

## 0.1 Higher-order tensors

We can create higher order tensors products. For example

$$V \otimes V \otimes V \otimes V^* \otimes V^*$$

We write elements of these as:

$$T_{j_1, \dots, j_q}^{i_1, \dots, i_p}$$

We can map from matrix to matrix etc higher dimensional

Matrix has A:  $a_{ij}$

Tensor can have T:  $t_{ijk}$  for example

0 rank tensor: scalar

1 rank tensor: vector

2 rank tensor: matrix

page on covariance and contravariance and type (p,q)