NETWORK INFORMATION THEORY

OMISSIONS TO ALL PRINTINGS

p. 220, Bibliographic Notes, line 14 should read:

The capacity region of the deterministic broadcast channel was established independently by Marton (1979a) and Pinsker (1978).

Marton, K. (1979a). The capacity region of deterministic broadcast channels. In C. F. Picard and P. Camion (eds.) *Théorie de L'information: Développements récents et Applications (Cachan, France, 1977)*, pp. 243–248. CNRS Editions, Paris. [220]

ERRATA TO THE SECOND AND THIRD PRINTINGS

p. 52, lines 2 and 3 should read:

…energy per bit $E > (2^{2R} - 1)/\underline{(g^2 R)}$ is …

p. 85, Proposition 4.1, line 2:

$\alpha R_{11} + \bar{\alpha} R_{21} \quad \longrightarrow \quad \alpha R_{11} + \bar{\alpha} R_{12}$

p. 121, 1 line below (5.9):

$|\mathcal{U}| \le \min\{|\mathcal{X}|, |\mathcal{Y}_1| \cdot |\mathcal{Y}_2|\} + 1 \quad \longrightarrow \quad |\mathcal{U}| \le \min\{|\mathcal{X}|, |\mathcal{Y}_1| + |\mathcal{Y}_2|\} + 1$

p. 143, Theorem 6.4, line 11:

$|\mathcal{Q}| \le 6 \quad \longrightarrow \quad |\mathcal{Q}| \le 7$

p. 146, line 2 should read:

… y_1 and y_2 are injective in $\underline{t_2 \text{ and } t_1}$, respectively …

p. 155, line 13:

$U_{2,6} = Y_{1,3}$ and $U_{2,5} = Y_{1,2} \quad \longrightarrow \quad U_{2,5} = Y_{1,3}$ and $U_{2,6} = Y_{1,2}$

p. 163, Problem 6.16 (a), line 11:

$|\mathcal{Q}| \le 6 \quad \longrightarrow \quad |\mathcal{Q}| \le 7$

p. 223, line 5:

$\lambda_{m_2 m_2} \quad \longrightarrow \quad \lambda_{m_1 m_2}$

p. 223, line 13 should read:

…upper bounded by $(2P_e^{(n)})^{n^2/2}$ for n sufficiently large.

p. 223, lines 19–21 should read:

…upper bounded by

$$\frac{2^{n(R_1+R_2)}}{n^4}(2P_e^{(n)})^{n^2/2}$$

for n sufficiently large. Further show that …

p. 230, line -14:

$\Phi\Phi^T \preceq I_R \quad \longrightarrow \quad \Phi\Phi^T \preceq I_r$

p. 242, lines -2 and -3 should read:

$$R_1 < \frac{1}{2}\log|G_1K_1G_1^T + I_r|,$$
$$R_2 < \frac{1}{2}\log\frac{|G_2K_2G_2^T + G_2K_1G_2^T + I_r|}{|G_2K_1G_2^T + I_r|}$$

p. 313, line -12 should read:

The quadratic Gaussian distributed source coding problem was studied …

p. 347, lines 6–9 should be without the inactive fourth inequality as:

$$R_0 + R_1 \geq H(U_1),$$
$$R_0 + R_2 \geq H(U_2),$$
$$R_0 + R_1 + R_2 \geq H(U_1, U_2).$$

p. 347, lines 11–13 should read:

As seen from the extreme points above, the first two inequalities can be simultaneously tight while the third can be individually tight. Interestingly, the values of the common rate R_0 corresponding to these two cases lead to several notions of *common information*.

p. 347, lines 17 and 18 should read:

Mutual information. The minimum sum-rate is $H(U_1, U_2)$. With no common rate, i.e., $R_0 = 0$, the minimum sum-rate jumps to $H(U_1) + H(U_2)$. The difference between these two sum-rates is the mutual information $I(U_1; U_2)$ and represents the value of having a common link.

p. 485, line 4 should read:

noise components Z_k, $k \in [1:N]$, are i.i.d. N(0, 1).

p. 497, line 3 should read:

are $1, \ldots, N'$, <u>where $N' \geq N/9$,</u> and

p. 497, lines 5 and 6 should read:

the symmetric capacity for these source nodes, and hence the symmetric capacity for all source nodes, are upper bounded by

p. 497, line 8:

$[N' + 1 : 2N'] \quad \longrightarrow \quad [N + 1 : N + N']$

p. 497, line 13 should read:

