Matrix-Vector Products

1 Why

TODO

2 Definition

The *product* between an $m \times n$-matrix and an n-vector is an m-vector whose ith entry is the inner product of the ith row of the matrix and the vector.

2.1 Notation

Let C be a nonempty set. Let $A \in C^{n \times m}$ and let $x \in C^m$. We denote the matrix-vector product of A with x by Ax, read "A x".

If we denote Ax by b, then

$$b_i = \sum_{j=1}^{n} a_{ij} x_j$$

for $i \in \{1, 2, \ldots, m\}$. Let

$$A = \begin{bmatrix} a_1^T \\ a_2^T \\ \vdots \\ a_m^T \end{bmatrix}$$

Or, if a_i^T is the ith row of A, then

$$b_i = a_i^T x$$

for $i \in \{1, 2, \ldots, m\}$.