CO2774
Machine Learning
Aug 13, 2021

Last class:-
- course objectives?
- what is ML?
- [Applications of ML]

ML ⟷ DL (Deep Learning)
ANN

Machine Learning Settings :-

(I) Supervised setting (II) Unsupervised setting (III) semi-supervised
(IV) (Deep) Reinforcement Learning

→ Supervised Learning :- Training Data: $\{x^{(i)}, y^{(i)}\}_{i=1}^{m}$ → # of examples
→ # of training examples

$x^{(i)}$ ↓ feature vector

$\forall i$: $x^{(i)} \in \mathbb{R}^n$ → dimension of feature space

$n > m$ corresponding

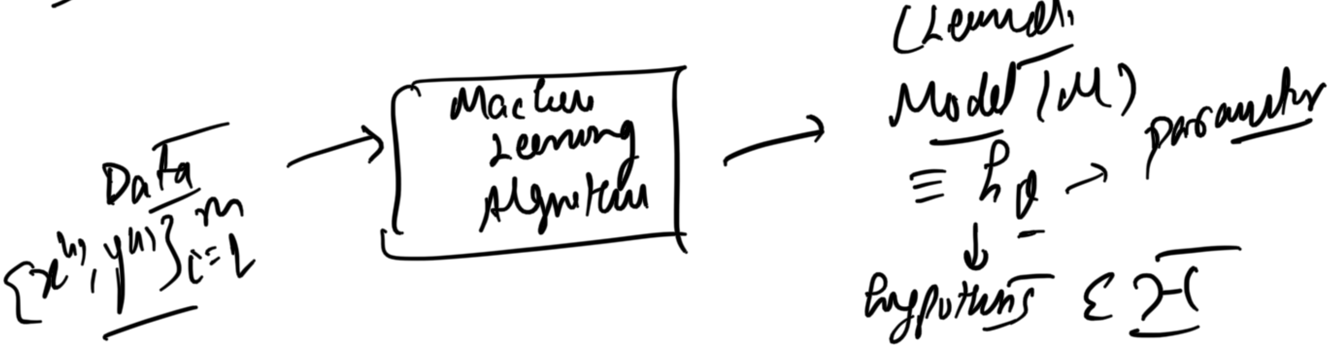
Classification problem (Discrete): $y^{(i)} \in \{ \dots \}$ set of discrete values

$y^{(i)} \in \mathbb{R}$ → Regression

[$y^{(i)} \in \mathbb{R}^n$]

↳ Test:- $x \in \mathbb{R}^n$, y?

↳ Test example



Test example → [M] → predict $\hat{y} \simeq y$

Instance (x) → [box] ⇒ $h_\theta(x)$

Monkey) chimps ⇒ classes

$y \in \{M, C\}$ (M: -ve, C: +ve)

