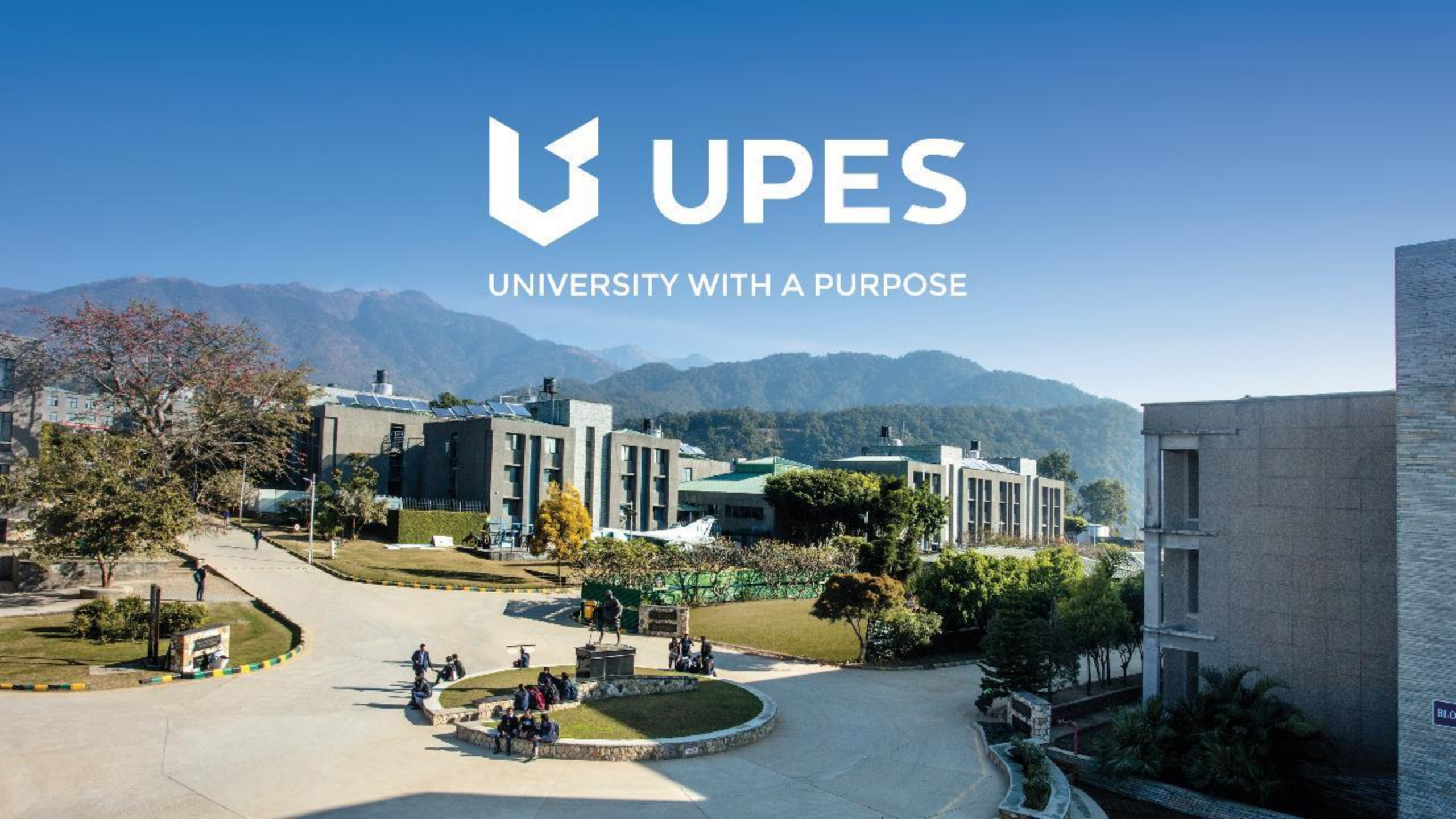
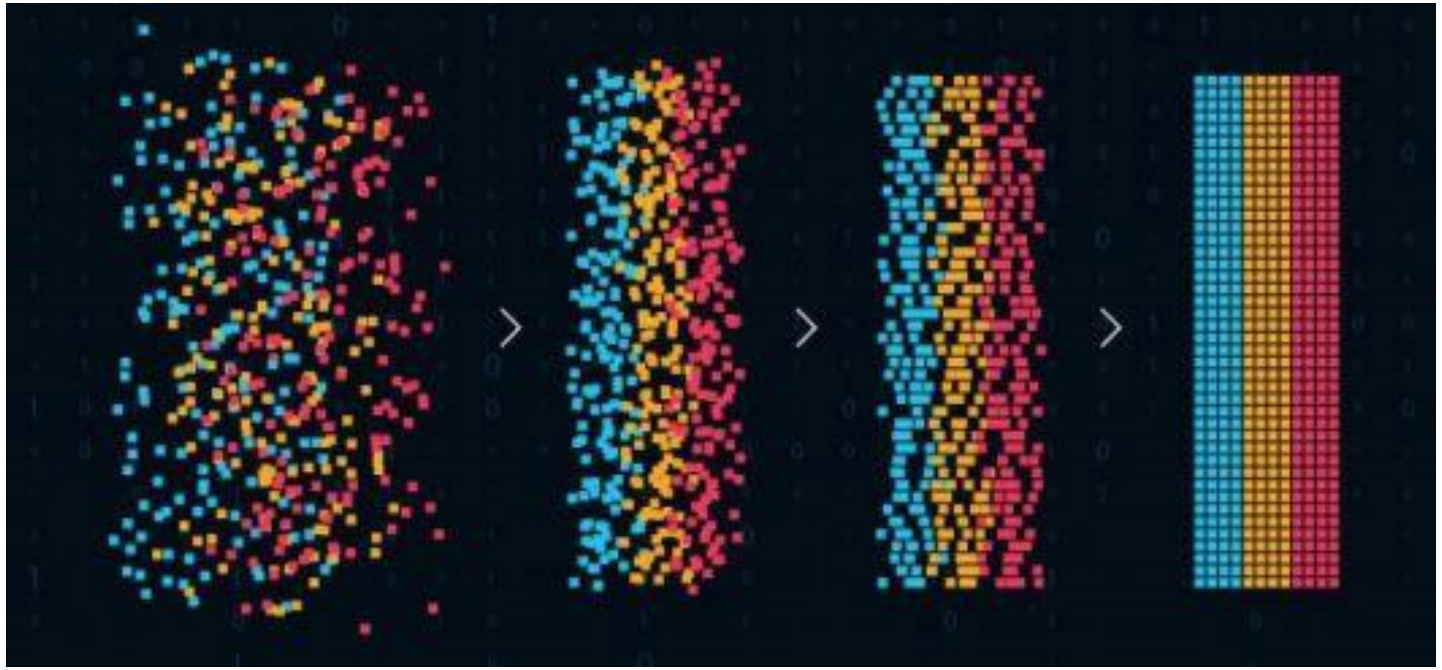

