



Figure 1: Relative error and speedup percentages for summing ciphertext elements using DFT vs RA (Rotate and Add).

Summation of ciphertext elements can be performed using two methods - (i) Discrete Fourier Transform (DFT); (ii) Rotate and Add (RA). This plot (1) depicts the relative error percentage and relative speedup percentage of these methods for various ciphertext lengths in summing ciphertext elements. The relative error percentage is calculated as:

$$Relativeerrorpercentage = \left(\frac{DFT - RA}{RA} \right) \times 100.$$

The relative speedup percentage is calculated as:

$$Relativespeeduppercentage = \left(\frac{T_{DFT} - T_{RA}}{T_{RA}} \right) \times 100,$$

where T denotes the time taken using the respective method.