Chapter 2. Linear Algebra

2.1 Scalar, Vector, Matrix, Tensor

2.2 Multiplying Matrix and vector

2.3 Identity and inverse matrix

2.4 Linear dependence and Span

2.5 Norms

- Norms for vector
- Norms for matrix

2.6 Special kind of matrix and vector

- Diagonal Matrix
- Symmetric Matrix
- Orthogonal Matrix

2.7 Eigen-decomposition

Definition: Wikipedia for eigen-decomposition

Definiteness of Matrix

2.8 Singular Value Decomposition(SVD)

Definition: Wiki for SVD

Application:

1. Dimension reduction
2. Partially generalize inverse to non-square matrix (Pseudoinverse)

2.9 The Moore-Penrose Pseudoinverse

Definite: Wiki page

Application:

- Obtain all solution of a linear systems
- Linear least-square
- Minimum norm solution to a linear system

2.10 Trace operator

Wiki page

- $\|\mathbf{A}\|_F = \sqrt{trace(AA^T)}$
- Invariance to cyclic permutation

2.11 Determinant

Can present volume in physical meaning

2.12 Example: PCA