…for $k \in [N + 1 : 2N]$, which does not affect the order of the upper bound since $N' = \Theta(N)$. Thus, each …

p. 498, line 6:

$I(X^N; Y_{N+1}^{2N}) \quad \longrightarrow \quad I(X^N; Y_{N+1}^{2N} | X_{N+1}^{2N})$

ERRATA TO THE FIRST PRINTING

p. xviii, Organization of the Book, line 5 should read:

…we first study channel coding settings, followed by …

p. 46, item 3 above Lemma 3.1 should read:

…conditionally independent given U^n that has …

p. 67, line 8 should read:

Because the maximal probability of error …

p. 69, Bibliographic Notes, line 10 should read:

Hence, we will adopt the random codebook generation and joint typicality decoding approach throughout.

p. 70, line -4 should read:

$$\lim_{n\to\infty} \mathsf{P}\{d(X^n, \hat{x}^n(m(X^n))) \le D\} = 1$$

p. 84, Proof of the converse, line 4 should read:

where ϵ_n tends to zero as $n \to \infty$. Thus, for any $\epsilon > 0$, $(R_1 - \epsilon, R_2 - \epsilon) \in \mathscr{C}^{(n)}$ for n sufficiently large. This completes the proof of the converse.

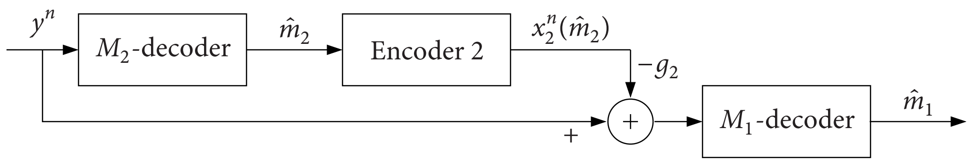
p. 86, Theorem 4.2 should read:

The capacity region $\mathscr{C}$ of the DM-MAC $p(y|x_1, x_2)$ is the convex closure of $\bigcup_{p(x_1)p(x_2)} \mathscr{R}(X_1, X_2)$.

p. 91, 2 lines above (4.4) should read:

…we have shown that the rate pair (R_1, R_2) must be in $\mathscr{C}'$, which is the closure of the set of rate pairs (R_1, R_2) such that

p. 97, Figure 4.10 should look:



p. 98, Theorem 4.5, line 4 should read:

for some pmf $p(q)\prod_{j=1}^k p(x_j|q)\ldots$

p. 101, last sentence of Problem 4.5 should read:

Show that the capacity region $\mathscr{C}$ can be characterized as the <u>closure</u> of $\bigcup_k \mathscr{R}^{(k)}$.

p. 113, 1 line above (5.3) should be an inequality:

$$\le \sum_{i=1}^n I(X_i, M_1, Y_1^{i-1}; Y_{1i}|U)$$

p. 129, Problem 5.18, line 3 should read:

…sender 2 encodes only $\underline{M_0}$.

p. 134, Remark 6.1, line 6 should read:

…larger than the convex closure of <u>the union of</u> $\mathscr{R}(X_1, X_2)$ over all $p(x_1)p(x_2)$.

p. 147, line -12:

$H(Y_2^n|X_1^n) \quad \longrightarrow \quad H(Y_2^n|X_2^n)$

p. 151, 1 line above Theorem 6.6 should read:

…achievable <u>within</u> half a bit.

p. 155, line 4 should read:

…where A is an $L \times LC'_{\mathrm{sym}}$ q-ary matrix. Decoder $j\ldots$

p. 163, Problem 6.16 (a) should read:

…when evaluated with Gaussian inputs (without power control), reduces to …

p. 181, Analysis of the probability of error, line 6 should read:

$$\mathcal{E}_3 = \{(U^n(l), Y^n) \in \mathcal{T}_\epsilon^{(n)} \text{ for some } l \notin [1:2^{n(\tilde{R}-R)}]\}.$$

