

TREX: DOSIMETRIC FEATURE EXTRACTION

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Dose array D of size $L_y \times L_x \times L_k$ with a total number of voxels, N , and voxel volume, v .

- Sum:

$$\text{Sum} = \sum_{i=1}^N D(i)$$

- Mean:

$$\text{Mean} = \overline{D} = \frac{1}{N} \sum_{i=1}^N D(i)$$

- Minimum:

$$\text{Minimum} = \min(D)$$

- Maximum:

$$\text{Maximum} = \max(D)$$

- Variance:

$$\text{Variance} = \frac{1}{N-1} \sum_{i=1}^N (D(i) - \overline{D})^2$$

- Skewness:

$$\text{Skewness} = \frac{\frac{1}{N} \sum_{i=1}^N (D(i) - \overline{D})^3}{\sqrt{\left[\frac{1}{N} \sum_{i=1}^N (D(i) - \overline{D})^2 \right]^3}}$$

- Kurtosis:

$$\text{Kurtosis} = \frac{\frac{1}{N} \sum_{i=1}^N (D(i) - \overline{D})^4}{\left[\frac{1}{N} \sum_{i=1}^N (D(i) - \overline{D})^2 \right]^2}$$

- Range:

$$\text{Range} = \max(D) - \min(D)$$

- Mean absolute deviation:

$$\text{MeanAbsDeviation} = \text{mean}(|D - \overline{D}|)$$

- Median absolute deviation:

$$\text{MedianAbsDeviation} = \text{median}(|D - \tilde{D}|)$$

- Interquartile range:

$$\text{IQR} = P_{75\%}(D) - P_{25\%}(D)$$

- Energy:

$$\text{Energy} = \sum_{i=1}^N D(i)^2$$

- Root mean square:

$$\text{RMS} = \sqrt{\frac{\sum_{i=1}^N D(i)^2}{N}}$$

For $x = 5\text{-}100$ Gy or $5\text{-}100\%$ volume:

- Absolute volume receiving at least x Gy:

$$aV_x$$

- Percent volume receiving at least x Gy:

$$rV_x$$

- Minimum Dose to the hottest $x\%$ volume:

$$D_x$$

- Mean Dose to the Coldest $x\%$ volume:

$$MOC_x$$

- Mean Dose to the Hottest $x\%$ volume:

$$MOH_x$$

For multiple values of n on the range $n = 0.15$ to $(1/0.15)$:

- Generalized Equivalent Uniform Dose [1,2]:

$$gEUD_n = \left[\sum_{i=1}^N v(i) D(i)^{\frac{1}{\alpha}} \right]^{\alpha}$$

REFERENCES

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- [2] X.A. Li, M. Alber, J.O. Deasy, A. Jackson, K.-W.K. Jee, L.B. Marks, M.K. Martel, C. Mayo, V. Moiseenko, A.E. Nahum, A. Niemierko, V.A. Semenenko, E.D. Yorke, The use and QA of biologically related models for treatment planning: Short report of the TG-166 of the therapy physics committee of the AAPMa), Medical Physics. 39 (2012) 1386–1409.