LA for AI & ML

MAY - 2020

M	T	W	T	F	S	S	M	T	W	T	F	S	S
				1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31							

→ 4 Assignment
→ Mids & Ends
100% Attendence

9 • Introduction to Applied LA
Boyd & Vandenberg

10 • LA & learning from data G. Strang

11 Vector Space :- V is vector space if
$\forall\ a, b \in V$ then $k(a+b) \in V$

12 where k is a scalar $(k \in F)$

1 Properties:-

→ Commutative $a+b = b+a \in V$

2 → associative $(a+b)+c = a+(b+c) \in V$

→ additive ~~inverse~~ identity $0 \in V$ st $0+a = a$

3 → additive inverse $\forall\ a \in V$, $\exists\ -a \in V$ st
$a+(-a) = 0$

4 → Distributive • $\alpha(a+b) = \alpha a + \alpha b$
$(a, b) \in V, \alpha \in F$

5 • $(\alpha+\beta)a = \alpha a + \beta a$
$a \in V,\ \alpha, \beta \in F$

6 • $(\alpha\beta)a = \alpha(\beta a)$
$a \in V,\ \alpha, \beta \in F$

→ multiplicative identity exits

Subspace :- ~~Eg~~ • closed under addition
(should have 0 vector) • " " scalar multiplication

10 Trivial Subspace :- $\{0\}$ $\{\mathbb{R}^n\}$
Proper subspaces (of $\mathbb{R}^n$) :- any lower dimension space/plane/line/pt passing through origin which is not trivial

2 Subspaces of $\mathbb{R}^2$:- • $\{0\}$ • $\mathbb{R}^2$ • line through $\begin{pmatrix}0\\0\end{pmatrix}$

4 Affine set :- subsets which missed bieng subspace by a fiscal
eg :- line not passing through origion in $\mathbb{R}^2$

Subspace → Some $\boxed{\text{hyperplane}}$ made from subset of a vector space that passes through $\boxed{\text{origin}}$

Linear Span :- $A = [v_1, v_2 \ldots v_k] \subseteq \mathbb{R}^n$

$\mathcal{L}(A) = \{\alpha_1 v_1 + \alpha_2 v_2 + \ldots \alpha_k v_k \mid \alpha_1, \alpha_2 \ldots \alpha_k \in \mathbb{R}\}$

Linear Span of A → (Subspace) → as closed under + αv
Dimension → $\leq k$

Linear Dependence

$\alpha_1 v_1 + \alpha_2 v_2 + \dots \alpha_k v_k = 0$

~~If~~ & if $\alpha_1, \alpha_2, \dots \alpha_k$ are not 0 simultaneously

Reason:- let $\alpha_j \neq 0$

$$\alpha_j v_j = (-1)\sum_{\substack{i=1 \\ i\neq j}}^{k} \alpha_i v_i \Rightarrow v_j = (-1)\sum_{\substack{i=1 \\ i\neq j}}^{k} \frac{\alpha_i}{\alpha_j} v_i$$

Opp:- Independence:- No one vector is linearly deducible from other vectors. (In previous case iff the only solⁿ is $\alpha_1 = \alpha_2 = \dots = \alpha_k = 0$, then set is linearly independent)