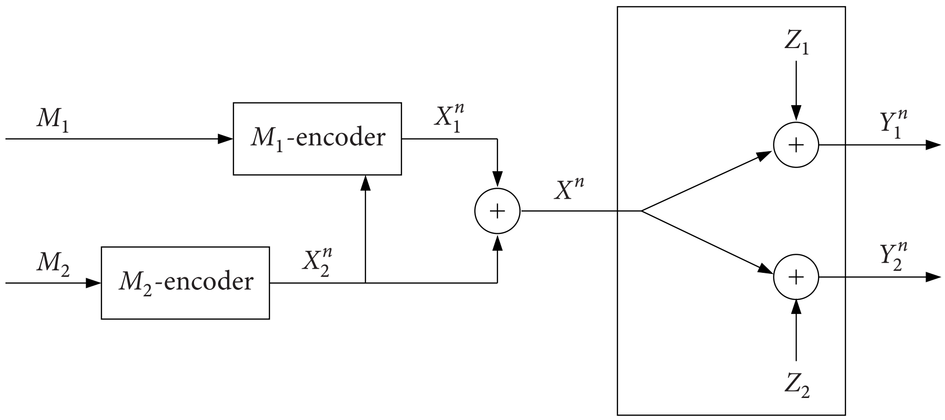
p. 186, Proof of Theorem 7.4, line 3 should read:

…with DM state and nonnegative cost function $b(x)$, $x \in \mathcal{X}$. We assume an input cost constraint

p. 209, Analysis of the probability of error, line 7 should read:

$$\mathcal{E}_{12} = \{(U_1^n(l_1), Y_1^n) \in \mathcal{T}_\epsilon^{(n)}(U_1, Y_1) \text{ for some } l_1 \notin [1 : 2^{n(\tilde{R}_1 - R_1)}]\}.$$

p. 211, Figure 8.10 should look:



p. 217, Theorem 8.6, line 8 should read:

for some pmf $p(u_1)p(u_2)p(u_0|u_1, u_2)$ and …

p. 221, 1 line above Problems should read:

ingenious counterexample …

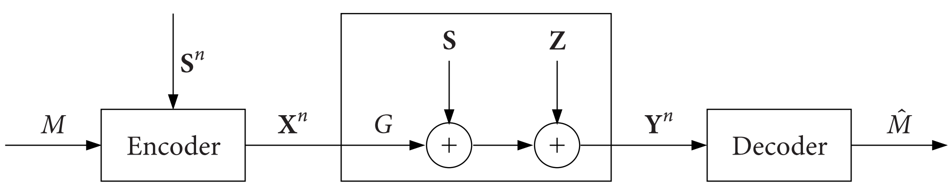
p. 230, 8 lines above Section 9.1.2 should read:

Noting that $\Psi\Psi^T \preceq \underline{I_r}$, we then …

p. 231, Lemma 9.1, line 1 should read:

…channel gain matrix G and …

p. 241, Figure 9.7 should look:



p. 242, lines -3 and -2 should read:

$$R_1 < \frac{1}{2} \log |G_1 K_1 G_1^T + I_r|,$$
$$R_2 < \frac{1}{2} \log \frac{|G_2 K_2 G_2^T + G_2 K_1 G_2^T + I_r|}{|G_2 K_1 G_2^T + I_r|}$$

p. 295, Theorem 12.1, line 7 should read:

…with $\underline{|\mathcal{Q}| \le 4}$, $|\mathcal{U}_j| \le |\mathcal{X}_j| + 4 \ldots$

p. 315, Problem 12.6 (b), line 4 should read:

where $r_j = (1/2)\log(1 + N_j/\tilde{N}_j)$, $j = 1, 2$.

p. 324, line -6 should read:

$$D_{\min} = \inf\{D\colon (R_1, R_2) = (1/2, 1/2) \text{ is achievable for distortion } \underline{\text{triple}}\ (0, D, D)\}.$$

p. 331, Example 13.2, line 3 should read:

…binary symmetric test channels

p. 337, line 5:

$\hat{\mathcal{U}}_1^{k_1} \times \hat{\mathcal{U}}_2^{k_2} \quad \longrightarrow \quad \mathcal{U}_1^{k_1} \times \mathcal{U}_2^{k_2}$

p. 356, Problem 14.6, line 1 should read:

Show that every rate pair (R_1, R_2) in the optimal rate region $\mathscr{R}^*$ of the Gray–Wyner system must satisfy the inequalities

p. 370, 3 lines above Example 15.3:

vector α $\longrightarrow$ vector $\boldsymbol{\alpha}$

p. 374, Theorem 15.4, line 3:

$(D_1, \ldots, D_{N-1}) \quad \longrightarrow \quad (\mathcal{D}_1, \ldots, \mathcal{D}_{N-1})$

p. 378, line 18 should read:

