



## MATRIX-VECTOR PRODUCTS

### Why

TODO

### Definition

The *matrix-vector product* between an  $m \times n$ -matrix and an  $n$ -vector is the result of the linear combination of the columns of the matrix with the sequence of scalars in the vector. So the matrix-vector product is an  $m$ -vector.

### Notation

Let  $C$  be a nonempty set. Let  $A \in C^{m \times n}$  and let  $x \in C^n$ . 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  $i \in \{1, 2, \dots, m\}$ . Let

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

Or, if  $a_i^T$  is the  $i$ th row of  $A$ , then

$$b_i = a_i^T x$$

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

