## Linear Algebra

| | |
|---|---|
| A+B | has result, only if A and B have same dim |
| A**x**=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)<br>(2) $(A^T)^T=A$<br>(3) $(A+B)^T=A^T+B^T$<br>(4) $(AB)^T = B^TA^T$<br>(5) $(tA)^T=tA^T$ |
| Inverse of Matrix | $AA^{-1}=I=A^{-1}A$ |
| Properties of invertible matrix | $(A^{-1})^{-1}= A$<br>$(AB)^{-1}= B^{-1}A^{-1}$<br>$(A^T)^{-1}=(A^{-1})^T$ |
| Singular value decomposition | $A = U\Sigma V^T$<br>what means that every vector-matrix-multiplication can be viewed as a 3 step process<br>(1) rotation into space V<br>(2) scaling by singular value<br>(3) rotation into new space U |
| Eigen value decomposition | $A = Q\Lambda Q^{-1}$<br>this is only possible, if A ***and*** Q are square matrices |

## Linear regression

| | |
|---|---|
| Model | $\mathbf{y} = X\theta^* + z$ |
| Risk | |

## Ridge regression

## Logistic Regression

## Support Vector Machines

## Neuronal Networks