…via an ingenious counterexample …

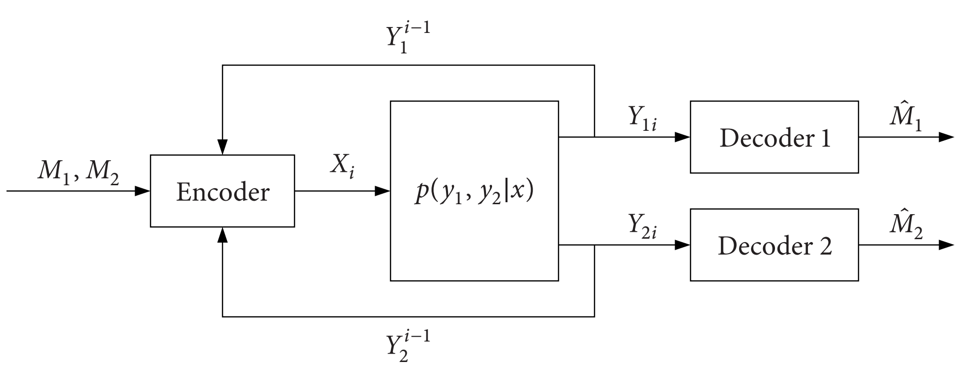
p. 395, Section 16.5, line 6 should read:

…and $Z_2 \sim \mathrm{N}(0, 1)$ and $Z_3 \sim \mathrm{N}(0, 1)$ are …

p. 426, lines 3 and 6:

$X_3 \quad \longrightarrow \quad Y_3$

p. 443, Figure 17.5 should look:



p. 446, 4 lines above Figure 17.8 should read:

The capacity region of the DM-TWC ...

p. 451, Section 17.6.2, lines 5 and 6 should read:

$$\begin{aligned}&= \sum_{i=1}^{n} I(M_1, X_1^i; Y_i | M_2, X_2^i, Y^{i-1}) + n\epsilon_n \\ &\leq \sum_{i=1}^{n} I(X_1^i; Y_i | X_2^i, Y^{i-1}) + n\epsilon_n\end{aligned}$$

p. 454, line -8 should read:

...Example 17.3. Elia (2004) improved the resulting inner bound using control theoretic tools. Cover and El Gamal (1979) ...

p. 454, line -5 should read:

Shannon (1961) introduced ...

p. 465, 1 line above Decoding should read:

...in block $j \in [1 : b]$.

p. 480, Remark 18.8 should read:

As for the interference channel, the rates achieved by the above coding schemes can be improved by using more sophisticated techniques such as superposition coding and rate splitting.

p. 539, Example 21.13, line 1 should read:

Let (X_1, X_2) be a DSBS(p), $Z_1 = Z_2 = X_1 \cdot X_2$. For two rounds ...

p. 552, line -7 should read:

...is monotonically decreasing in

p. 555, Section 22.1.2, last three lines of displayed equations should read:

$$\begin{aligned}&\stackrel{(d)}{=} n\big(I(U; Y|V) - I(U; Z|V)\big) + n(\epsilon + \epsilon_n) \\ &\leq n \max_v \big(I(U; Y|V = v) - I(U; Z|V = v)\big) + n(\epsilon + \epsilon_n) \\ &\stackrel{(e)}{\leq} nC_\text{S} + n(\epsilon + \epsilon_n),\end{aligned}$$

p. 557, displayed equations in Theorem 22.2 should read:

$$\begin{aligned}R_0 &\leq \min\{I(U; Z),\ I(U; Y)\}, \\ R_1 &\leq \big[I(V; Y|U) - I(V; Z|U)\big]^+ + R_\text{L}, \\ R_0 + R_1 &\leq I(U; Z) + I(V; Y|U), \\ R_0 + R_1 &\leq I(V; Y)\end{aligned}$$

p. 559, Wiretap channel with secret key, line 3 should read:

…then the secrecy capacity of a more capable DM-WTC $p(y, z|x)$ is

$$C_{\mathrm{S}}(R_{\mathrm{K}}) = \max_{p(x)} \min\bigl\{I(X;Y) - I(X;Z) + R_{\mathrm{K}},\ I(X;Y)\bigr\}. \tag{22.7}$$

p. 624, Lemma A.2, line 2 should read:

Let $\mathscr{A}$ be a subset of the boundary points of $\mathscr{R}_1$ such that its convex hull includes $\mathscr{R}_1$.

(Last modified: January 8, 2018)