Deep Learning - Theory and Practice

Basics of Machine Learning

17-01-2019

http://leap.ee.iisc.ac.in/sriram/teaching/DL19/

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Problems in Decision Theory

❖ Decision Theory

　❖ Inference problem

　　❖ Finding the joint density $p(\mathbf{x}, \mathbf{t})$

　❖ Decision problem

　　❖ Using the inference to make the classification or regression decision
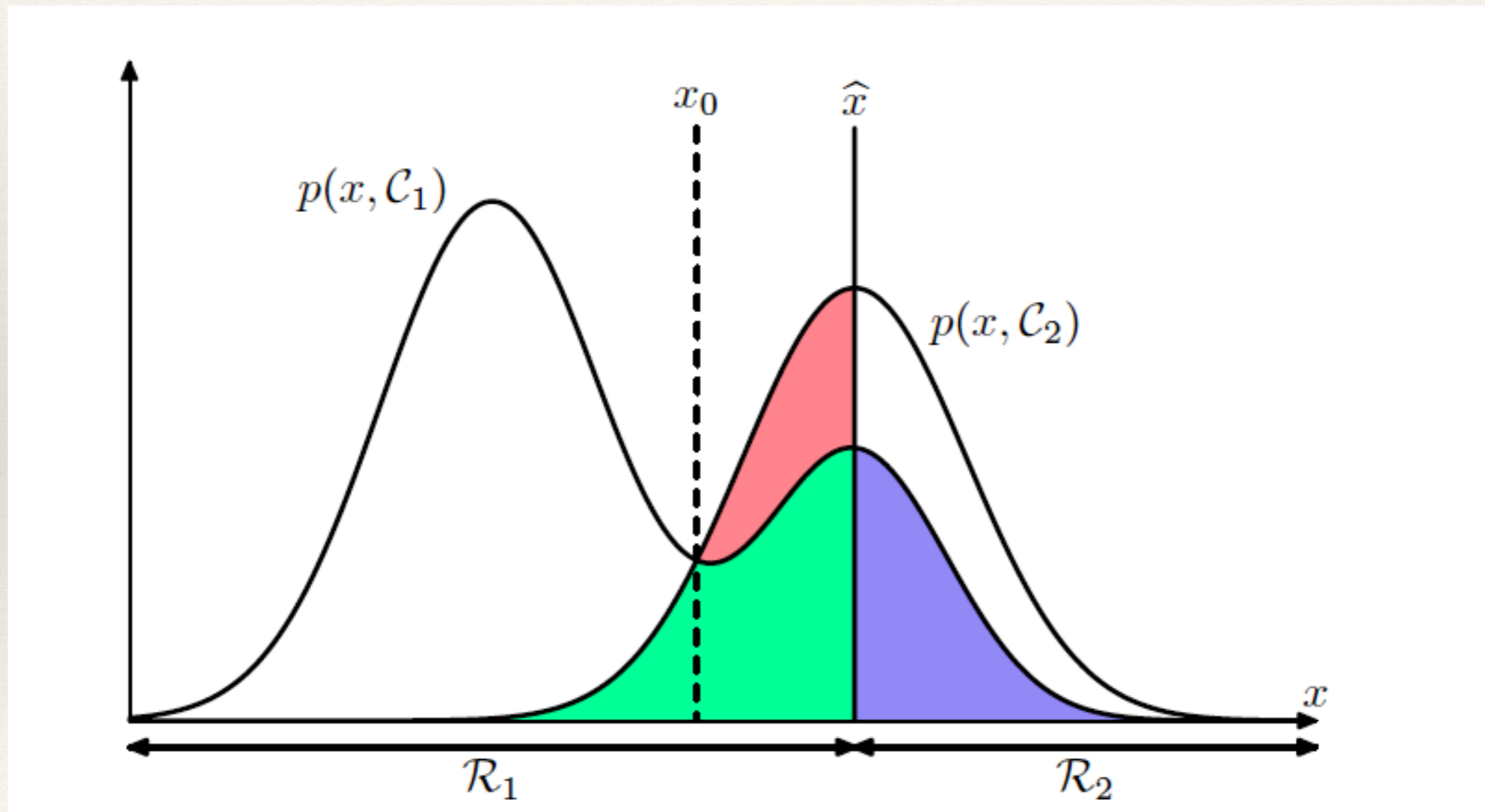
Decision Problem – Classification

- ❖ Minimizing the mis-classification error

- ❖ Decision based on maximum posteriors

$$argmax_j \ p(C_j|\mathbf{x})$$

- ❖ Loss matrix

  - ❖ Can be used for non uniform error weighting.

Decision Theory

Approaches for Inference and Decision

I. Finding the joint density from the data.

$$p(C_k|\mathbf{x}) \; \alpha \; p(\mathbf{x}|C_k)p(C_k)$$

II. Finding the posteriors directly.

Neural Networks

III. Using discriminant functions for classification.

Advantages of Posteriors

❖ Minimizing the risk

❖ Reject Option

❖ Combining models

❖ Compensating for class priors

Loss Function for Regression

- With a mean square error loss

$$\mathbb{E}[L] = \int\int \{y(\mathbf{x}) - t\}^2 p(\mathbf{x}, t) \, \mathrm{d}\mathbf{x} \, \mathrm{d}t.$$

- The problem boils down to conditional expectation of the data given the

Regression Problem