Letter to the Editor

Modified dose difference method for comparing dose distributions

Dear Editor-in-Chief,

I would like to comment on the article by Jino Bak, Jin Hwa Choi, Jae-Sung Kim, and Suk Won Park, “Modified dose difference method for comparing dose distributions,” J. Appl. Clin. Med. Phys. 2012; 13(2): 73-80.

Something almost identical to their method was in fact first described by Bakai et al.\(^1\) who called their dimensionless index \(\chi\). While it is true that Bak et al. refer to this work in Reference 13, the authors do so in a list of variations on the \(\gamma\) index. However, \(\gamma\) indices involve a search over dose and spatial coordinates, while \(\chi\) is a gradient-dependent function like theirs, and I do not think that they properly acknowledge the similarity. The difference between their “modified dose” index and \(\chi\) lies in the dimensionless parameter \(\beta\), described in their Eq. (1) as:

\[
\beta = |\nabla D| \left( \frac{r_{cri}}{D_{cri}} \right) \quad (1)
\]

where \(r_{cri}\) and \(D_{cri}\) are distance-to-agreement and dose difference criteria (my symbols), and \(\nabla D\) is the gradient of the reference dose distribution. Where the authors define a modified dose difference,

\[
\delta^{(M)}D = \delta D / (1 + \beta), \quad (2)
\]

Bakai et al. would define the index \(\chi\) as

\[
\chi = \frac{\delta D}{D_{cri}} / (1 + \beta^2)^{1/2} \quad (3)
\]

for an actual dose difference \(\delta D\) at a point \((x,y,z)\), when their Eq. (6) is cast in the above terminology. In addition, Bakai et al. provided a convincing theoretical basis for the \((1 + \beta^2)^{1/2}\) factor, rather than \((1 + \beta)\), in terms of the minimum distance between two surfaces in \((x,y,z,D)\) space when measured in appropriate units.

To be fair to the authors, Bakai et al. did not actually define a modified dose difference \(\chi D_{cri}\), nor the weighting factor \((1 + \beta^2)^{1/2}\) explicitly, so the similarity could easily have been missed. I realize it is a bit unseemly to reference one’s own work, but I did make that definition myself in connection with evaluating 3D dose differences.\(^2\)

Sincerely,

Will Ansbacher

REFERENCES

1. Bakai A, Alber M, Nusslin F. A revision of the gamma-evaluation concept for the comparison of dose distributions. Phys Med Biol. 2003;48(21):3543–53.
2. Ansbacher W. Three-dimensional portal image-based dose reconstruction in a virtual phantom for rapid evaluation of IMRT plans. Med Phys. 2006;33(9):3369–82.