

### Linear Algebra

$A+B$  has result, only if A and B have same dim

$Ax=x_1*a_1+...+x_n*a_n$  result is vector

$A*B$  row of A times column of B, result is matrix

$A^T$  row becomes column and vice versa

Properties of transpose

- (1) if A is (m x n)  $A^T$  is (n x m)
- (2)  $(A^T)^T=A$
- (3)  $(A+B)^T=A^T+B^T$
- (4)  $(AB)^T = B^T A^T$
- (5)  $(tA)^T=tA^T$

Inverse of Matrix  $AA^{-1}=I=A^{-1}A$

Properties of invertible matrix

- $(A^{-1})^{-1}=A$
- $(AB)^{-1}=B^{-1}A^{-1}$
- $(A^T)^{-1}=(A^{-1})^T$

Singular value decomposition

$A = U\Sigma V^T$

what means that every vector-matrix-multiplication can be viewed as a 3 step process

- (1) rotation into space V
- (2) scaling by singular value
- (3) rotation into new space U

Eigen value decomposition

$A = Q\Lambda Q^{-1}$

this is only possible, if A *and* Q are square matrices

### Linear regression

Model  $y = X\theta^* + z$

Risk

### Ridge regression

### Logistic Regression

### Support Vector Machines

### Neuronal Networks