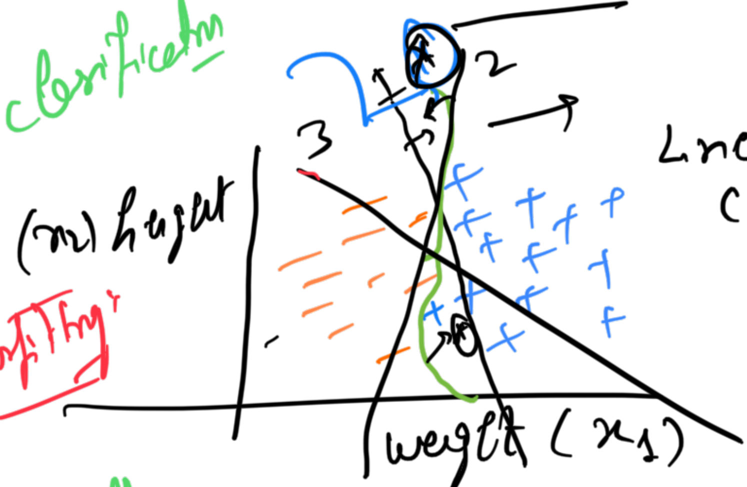
$\{x^{(i)}, y^{(i)}\}_{i=1}^{m}$

~~height~~ weight, height $n=2$

$x^{(i)} \in R^2$

new instance: $h_\theta(x^{(i)}) = ??$

Classification

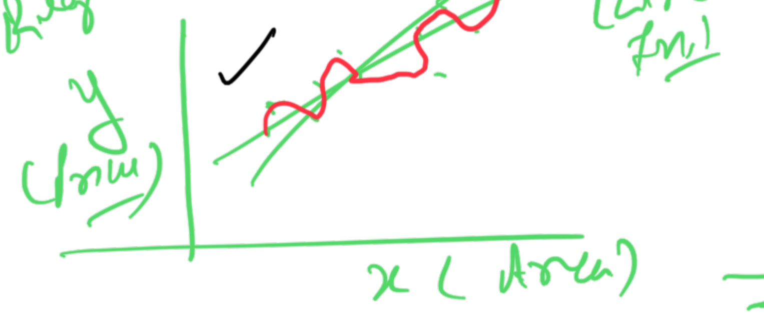


Linear classifier

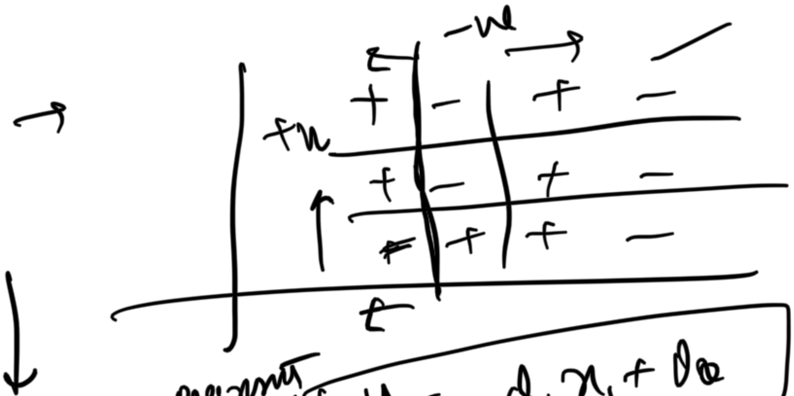
$x^{(i)} = (x_1^{(i)}, \ldots, x_j^{(i)}, \ldots, x_n^{(i)})$

- → Hypothesis space
- → What is a good separator? (Error fn.) ↳ optimized
- → How do we find this "best" separator.

Regression



(Linear fn.)



Kernels

Hyperplane:

$\theta_2 x_2 + \theta_1 x_1 + \theta_0 = 0$

$\theta_3 x_3 + \theta_2 x_2 + \theta_1 x_1 + \theta_0 = 0$

$\sum_{j=1}^{n} \theta_j x_j + \theta_0 = 0$

Linear regression: $y = \theta_1 x_1 + \theta_0$

1. Logistic Regression
2. GDA (Generative / Graphical models)

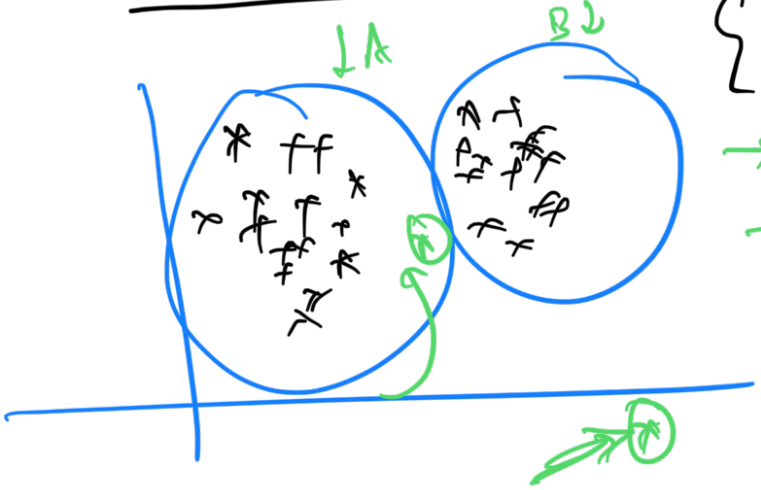
③ Naive Bayes

④ Decision Tree

⑤ SVM

⑥ NN | DNN

→ Unsupervised learning : I



$\{x^{(i)}, y^{(i)}\}_{i=1}^{m}$ K-Means

→ clustering

→ Density Estimation GMM

→ ~~Outlier~~ EM :- Expectation Maximization

PCA :-