{(\ell)}$ and $P_{\bar{\mathrm{t}}}^{(\ell)}$ since t is not a variable (e.g., a time index); it stands here as an abbreviation of 'tree'.

19. Page 91, item 2 entitled 'The Herbst argument': the divergence $D(P^{(\lambda f)} \| P)$ first appears on page 91 (9th line) though it is defined and calculated later on page 94. For p. 91, please add

$$D(P^{(\lambda f)} \| P) = \mathbb{E}_{P^{(\lambda f)}} \left[\ln \frac{\mathrm{d}P^{(\lambda f)}}{\mathrm{d}P} \right] = \mathbb{E}_P \left[\frac{\mathrm{d}P^{(\lambda f)}}{\mathrm{d}P} \ln \frac{\mathrm{d}P^{(\lambda f)}}{\mathrm{d}P} \right].$$

20. Page 111, Eq. (3.2.34): for improving readability, this inequality is

$$D(P^{(tf)} \| P) \le \left(\frac{t^2}{2} \right) \mathbb{E}_P^{(tf)} \left[\| \nabla f(X^n) \|^2 \right] \le \frac{t^2}{2}.$$

21. Page 168: there should be a full-stop at the end of inequality (3.4.79).

22. Page 170: the full-stop at the end of (3.4.81) should be removed.

23. Page 191, Theorem 3.6.3: the full-stop at the end of the two inequalities for R_1 and R_2 should be removed.

24. Page 221, three lines from the bottom of the page: the sentence needs to be 'We provide the proofs of (3.B.8) and (3.B.9) in Appendix 3.C.'

25. Page 232, one line from the bottom: to improve readability, it is preferred writing $\frac{c(T)}{2}$ at the end of this line.

26. Page 236, ref. [20] is from June 2005 (instead of February 2008). The link to this PhD dissertation is `http://arxiv.org/abs/math/0507526`.

27. Page 237, ref. [29]: this journal paper was published in October 2014 (April 2013 was the date of its first publication online).

28. Page 241, ref. [91]: the link to this accepted paper is `http://dx.doi.org/10.1016/j.spa.2014.08.001`.

29. Page 242, ref. [104]: should be '<u>d</u>istribution'.

30. Page 247, ref. [168]: the link to this un-published paper is `http://arxiv.org/pdf/0907.4491v1.pdf`.