

Diagram illustrating a sparse matrix-vector multiplication operation:

The matrix $A_{m \times n}$ (where $m \ll n$) is shown with columns indexed by $b_0, \dots, b_k, \dots, b_{n-1}, b_n$ (red labels) and rows indexed by a_1, a_2, \dots, a_m (blue labels). The matrix is partitioned into blocks, with the k -th column highlighted in orange.

The vector $x_{n \times 1}$ (labeled $(K\text{-sparse})$) is shown as a column vector with K non-zero elements (green blocks) and $n-K$ zero elements (white blocks).

The vector Δ_i (labeled (increment)) is shown as a column vector with a single non-zero element k (orange block) and $n-1$ zero elements (white blocks).

The operation is defined as:

$$A_{m \times n} \times \left(x_{n \times 1} + \Delta_i \right) = y_{m \times 1} + b_k$$

where $y_{m \times 1}$ is the resulting vector (labeled $(\text{sketch of } x)$) and b_k is the update vector (labeled (update)).