DOSEPY VALIDATION

OLIVARES-JIMENEZ, L. A.

Centro Estatal de Oncología "Dr. Rubén Cardoza Macías", Secretaría de Salud, 23085 La Paz BCS, Mexico
alfonso.cucei.udg@gmail.com

Introduction: Intensity modulated radiation therapy allows the generation of high dose gradients to spare healthy tissue irradiation. Its implementation must be in conjunction with a patient-specific dosimetry evaluation, where before treatment delivery to the patient, associated dose distribution should be measured and compared with the intended one.

Comparison between measured and calculated dose distributions can be done using commercial software. However, not everyone has access to them. DoseLab 4.11 could be a good option since it is distributed as open source, unfortunately it is unsupported and installation requires an operating system that is no longer available. This work presents the development and validation of a software that allows dose distributions comparison using profiles and gamma index test.

Material and method: Dosepy is a software written in python and hosted on GitHub for code visualization and/or improvement suggestions. It uses well-established python libraries like NumPy, Pydicom and tifffile for data manipulation.

Dosepy reads two files in CSV or DICOM format, that represents reference and evaluated 2D dose distribution. For visual comparison, horizontal and vertical profiles can be plotted. Quantitative analysis is performed by gamma test evaluation according to Low D. A. definition [1] and some AAPM TG-218 recommendations [2].

Dosepy validation was performed by comparing gamma passing rate results versus that obtained with DoseLab 4.11 and VeriSoft 7.1.0.199 software. For that, 6 dose distributions were calculated with Eclipse 15.1 and exported as DICOM format. Three conventional treatment plans (2 Gy/fx) were measured with the OCTAVIUS system coupled to an array of 729 ionization chambers. Processed dose distributions were exported from VeriSoft and saved as CSV format for importing into Dosepy.

Additionally, three SBRT plans (8–10 Gy/fx) were measured using EBT3 radiochromic film and later transformed to absorbed dose using an internal protocol. Both measured and calculated dose distributions were saved as uint16 data type in order to be stored as tiff format for DoseLab readout.

Results: Table 1 shows Dosepy versus DoseLab comparison. Mean differences of +0.5 % and -0.01 were obtained for gamma passing rate and average gamma index, respectively. On the other hand, -1.5 % and +0.07 were obtained for Dosepy versus VeriSoft comparison. The higher difference obtained for the last one could be associated with the internal interpolation of the measured data that VeriSoft performs for graphical visualization and data export, but not for gamma calculations.

	Criteria	DoseLab		Dosepy		Difference	
	[%, mm]	Gamma rate	Mean index	Gamma rate	Mean index	Gamma rate	Mean index
1	3, 3	99.6%	0.26	99.7%	0.24	+0.1%	-0.02
	2, 3	99.1%	0.33	99.3%	0.32	+0.2%	-0.01
	2, 2	98.6%	0.38	98.7%	0.36	+0.1%	-0.02
2	3, 3	96.2%	0.43	96.5%	0.42	+0.3%	-0.01
	2, 3	92.0%	0.53	92.9%	0.52	+0.9%	-0.01
	2, 2	86.0%	0.64	86.2%	0.64	+0.2%	0.00
3	3, 3	90.9%	0.48	91.1%	0.47	+0.2%	-0.01
	2, 3	83.3%	0.63	84.3%	0.61	+1.0%	-0.02
	2, 2	79.0%	0.71	80.4%	0.70	+1.4%	-0.01
			Average			+0.5%	-0.01

Table 1: Dosepy and DoseLab comparison according to gamma passing rate and average gamma index.

Conclusions: Dosepy can be used for teaching and research purposes. Gamma test results are comparable with two widely used software.

Dosepy is distributed without any warranty to be free from bugs and errors. Clinical use is the responsibility of the user. See the project at https://pypi.org/project/Dosepy/.

References:

1. D. A. Low, et. al., *Med Phys*, 25, 656-661 (1998).
2. M. Miften, et. al., *Med Phys*, 45(4), e53-e83 (2018).