

1 Linear Algebra

Column wise decomposition Any matrix $\mathbf{A} \in \mathbb{R}^{m \times n}$ can be decomposed into the sum of its columns:

$$\mathbf{A} = \sum_{j=1}^n \mathbf{A}_{:j} e_j^\top, \quad (1)$$

where e_j are standard basis vectors of \mathbb{R}^n . Notice that this is a rank 1 decomposition.

Row wise decomposition Any matrix $\mathbf{A} \in \mathbb{R}^{m \times n}$ can be decomposed into the sum of its rows:

$$\mathbf{A} = \sum_{i=1}^m e_i \mathbf{A}_{i:}^\top, \quad (2)$$

where e_i are standard basis vectors of \mathbb{R}^m . Notice that this is a rank 1 decomposition.