UPES
UNIVERSITY WITH A PURPOSE

Pattern and Anomaly Detection



Source: Edureka

B. Tech., CSE + AI/ML

Dr Gopal Singh Phartiyal

18/10/2021

Recap: Linear Models for Regression

Goal: Find **w?**

- Why linear model?
- Simple linear regression
- Basis functions and multiple output
- Solving for w using maximum likelihood and least squares or sequential
- Regularize the model (different regularizers)
- Bayesian linear regression models: Parameter and predictive distributions (prior and posterior)
- *Equivalent kernels (output as a linear combination of training data directly)*

Linear Models for Classification

- Goal of classification: Take input (let say x) and assign it to one of the K discrete classes C_k a classes where k = 1, 2, 3, …….K.
- Generic assumption: Classes are disjoint (an input can be assigned to one and only one class, no more no less)
- Models analogous to regression models but for classification problems
- The input space is divided into decision regions whose boundaries are termed as **decision boundaries** or **decision surfaces**.
- At first we will discuss linear models for classification? Decision surface.
- (D-1) dimensional Hyperplane is a linear function of D dimensional input .
- Datasets whose classes can be separated by linear decision surfaces are called linearly separable.

Linear Models for Classification

- For regression problems, the target variable t was simply the vector of real numbers whose values we wish to predict
- In the case of classification, there are various ways of using target values to represent class labels
- **Example**: Two-class problem solved by probabilistic models
- Most convenient is the binary representation

$$t \in \{0, 1\}$$

- Where, t = 1 represents class C_1 and t = 0 represents class C_2. Interpret the value of t as probability of class C_1.

Linear Models for Classification

- For more than two class: one hot encoding or one-of-K coding is used.

$$\mathbf{t} = (0, 1, 0, 0, 0)^{\mathrm{T}}$$

- For non-probabilistic models, alternative choices of target variable representation can be opted.
- Categories:
  - Discriminant functions
  - Generative
  - Deterministic

$$y(\mathbf{x}) = f\left(\mathbf{w}^{\mathrm{T}}\mathbf{x} + w_0\right)$$

$$y(\mathbf{x}) = \text{constant}$$

Thank You