CS 723 Introduction to Probability and Linear Algebra, IITB Autumn 2009 notes errata

This is an errata for the lecture notes. Sub-sections names correspond to the names of the files.

cs723Notes.pdf

Here, page numbers denote the actual page numbers shown on every page. The following corrections were suggested by Sagar:

1. Page no. 8, last para: instead of "$0 < k \leqslant 1$" it should be "$k \geq 1$ and k integer".
2. Page no. 13, paragraph after Definition 3.2.1: instead of "Now each of $E_i \cup B$ is" it should be "$E_i \cap B$".

cs723Scans1.pdf

Here, page numbers are as shown in a pdfviewer. The following corrections were suggested by Sagar:

1. Page no. 7: The line after the plot: "f_X increases till $\lambda - 1$ and then decreases". Actually "f_X increases till $\lambda - 1$, then $f(\lambda - 1) = f(\lambda)$ and it decreases after λ" (it is actually shown in the plot).
2. Page no. 18: In the bottom half, it should be $f_Y(y) = (1/a) f_X((y-b)/a) = \begin{cases} 0 & y < b, \\ 1/a & b \leqslant y \leqslant a+b, \\ 0 & y \geqslant a+b \quad \text{(While current version shows equal to 1 for this case)} \end{cases}$.
3. Page no. 20: The second last line, the integral should be "$\lim_{a\to\infty} \ldots$" instead of "$\lim_{a\to 0} \ldots$".
4. Page no. 23: Last para: $\mathrm{var}(X) = 1/12$ for Uniform$[0, 1]$ (notes show $1/3$). This was also pointed out by Lokesh and Salil.
5. Page no. 24: Third to last line: in the formula for $f_Y(y)$ it should be $e^{-(y-\mu)^2/(2\sigma^2)}$, $y \in \mathbb{R}$. In the notes, instead of y, x is used.
6. Page no. 61: Fourth line: instead of "if all $q_y = 1/m$ (for $y = 1$ to m)," it should be "if $p_1 = p_2 = \cdots = p_m$,".

Salil suggested the following correction in Page 21: Line 2 sumation should read $\sum_{x_i \in E} |x_i| f_X(x_i)$ (Currently, the index i is missing inside the sum).

cs723Scans2.pdf

Here, page numbers are as shown in a pdfviewer. Here is a correction revealed in the lectures: Page 61: The statement which says idependence implies conditional independence is false. Enough examples were shown in support of this in the lecture.

The following correction was suggested by Lokesh and Salil:

1. Page 6: In the last TWO equations, final result is written incorrectly as E[X] (in both of them) whereas it should be E[g(X)].

cs723Scans3.pdf

Here page numbers are as shown in a pdfviewer. Here is a correction stressed upon in the lectures: Page 69: the statement "if all eigen-values are real, then the matrix is symmetric" is ofcourse false. There are examples in support of this elsewhere in the notes.

The following comments are by Sagar:

1. Page no. 13: Fourth step: instead of $=$ it should be $\leqslant$. This was also suggested by Salil.
2. Page no. 27: Need to mention that the transformation matrices M_{T_1} and M_{T_2} for the transformations $T_1 : V \to W$ and $T_2 : W \to U$ respectively are with respect to the same basis in the vector space W.
3. Page no. 34: The step after the step 4; "since $\mathcal{N}(M)$ and $\mathcal{R}(M)$ are subspaces in $\mathbb{R}^n$, we have $\dim(\mathcal{N}(M)) + r_r \leqslant n$. Actually, as mentioned in lectures, we need to use fact that they are not arbitrary subspace in $\mathbb{R}^n$, but they are orthogonal subspaces and hence the statement about dimensionalty is true.
4. Page no. 37: The third line says that "The equation $M^T Mx = M^T b$ always has a solution." But the reasoning given is not sufficient. The reasoning is as follows (as explained in lectures): It means $M^T(Mx - b) = 0$ has a solution. Now $\mathcal{C}(M)$ and $\mathcal{N}(M^T)$ are orthogonal complements and hence b can be written as a linear combination of columns of M and a basis of $\mathcal{N}(M^T)$, say $b = M\beta + \alpha_1 u_1 + \cdots + \alpha_k u_k$, where $u_1, \ldots, u_k$ is a basis of $\mathcal{N}(M^T)$. It is easy to see that $x = \beta$ is indeed a solution for $M^T(Mx - b) = 0$. If columns of M are not linearly independent then we can have multiple such β's. Otherwise, there is exactly one such β and hence a unique solution to $M^T Mx = M^T b$. Exactly in this case $M^T M$ is invertible.
5. Page no. 59: In the second example, instead of "Hence the eigen values are $0, 0, 2$" it should be $0, 0, 3$. This was also pointed by Rachit and Rajdeep.
6. Page no. 68: Second para first line: instead of "orthogonal complement of M" it should be "orthogonal complement of subspace spanned by v_1".
7. Page no. 81: Second subpoint in the second point should be "orthonormal basis of **column** space is u_2, u_3."

The following comments are from Rajdeep:

1. Page 39: The line defining gradient of Lagrangian contains error. Its written as: $\nabla_x L = 0 \Rightarrow 2x + M^T\lambda = 0$, whereas it should be: $\nabla_x L = 0 \Rightarrow x + M^T\lambda = 0$. This was also pointed out by Lokesh.
2. Page 67: Proof of iii. Second line. Should be "Pick any eigen value" (instead of pick any eigenvector)

The following correction was suggested by Rachit:

1. On page 26: $T(v_{m+1}) = 0w_1 + 0w_2 + \ldots + mw_m$ (Currently coeffcient of w_2 is 2 instead of 0).

Salil found that the link http://www.snl.salk.edu/ shlens/pub/notes/pca.pdf (refered to on the last page) is not available any more. It is now available at www.snl.salk.edu/ shlens/pca.pdf.